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LETTER FROM EDITOR-IN-CHIEF

The macro level efforts made during 1982 in the field of conservation of energy and materials, maintenance management, labour relations, environmental pollution and growth of small, cottage and village industries have generated a nationwide consciousness in all sectors of the economy to optimise the use of resources and to achieve better capacity utilisation. The year 1983 is full of promise for a faster economic growth. However, despite the ground work already done, there is need to synthesise two basic factors viz. technology development and employment generation. The frontiers of knowledge which are extending at an incredible rate have opened new vistas for technological advancement which can become more satisfying in terms of human and social needs influencing the life styles and societal expectations.

The inter-linkage between technology which is imported and the indigenous efforts made to update the technology through R & D calls for improvement in the skills and know-how of workers/artisans and the craftsmen. Infact this is going to determine the rate at which employment generation and increase in purchasing power can take place for achieving the growth rate.

While we can take pride in being the third largest technical manpower in the world, the fact remains that our indigenous R & D efforts have not been put to effective use. This is imperative in view of scarce capital resource and abundant manpower. Despite this there persists a scramble for foreign collaboration and for the import of technology which, in many cases, is certainly desirable, but in many others can pose a potential threat for the sustenance of technology itself.

A constant endeavour to improve technology is the key to progress. There is need to look out for centralised institutions for transfer of technology. A major element of our success in this direction will depend upon the motivation on the part of the people who have to use it. Our Prime Minister, Smt. Indira Gandhi while inaugurating the 30th session of the Indian Science Congress had given directions on the new technology policy to be followed. If the planners, investors and the users can develop a cohesive approach to this vital aspect and iron out many of the misconceptions and misunderstandings which concern management, labour and Government and other sections of the society, it can become a leap forward for ensuring that tomorrow shall be better.

(DR. A. N. SAXENA)

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Operations Planning—A Functional Approach

NARENDRA K. SETHI

The purpose of this article is to demonstrate the functions and responsibilities of the operations planner. By knowing his value and job duties, he can assist management in accepting and utilizing the skills of direction and discipline within the enterprise. The planning process is also analysed with a view towards relating the duties of the operations planned in it. Secondary research method is used for data analysis.

Narendra K. Sethi, Ph.D, St. John's University, New York.

The Planning Process

The task of planning any operation must be undertaken with considerable care as planning is a vital function of management at all levels. Planning begins with a statement of goals and proceeds with the development of policies and procedures, and the determination of these activities necessary to achieve the stated objective. Planning is a dynamic activity which continuously considers the environment in which the enterprise exists. In order to be more fruitful, planning cannot be an intermittent activity. Rather, it must be conducted in a thorough and regular pattern and cycle.

In actuality, planning encompasses evaluation of all alternative courses of action, and the selection of a particular course of action from these alternatives. Hence, planning is essential to the process of making the decisions necessary to reach the stated objectives. The decisions made (related to the enterprise strategy and operations policies of the enterprise) would greatly influence the planning functions of the operations manager.

The Operations Planner

Every job has job descriptions and job functions that substantiate their existence. Some may entail line responsibilities, others are staff related. The operations planner in most instances is a staff related function that organizes line responsibilities of the

operation. The planner generally reports to the vice-president of operations or to someone in the Operations Management.

The duties of the operation planner should be consistent from one firm to another. The following is a suggested example :

(1) Data collection;
(2) Forecasting;
(3) Procedural formation;
(4) Planning integration;
(5) Coordination of the planning effort;
(6) Budgeting development;
(7) Planning testing implementation; and
(8) Review of Planning Control

The operations planner generally will set up this format with the operations management people and devise a workable plan. He could use their input or rely strictly from his own experience to establish his plan. Whichever choice he makes must be effective, and realistic or if it is not, he will not maintain his job status and reputation in the field as being successful at planning and/or operations organization. It is important to note that this planning methodology is extremely complex, and many of the above functions happen simultaneously and are at times difficult to measure separately. Nevertheless, these activities are necessary to be worked out together.

Choice of Sources of Information

The foundation of the operational planner's job is the sources of information he chooses to select. Naturally, previous records of sales, gross profit, expenses, and other variable expenses should be considered in the collection of data. A continuing study of the environment to guide the company in its future actions is necessary. A company often parallels itself the way the economy is heading, hence, knowing where you are going in five years is more pertinent than the past and current information. Terms like interest rates, labour rates, fuel costs and tax laws are variable, to be considered in collection. Terms such as objectives, goals deadlines and policies are tangible factors he derives from the actual plans.

Forecasting

An important tool not only for the operations planning but for the operations management is the ability to forecast. Improper forecasts can create excessive wastes in labour, material, and profits. Thus, a forecast is essential to get the operation on the right track and to establish effective planning strategies and goals. Some of the more common methods used in forecasting are as follows :

Moving Averages

A moving average is a method of eliminating regular seasonal or cyclical patterns from the data to indicate the underlying smoothed trend. Moving averages are rarely useful for long-term forecasts. Their primary disadvantage is that they fall short of the actual data available. The projection has to cover not only the future but also some of the past.

Exponential Smoothing

This method is based on a moving average which is weighted so that the more recent statistics receive greater emphasis.

Regression Analysis

This is perhaps the most sophisticated forecast method mentioned so far. Regression analysis provides a rational way of using management judgement. It enables the operations manager to measure explicitly the association between variables over time. Although the variables are measured statistically their first identification is a value of judgement.

Econometric Models

An econometric model attempts to represent the interdependent relationships of a number of variables which effect a particular activity. These models are often built to forecast numerous fields of activity.

Other methods are Delphi technique, Input-output

analysis, Scenarios, Impact analysis, Extrapolative techniques, and Morphological analysis.

In general, the forecasting function is a necessary planning activity for the operations manager, if he is dealing with the product life cycle of a product he must be able to use the most advantageous methods of forecasting to best accommodate his estimation of its life.

Measurement Techniques

There are various methods of measuring work performance. The most common are, predetermined time standards, stop watch studies, work sampling-physiological work measurements, and programming. These are discussed emphasizing their basic understanding and application, and examples of how they are related to planning.

Stopwatch Time Study Technique

This is the most commonly used method for deriving time expectancies. The idea is to breakdown operational functions to their smallest component, then record each function enough times to establish reasonable time expectancy. This would be called 100% hours. Adding up the hours needed to complete the task plus all needed fixed activities, would give the total 100% hours of performance.

For example if the 100% hours needed to operate a popcorn assembly was 25 hours, and the actual hours of production was 32, the per cent performance would be 73.

A second technique for establishing time standards uses *Predetermined Time Data* for such basic body movements as "reach", "grasp", or "hold". For each action a normal time has been calculated by using stopwatch techniques, and other more complex procedures, such as motion pictures and electronic measurement devices. The operations planner can use this information to help him plan his schedule of daily, weekly or quarterly hours and also plan what payroll and payroll per cent he wants or must meet. It is conceivable that this may be a goal for him to achieve by upper management within a given physical period. If current performances were 82% and top management may set a goal of 85%, a 3 point increase would make a necessary productivity increase.

A third approach is *programming*. This technique is used in a more descriptive format. For example, if a person is to work the normal eight-hour day, he would then plan his own day and establish his own time to get the functions done. This work method can only be used with regard to specific jobs, but can be effective if the programme is realistic and beneficial for both the management and the employee.

Policies & Procedures

Strategy is important to the success of the enterprise, and if the strategy determines the task of the operations function it follows that it is necessary to develop framework for the implementation performance and control of the task. The operations policies of the enterprise flow from the strategy and objectives adopted. Therefore, it is the framework which sets the limits within which important decisions must be made.

It is crucial to choose criteria which will be useful in measuring the effectiveness of the decisions made. In selecting these decisions the operations planner will find that due to restrictions and limitations in the company's skills and resources, he will *have* to compromise.

In setting the operations policies, a large number of decision alternatives must be weighed against one another. Some of the broad operations policy areas include product planning, process planning and production-inventory planning and control.

Within each of these areas the operations planner faces a variety of decisions. There would be numerous alternatives that he must evaluate relative to each decision from among which he selects the most appropriate for the strategy and operations policies of the company.

The systems approach has been increasingly designed to the solution of business problems. Systems analysis requires the planner to visualize the internal and exter-

nal environment as an integrated perspective. By using the system analysis, it is expected that the solutions to problems will take into consideration the total company. Operation planners will not make decisions primarily to optimize their own function within the organization, but will choose alternatives fruitful for the *entire* organization.

Manpower Planning

Manpower planning is concerned with determining the enterprise's future numerical requirements for people, establishing a programme of recruiting and selecting these people, developing and training them to the level of skill required, and motivating them to achieve the desired performance.

Manpower is one of the prime functions of production. It must be harnessed with other factors to produce the finished product of the system. Hence, manpower is one of the areas for which the management and planners must develop effective policies. Being able to establish policy correctly enables the management to devise an environment for the realization of the goals for optimum capacity and the survival of the organization.

As mentioned earlier, forecasting plays a critical role in ascertaining the quantity of help needed. Determining the volume and knowing the level of skill for the desired function is the start in acquiring the work force.

The next phase in the operational manpower plan is what methods are to be used to get the people. In the selection process, the manager must review the candidates to determine who will fit the needs of the enterprise. Selection policy covers those activities required to acquire the people who best fit the needs. Both the long range and short range intention is to get those types of professional people that work well or complement each other. Therefore, in order for the planning integration and the coordination of the planning effect to work properly and effectively, this phase of people and coordination must mix well.

Budgeting

A fresh appraisal of prospective revenues and expenses is vital. Instead of extrapolating recent trends, each operations manager of a responsibility centre should weigh such factors as guidance from top management, director of budgets, pertinent leading economic indicators, and departmental objectives. Then he can build up, separately, for the expected and somewhat less probable levels of output, the commensurate tangible requirements for the future periods.

Budgeting can be the numerical equivalence to planning. This process is an effective planning measurement because it states what the project or total operation is expected to achieve. Effective operations planner will use progressive information to project sales and objectives, while using actual texts and costs for expense items. A good budget should be realistic. It is a guide to go by over the duration of the budget, and will alert the planner when a specific area is running above or below variance levels.

At times it will be necessary for adjustments to be made to the budget, unexpected increased costs in materials and labour, but these adjustments should be sparingly made, so that the budgeting process is not abused.

In many companies fiscal or quarterly budgets are out of phase with the operations. At the very time that budgets are needed more than ever, increasing complexity in business could paradoxically diminish their relevance. Budgets cannot afford to be cynical for the planner, in that they must not only know the price of everything but the value as well.

Functions of the Operations Manager

The initial function of a manager is the identification of goals. Every operation thus exists for a specific purpose. Most activities in a business organization exist for a specific purpose, even if the purpose is not always clear to those who follow through.

The primary function of the manager is to locate and define the goal towards which he wishes to operate the organization. Once the goal is clear, the next stage is the planning of the work. Thus, it becomes necessary to plan the stages of implementation which

will carry the organization from a definite point to the accomplishment of the goals set by the manager.

The final segment of the operations manager work is control. The manager compares the work done with the plans and determines whether the job is progressing at the rate under the planned conditions. The better tool for controls is quantitative one, as the comparisons between the plan and the actuality must be done with the quantitative tools and not by intuition. The control segment permits the operations planner unlimited visibility in constructing quantitative control methods.

One such method the operations planner might follow through with is the PERT Process. The PERT planner must specify all the steps that lead to the completion of the activity. The intensity of the job depends on the planner, as the instance he determines the "depth" with the PERT system he will set up for himself all the steps which aim to mark the completion of the job.

Another advantage of the PERT system as a planning technique is that the planner must recognize that specific stages of the job can be done simultaneously while other phases must be successive. The PERT method makes it possible for the planner to see all of the phases of the job which are going on more realistically.

Perhaps one of the more important advantages for the manager in this system is that it identifies for him those phases of the project which give the main managerial attention. In large activities consisting of 300 or more activities, PERT permits the planner to identify the critical path which is the chain of activities. This critical path comprises a small percentage of the total functions in the project. Hence with this method, the planner can know ahead of time which segments of the job he must devote maximum managerial efforts.

In general, if the manager is capable of translating the work of his company into the terms of its recurrent jobs to which the PERT method can be applied, he can prosper with the advantages of both Gantt and PERT systems.

Conclusion

The success of the plan lies in its organization. It represents a system to get work done and when used in a designed format, it is rewarding both in profit and prestige.

It is vital for the operations planner to develop the objectives and goals for *all* administrative activities in the operational plan. He must be realistic and disciplined enough to make the plan work through. He must be able to distinguish between useful and unnecessary information as wrong information leads to wrong projections and goals.

In addition, the coordination and control between his operating plan must be thoroughly implemented. There should be a measurement to know what was planned.

The planner gets out of a plan what he puts in. There is no substitute for good organization and the follow-through of work to the operations planner.

REFERENCES

Books

1. Concepts for Operations Management, Ray Wild, A Wiley-Interscience Publication, New York, 1977.
2. Corporate Planning : Theory and Practice, David Hussey. Pergamon Press, Oxford, 1979.
3. Development Planning : Lessons of Experience, Albert Waterston, John Hopkins Press, Baltimore, Maryland, 1978.
4. Management Planning & Control in Inflation, Kenneth P. Gee. Holmes & Meier Publishers Inc., 1977.
5. Operations Management, Arthur C. Laufer, South-Western Publishing Co. Dallas, 1975.
6. Operations Planning & Control, John L. Colley Jr. Robert D. Landel, Holden-Day Inc., San Francisco, 1978.
7. Operations Research in Production Planning, C.H. Martins, Free Press, New York, 1977.
8. Organization Planning & Development, William F. Glueck, American Management Association, 1974.

Articles

1. Aggarwal, R. Using Management Science Models : A Critique for Planning. "*Managerial Planning.*" 28 (Jan. 80). pp. 12-15.
2. Becker, P. E. Optimum Planning Period Problems. "*Omega*" 5 (Nov. 77) pp. 87-88.

3. Corbin, A., Using a Team Approach to Market Oriented Planning. "*Management Review*" 66 (June 77) pp. 70-77.
4. Fox, Harol W. A Budget Format with Operational Relevance "*Managerial Planning*" 21 (Jan. 76) pp. 22-29.
5. Groth, J.C. & Philips, C. A., What Would you do if a Crisis Hit Your Firm, "*Management World*". 7 (Mar. 78) pp. 12-4.
6. Hubbard, T.D., Planning and Supervision Flow/Charts, "*C.P.A. Journal*" 48 (Oct. 78), pp. 74-6.
7. Hughjes, R.F., Planning the Essence of Control, "*Managerial Planning.*" 26 (May 78), pp. 1-3.
8. Ksanknak, James E., Measuring Productivity, "*Managerial Planning*" 25 (Nov. 74), pp. 15-21.
9. Levesque, J. D. Municipal, "*Personnel Management*" 9 (March 80), pp. 61-7.
10. McVay, H.L., Detailed Cost Planning in a Manufacturing Environment. "*Managerial Planning*" 35 (Jan. 1975), pp. 30-5.
11. Roney, C.W. Two Purposes of Business Planning. "*Managerial Planning*" 25 (Nov. 76), pp. 19-24.
12. Shwinger, Pinhas, The Uses of PERT in a Developing Economy "*Managerial Planning*" 35 (Jan. 75) pp. 30-35.
13. Weeks, J. Planning for Physical Distribution "*Long Range Planning*" 10 (June 77), pp. 64-70.
14. Yuran, Neil A. Corrective Motivation "*Managerial Planning*" 41 (Jan. 71), pp. 12-14.

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Progress Through Productivity

DR. A. N. SAXENA

Of late, there have been a number of dismal prophecies. The economic situation in the developing countries has been described in distressing terms. The author in this paper looks at the situation in the developing countries objectively and suggests various steps which can improve the situation. He insists that what is required is a positive attitude and a bent of mind to continuously strive for improvement in productivity, to achieve growth, progress and prosperity.

Dr. A.N. Saxena is the Director-General, National Productivity Council, New Delhi. This article is an adaptation of his address to International Productivity Congress at Bombay, 22-24 January, 1983.

The Scenario

THE GLOBAL 2000 REPORT describes in dreadful details the economic consequences of Less Developed Countries (LDC) and so-called Developing Countries (DCs) and forecasts negligible per capita economic growth and possible decreases in per capita consumption over the 1985-2000 period. Obviously countries having at present a per capita income of less than 200 US $ will be no better in 20 years than they are today.

While the above forecasts might sound distressing, disgusting or even shocking they can become a stark reality, if we do not take cognizance of the fact that objectively structured economic policies coupled with well conceived development programmes directed towards optimum utilisation of existing and available technologies can sustain the economic growth process. We are no more destined to be under privileged in terms of economic and social development.

In its wider implications, the necessity of using the limited resources available with both Less Developed and Developed countries is a matter of imperatives or compulsions. Productivity route for economic development today is no more a matter of choice but the only route to prove to the posterity that the figures of annual growth rates of per capita income and GNP as estimated by the Global 2000 report were highly conservative and subjective and did not take due cognizance of the potentialities and latent capabilities.

The State of Developed Countries

The process of economic development in most of the developed countries is characterized by the following major problems :—

1. Stagnation in the economy
2. Unemployment or underemployment
3. Malnutrition and under nourishment
4. Paucity of resources and lack of infrastructural facilities
5. Energy crisis
6. Adverse trade balance
7. Inadequate human resource development

These problems have a dampening effect on the economic growth process. They seem to be touching every segment of national economy, be it agriculture, industry or services sector. A shift in the demand pattern and inflation are the two acute problems facing the economies and developing countries are hard pressed to beat these trends.

Productivity Dimensions

While productivity is reckoned as an essential element of economic growth process, policy makers are generally tempted to apply monetary brakes through credit control high interest rates which in the short run do have an anti-inflationary impact but in the long run have only limited effect and sometimes even prove counter productive. Monetary measures tend to choke the investment climate so necessary to help improve productivity. It must be realised that as long as productivity is falling, the problem of inflation is further accentuated and the economy gets into a vicious circle of increase in cost-wage push with undesirable social consequences.

In most developing countries, the energy import bills have risen to such high value that even increased export earnings are unable to bridge the trade gap fully leaving a substantial deficit. Such a situation automatically leads to import restrictions as a result of which it is not possible to induct new technologies. However, the fact that productivity is the product of total technological efficiency and managerial effectiveness, needs to be clearly understood. While the quantum of productivity improvements which could be brought about through managerial effectiveness is dictated by the level of technology adopted and therefore it should be realised that to achieve quantum jumps in productivity levels, adoption of advanced technology closely followed by technological innovation through indigenous R & D is absolutely necessary.

Infrastructure Development

Since the process of economic growth runs through several sectors of national economy, the productivity levels in one sector influence the productivity of all other sectors. It is further recognised that productivity increases in the service sector have a salutory effect on the accelerated growth of value added sector. According to available information one-third of decline in American productivity could be attributed to problems plaguing the service sectors. Earlier when American productivity was growing at 3% per year, the productivity of electrical and gas utilities was growing at a rate of more than 6% a year. Now that productivity in these utilities is declining at the rate of 1% per year, there is a slow down in productivity and it accounts for nearly 10% of this decline. The British and French experience has been no different.

The infrastructure development of areas such as steel, power, transport, fertilizer, cement, communication, health, civic amenities etc. have been reckoned as problematic and expensive aspects of development but have become inevitable in order to promote economic self-reliance. In many developing countries for instance South Korea where massive investments were made in these sectors, economic growth has paid off the investment many times over. It is therefore fairly explicit that developing countries not only have to make optimum use of already existing infrastructural facilities but have to make massive investment and perhaps to continuously do so in spite of some inherent drawbacks and unduly long pay-back periods.

Impact of Technology

Science and Technology have transcended the national boundaries and affected the lives of human

beings throughout the world. While technological progress has truly shrunk the world into a compact unit, the progresss achieved the world over, has been rather uneven. The North for example continues to be the pace setter for technological change and is in command of most of the resources whereas South continues to be steeped in poverty and poor standard of living.

Promotion of science has to be made more relevant to national needs with the involvement of scientists, academics and professionals and by seeking closer involvement of scientists to promote a "science of humanism" which will usher in a new culture which can confidently withstand the humanity in the coming decades and prepare them for an onward march beyond 2000 AD.

The Human Resource Development

As the economy grows, industrial base expands and services gear up to meet the expanding and diverse requirements of the economy. It is precisely under such circumstances that the need of skilled manpower and managerial talent is acutely felt. We cannot build high quality economy with low quality inputs, and specially the human factor which is most critical since this permeates in every domain of economic endeavour. The importance of human resource development is therefore obvious, but unfortunately this is one dimension of economic growth which is underrated and often given low priority. Ultimately economy needs upgraded skills which may not be available and therefore it cannot thrive unless there is a major effort to upgrade the manpower skills from top down the line.

Productivity—A Retrospect

Productivity movement evolved through the industrial revolution in the west and had to be strengthened, out of sheer necessity during the two World Wars. After the Second World War both the ravaged and the exploited economies were left high and dry with very little manpower and productivity movement obviously was directed towards improving labour productivity.

With political freedom and the determination on the part of emerging nations to achieve a faster economic growth the approach to productivity had to be modified and refined. In view of the fact that industries in the past were largely labour intensive, productivity efforts were primarily directed towards time and motion studies which were considered to be the core productivity techniques. Productivity improvement cells were set up in industrial establishments and offices. These were concerned with activities such as layout, staffing pattern, manpower requirements fixation of norms, O & M studies etc. The emphasis had been largely on shop floor or desk-top tasks and how well these could be done. In other words, 'productivity' continued to be highly misunderstood and productivity ideas could hardly take the shape of a movement. Any 'movement' by its definition must necessarily involve everyone be it labour, employer, government or the general public. At macro or national level, productivity was rarely pursued as a policy or as a movement, or a process of growth strategy.

Productivity—The Pace Setter

In India, productivity activities were launched in a big way in 1958 and National Productivity Council was chartered to spearhead this drive. To make it a national movement, we now have a base of 48 Local Productivity Councils which constitute the grass-root mechanism of productivity. However, the most eventful feature of the productivity movement in India has been the observance of 1982 as the Year of Productivity when our Prime Minister gave the clarion call to make coordinated efforts to maximise capacity utilisation in all sectors of the economy and to achieve greater efficiency in the implementation of the projects. The 20-Point Programme with its emphasis on major areas of endeavour and the minimum targets to be achieved for rapid development, modernisation and industrialisation have reaffirmed the need to optimise results to provide a better standard of living to the people.

To ensure that productivity efforts create greater impact on the national scene, the National Productivity Council identified five major areas of national endeavour :

1. Energy and materials conservation
2. Maintenance Management

3. Labour-Management Relations
4. Pollution Control
5. Small Scale, Khadi and Village Industries.

As per the decision of the Central Advisory Council of Industries seven industry-wise Productivity Boards have been set up for major industries :—

1. Cement
2. Paper, Pulp and allied industries
3. Leather and Leather goods
4. Automobiles and Ancillaries
5. Machine Tools
6. Industrial Machinery
7. Power Generation, Transmission and Distribution Equipment.

The National Productivity Council has instituted Productivity Awards for core sector industries, viz. Fertilizers, Cement, Thermal Power Generation, Road Transport (Passenger), Paper, Coal, Sugar and Heavy Engineering.

Recognising the important role which trade unions and workers play in promoting productivity special efforts were made to bring closer involvement of workers and trade unions through orientation of trade union officials in productivity and by undertaking productivity programmes for workers. Another task taken up was to promote workers' participation in management and taking up special studies in about 100 selected units to assess the present status and to identify factors which hinder or help the participative management.

Time for Accelerating

In India we recognise that productivity efforts to be pragmatic should concentrate on critical sectors of the economy. From a stage of "operation forward" we have to move to "acceleration phase". We have therefore to lay greater emphasis on materials and energy conservation, human resource development, management information system for effective and speedy implementation of projects, re-cycling of waste materials, environmental pollution etc. We further recognise that the survival and economic revival of developing countries hinges on productivity improvements. What is therefore required, is a positive attitude and a bent of mind to continuously strive for improvements. Productivity is no more a propelling force but a positive promoter of the will and the wisdom of our people which can usher in growth, progress and prosperity.

An Institution is like a 'tune';
It is not constituted of individual sounds,
but by the relations between them

—Peter Drucker

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Productivity Based Incentive Schemes— Some Aspects

PADMANABHAN N.

The importance of praductivity in general and of labour productivity in particular, to the wellbeing of a country geared to a planned economy and with a vast reservoir of manpower, cannot be over emphasised.

Productivity linked wage schemes have not, however, proved to be unalloyed blessing. While a good deal of conceptualisation is possible and such thinking has enriched the literature on the subject, there are certain aspects of productivity schemes which the practising manager would do well to keep in view. For example, the category of personnel to be covered, whether the scheme should be individual based or group based, the parameters and of course the rates. There should also be an inbuilt provision for review. The tendency to look upon an incentive system as a panacea for all ills or even as a remedy for low wages or low level of efficiency, should be eschewed. If these ground rules are taken care of, there is every reason to expect that the scheme which is evolved, will work satisfactorily.

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It may look like stating the obvious if one were to stress the importance of 'productivity' particularly for a developing country like ours. Nevertheless the concept is so relevant and its translation into action is so important that it may bear repetition to consider—albeit briefly—the definition of 'productivity' and the essential attributes of that concept.

What is Productivity ?

Literature is replete with definitions and explanation of productivity so much so it may even appear that there is no agreed definition of the term or at any rate an element of ambiguity or haziness persists in dealing with the concept. For all practical purposes, however, a workable definition would be that given by the I.L.O. namely, that productivity is the "ratio of the output of wealth produced and the input of resources used up in the process of production."

Labour productivity i.e. the productivity of labour, as one of the factors of production, may be defined as the ratio of output to labour inputs. It is the output per unit of labour employed, reckoned in terms of the man-hour or man-day.

A glance at elementary statistical data relating to our workforce, will bring out in clear focus the benefits of even a marginal improvement in productivity. The total working population in India is estimated to be in the region of 180 millions. Factories alone taken

together, employ near about 6 million persons. Their wage bill is of the order of 3.3 billion rupees. The amount (sales) turnover of the public sector, with a workforce of 1.8 millions, is to the tune of Rs. 20,000 crores. The benefits that would accrue all round of even a small increase of say 2% in the productivity of this huge manpower asset—is too obvious to need any elaboration. The production of the Small Industries Sector during 1979-80 has been valued at Rs. 19,000 crores. It employed 6.5 million persons and contributed Rs. 1,050 crores to the country's exports. In terms of value added, the production represents 28% of the total industrial production in the country. By 1984-85, the production by this sector is expected to reach Rs. 33,000 crores with an employment level of nearly nine million persons.*

These are impressive figures by any standard. The relevance of further increase in productivity here is, if anything, even greater.

Productivity—Conceptual problems

Now productivity is the end-result of the application of a number of factors—machinery, materials and men. When we consider wage-incentive schemes, we are referring to the third factor—the productivity of labour—the important role of which in the matter of productivity is all the greater in labour intensive industries and in developing countries with a large reservoir of manpower.

That a monetary incentive scheme can help raise the productivity of the average worker presupposes that money can act as a motivator in inducing him to put in greater effort. This no doubt involves too simplistic an assumption about the nature of man. Nevertheless, it cannot perhaps be gainsaid that at the present level of wages, the inducement offered by higher earnings does have a measurable impact on the output.

In any commonly accepted scheme of incentives the benefits of this increase are shared between the labour and the capital. Labour gains in the obvious form of increase in earnings. The gains to the enterprise can be in many forms and establishing a direct relationship between the gains and the increase in production may be more complex that may appear on the surface. Lowering of cost of production per unit of the output is by far the most common form in which the gain may manifest itself. Where the machinery employed or the equipment used is costly or where fast changing technology may render the existing machinery obsolescent in a short period, there are definite advantages arising out of the more intensive use of the machinery or equipment. Again as the incentive earnings are generally allowed only on production measuring up to the specified standards of quality, the worker tends to become his own supervisor to a significant extent and this brings down the need for closer and tighter supervision with its attendant favourable implications in human relations.

Incentive schemes arrived at increasing productivity have not, however, proved to be instances of unalloyed blessing. In fact such schemes were not intended to be and they cannot, in the very nature of things, be a panacea for all the ills that may afflict production in an enterprise. (We use the term 'production' here in a larger sense by referring not only to production of material or concrete things but also to services like transport, banking and the like.)

Complexities, to some extent at least, are inherent in any incentive scheme—group of individual. These arise from some fundamental considerations. The determination of the norms for measuring work levels for reckoning incentive payments, lead, in the ultimate analysis, to the intractable issue of a "fairday's work" —a neatly carved out term but difficult to dissect and even more difficult to spell out in practice. At a lower level of conceptualisation, the determination of incentive payments involves, at some stage or the other, subjective factors, which, as they involve dealing with people in large numbers in a work situation, are bound to have inbuilt sources of difference of opinion if not of straight conflict. The greater the endeavour to reduce the impact of the subjective elements the greater is the complexity that creeps into the system. Thus there is a kind of trade-off between these two parameters which have seemingly opposite effects. The determination of

*From the Annual Report for 1979-80 of the Small Industries Development Organisation as referred to in the Issue dated 13.5.1981 of the Times of India, New Delhi.

the optimum point will be governed by the circumstances obtaining in each enterprise or unit where the scheme operates.

While these considerations refer in brief and in a rather abstract form, the difficulties which may have to be reckoned with in devising a scheme which is not only acceptable but also workable, experience has highlighted certain specific areas where problems may be encountered.

Productivity—Practical Problems

One of the primary difficulties in devising an incentive scheme is in determining the scope of coverage of the scheme i.e. the workers (and if a higher level than operatives is to be covered, the cut-off level) to whom the scheme would apply. The workers directly concerned with the manufacture or assembly of the product of the enterprise are obviously very much covered. Difficulties, however, arise when one has to consider the claims of those who may not be directly involved in the production process but whose contribution will nevertheless be essential and significant. In a manner of speaking all the persons employed in an enterprise contribute to its final working results operational or financial. In fact some of the labour enactments, in so far as their coverage is concerned, are based on this approach. Such an approach would, however, be relevant only to these schemes whereby virtue of the diverse nature and vast magnitude of the operations of an enterprise a scheme restricted to specific areas of its production may not be workable or may even be counter-productive e.g. due to its adverse impact on harmonious industrial relations within the enterprise.

In many enterprises this problem has been met by including in the scheme such of the workers as are closely associated with the production process—though not directly involved in it. They are sometimes referred to as "essentially indirect workers." The rate of incentive payment in their case will, however, generally be lower than in the case of the direct workers.

Yet another problem, which may sometimes prove to be intractable is that arising out of differences in earnings caused by incentive payments, when differences are of such magnitude as to create marked disparities between different workers. The disparities may be among the workers participating in the scheme or they may be between 'incentive workers' and those not covered by the Scheme or both. This problem is quite likely to arise when the incentive earnings constitute a major or even a significant component of the total emoluments of the workers. The resulting disaffection and consequent loss of morale or lack of motivation particularly among those not covered by the Scheme may sometimes assume such proportions as to detract from the effectiveness of the Scheme as a whole in improving productivity. Careful thought has to be given to this possibility when devising an incentive scheme.

The more closely the incentive payments are related to the level of production the greater will be the tendency to speed to production even at some personal risk. Hence the possibility of overlooking safety requirements and consequent increase in accidents. On the other hand if the payment is not closely related to the production the incentive effect is correspondingly reduced. Here again an optimal point has to be arrived at. For a similar reason quality is also likely to be a casuality. Even though adherence to quality standards can be ensured by stricter inspection, the cost—direct as well as in terms of inter-personal relations—has to be reckoned with. Further one of the assumed advantages of a wage incentive scheme, namely need for less close supervision is virtually lost if inspections have to be tightened to ensure that quantity is not attained at the cost of quality because of the incentive system.

In industries where change in technology is comparatively faster or rate of obsolescence is greater, a particular difficulty may arise as norms for production on which the incentive is based may not be relevant for the new technology or machinery. This would obviously necessitate material changes in the incentive scheme but it may give rise to problems particularly in recasting or revising the Scheme in an acceptable manner.

The foregoing considerations bring up certain aspects which Managers who wish to evolve a durable and effective incentive Scheme, will do well to keep in view. Certain other aspects also are worth noting.

The first and the foremost consideration to be taken note of is that a wage incentive scheme can never be a substitute for a satisfactory wage and salary structure. In fact where the wage level or the wage structure is such as to be basically unsatisfactory, a wage incentive scheme may cause more problems that it may purport to solve. The basic wages should be adequate and should be perceived to be fair in comparison to those prevailing in similar industries in the same region. Only when this condition is substantially fulfilled can a wage incentive scheme be thought of if it is to serve the purpose for which it is designed.

We have considered some of the problem areas which the manager proposing to introduce a wage incentive scheme may confront. Apart from these, there are certain aspects deserving attention in the context of instituting such a scheme.

One of the main points to which attention has to be paid before devising a scheme is whether the incentive should be for individual plants or factories in the organisation or it should cover the enterprise as a whole. A scheme, the parameters of which are directly connected with the production at the unit level cannot obviously be extended to cover the entire organisation. A classic example is the piece rate system—one of the oldest methods of linking wages to productivity—which can by no standard of reasoning be extended to individuals or groups not directly concerned with production. The incentive effect of a unit level particularly when the incentive payments are paid as part of monthly wages is direct and perceptible. Nevertheless it may not yield the desired results in full measure as other members of the organisation whose indirect contribution may be material, are outside the purview of the scheme.

A scheme covering the enterprise as a whole is free from this drawback but it presents certain other problems, the chief of which are : (i) evolving norms relevant and equitable for the various kinds and levels of workers whose contribution to the overall performance would be varied in quality as well as magnitude; and (ii) dilution in the incentive effect as the reward is far removed from the centre of action.

If it is decided to have a plant level incentive scheme, a further decision has to be taken whether the scheme will be individual-oriented or group-oriented. The foregoing considerations apply to a substantial extent to the two possible methods of incentive remuneration.

When contemplating the introduction of an incentive scheme, the Manager has to carefully assess the state of industrial relations in the plant or the organisation as the case may be. When the state of labour-management relations leaves much to be desired or even when the relations are strained, albeit temporarily, it would be inopportune, even if the other factors are found to be very favourable, to introduce such a scheme. The existence of industrial relations in a reasonable state of health would thus be a very desirable circumstance conducive to the successful working of a well-conceived scheme.

As in the case of wages and industrial relations, attainment of minimum level of efficiency is also a prerequisite for introduction of a wage incentive scheme. Thus such a scheme should not be used as a device for bringing up efficiency to the minimum or average level in the particular industry or trade. This conclusion follows also from the reasoning that the norms for earning incentive payments should be neither so slack as to be easily attainable with little or no effort on the part of the worker nor so light as to be almost unattainable.

Incentive Earnings Vis-a-Vis Total Earnings.

Where incentive payments constitute a large part of the pay packet of the majority or a substantial part of the work force, they have an impact on the attitude of the workers. A tendency may develop to look upon such earnings as part of the normal monthly earnings and demands may build up for workers being guaranteed such payments irrespective of the condition enjoined in the relevant scheme for such earnings becoming admissible. Unions may take up such demands and collective disputes may be the result. When such situations arise it is possible that arguments on either side may get torn from the context overlooking the basic aims of the parent scheme.

On the other hand where incentive payments are unreasonably low, they will, for obvious reasons, cease

to have an incentive effect. Similarly when earnings on other counts are comparatively larger they are likely to distract the attention of the workers governed by the incentive scheme, particularly when they can be secured with comparative ease. Overtime earnings is a case in point. It is not suggested that the incentive rates should be jacked up merely to get over this difficulty. But management can certainly sit up and have a fresh look at the scheme and the principal conditions governing it to see whether they have not got out of line when viewed in the context of the change in circumstance from the time when the scheme was originally introduced. For example, regulation of overtime working and overtime earnings may be largely a matter of managerial control but when a marked tendency to earn more through overtime working in preference to incentive working is noticeable, it certainly behoves the manager to have a look at the factors relating to the incentive earnings too.

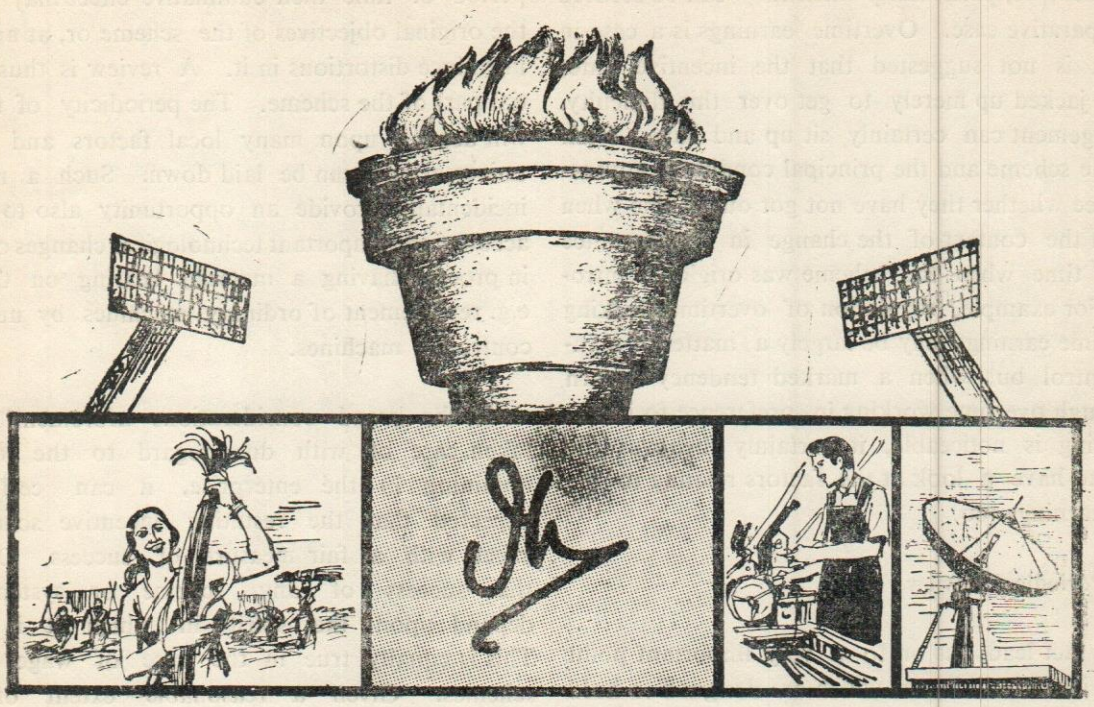
Need for Periodical Review

This in fact leads us on to a very important point relating to incentive schemes which are designed to hold the field on a long-term basis. An incentive scheme should always have an in-built provision for a review. The parameters governing a scheme designed to achieve labour productivity are such that a periodic review is necessary if the scheme is to retain its dynamic character and subserve the purpose for which it was evolved. In the course of operation of such a scheme modification on matters of detail are bound to take place either as a result of demands made by labour or otherwise. Decision in this regard may be taken from time to time in comparative isolation with the result that over a period of time their cumulative effect may be to blur the original objectives of the scheme or, at any rate, to introduce distortions in it. A review is thus an essential part of the scheme. The periodicity of the review will depend upon many local factors and hence no universal rule can be laid down. Such a review will incidentally provide an opportunity also to take into account any important technological changes or changes in process having a material bearing on the seheme e.g. replacement of ordinary machines by numerically controlled machines.

If the broad considerations aforementioned are taken care of with due regard to the conditions obtaining in the enterprise, it can certainly be expected that the resulting incentive scheme will meet with a fair measure of success. Of course, the success of any scheme or system would depend upon the spirit in which it is worked. This is equally true in the case of wage incentive schemes. Given a reasonable extent of understanding and an attitude of accommodation on the part of all the parties concerned with the working of such a scheme, particularly of management of labour, there is no reason why a scheme which takes care of the essential aspects outlined above should not succeed and contribute to the progress of the organisation and its members and thereby to the welfare of the community as a whole.

If you want people to think well of you,
do not speak well of yourself

—Balrse Pascal



SHRAMA EVA JAYATE

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Solar Energy in Rural Development

MOHAN LAL GUPTA

In this paper an evaluation of the contribution which solar energy can make to the rural development efforts of the developing countries has been presented. In particular the priorities of solar energy implementation geared to specific objectives within rural development programmes are outlined. The difficulties incurred are considered and the strategy for further development of solar enegy in rural area are specified.

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Introduction

The multifold rapid increases in the oil prices by Oil Producing and Exporting Countries (OPEC) in 1973 and onwards from time to time due to political reasons and geometrical increase in the population, depletion of fossil fuels and the policies of distribution of available fuel by the Government brought into sharp focus the need to consider alternative sources of energy such as biomass energy, solar energy, wind power, biogas energy, energy from ocean waves etc. to solve the present energy crisis. Various research and development programmes aimed at utilizing these energy resources are being pursued in India and elsewhere. Of these, renewable resources are attractive in the long run and deserves strong considerations even if they are more expensive than fossil fuels.

There is not any particular conventional energy resource suitable to meet the total energy demand for all tasks in rural sector. Sun energy is a well known resource which is widespread, non-exhaustible, non-polluting and free of cost with the high potential of applicability, and therefore more viable than others. In this paper attempts have been made to present the appropriateness of solar energy in the rural development programmes.

Criteria for Evaluating Appropriateness

The appropriateness of an energy resource in rural context can be determined by its relationship with rural development. Rural development can be stated in

simple terms as the problems of providing gainful employment to people in villages in the quickest possible time with a reasonable expenditure of resources (including finances) and in a manner consistent with the lifestyle of the people. Viewing from this angle, in order to assess the appropriateness of energy resources, following attributes can be identified :

(i) Capital cost of energy conservation devices,
(ii) Recurring costs,
(iii) Energy technology availability: time factor,
(iv) Priority for the use of resource under consideration in a given application,
(v) Organisational and maintenance aspects,
(vi) Socio-economic acceptance,
(vii) Generation of local employment,
(viii) Use of locally available fuels or materials.

The above attributes can be summarised for appropriateness of solar energy implementation devices in the rural areas :

(i) The evaluation of some specific areas of rural development projects where solar energy could be applicable and where its utilization would further its acceptance as an aid to development.
(ii) The identification of low cost solar energy devices applicable to rural areas and suitable for local manufacture.
(iii) The assessment of factors relevant to the implementation of solar energy in rural areas, such as socio-economic considerations, technical appropriateness, development, strategy and the national/international co-operation required.

Appropriate Level for Solar Energy Utilization

The utilization of solar energy in rural areas of a developing country will only be achieved if it explores the possibility of introducing it at the appropriate level as an aid to development. In other words an appropriate technology is a style of development which will create employment and improve productivity and suit the conditions of the rural areas. Solar energy technology is indeed very much suitable to climatic as well as socio-economic conditions in developing countries. The appropriate technology level for harnessing the potential of solar energy in the rural areas is one, in which the capital cost should be minimised, local materials should be used in any construction and the operation. Maintenance of the appliances should be given in the rural sector itself so that time factor as well as transportation charges can be minimised.

Solar Energy in Rural Development Programmes

In the rural areas of developing countries solar energy can be profitably applicable in the following rural development programmes :

(a) Food & Agriculture production, preservation and processing :

Some of the viable possible applications of solar energy for particular area of development are given below :—

(i) Strengthen and improve knowledge of climatic factors in the various regions so as to make better use of water and sunlight using pumping and distillation equipment.
(ii) Storage and preservation of agricultural produce using solar drying, cooling/refrigeration equipment.
(iii) Development of fisheries using solar drying and refrigeration, and
(iv) Development of food technology using new techniques in processing the food and agricultural produce via rural industries employing solar heating/cooling and power units.

The viability of various solar appliances keeping in view the appropriateness, are as following :

Solar Pumps

The use of solar pumps for irrigation purposes is attractive as the intermittent nature of solar energy need not necessarily be a major problem. The major obstacle to the more widespread use of solar pumps at present is their high initial cost. Their widespread use in rural areas of developing country would not be a

feasible proposition unless costs could be reduced. Development is necessary in order to reduce costs and to improve the efficiencies of the units which have been built.

With imaginative design it is possible to reduce the capital cost of installation e.g. the collector consisted of a corrugated iron arrangements. In this way we may use the roofing material available locally and some economy in the cost of the overall development of the area can be easily achieved.

Solar Stills

In order to achieve solar distillation at minimum cost in rural areas of developing countries, it is essential to have installation which utilises local materials and man power as much as possible. Low cost designs using appropriate techniques are required to assess the efficiency under limited climatic conditions.

Solar Cookers

In order to achieve benefits of solar cookers in the rural areas of the developing countries, it is highly essential to make it low cost installation so that a majority of people can use it with a great convenience. Low cost designs using appropriate levels are essential to have better efficiencies under limited climatic conditions with the use of local material and manpower.

Solar Driers

A large contribution to make in food preservation in rural areas in both agriculture and fisheries, is solar drying. 20 to 40 per cent of agricultural produce is lost due to the poor storage, dampness etc.

Simple solar drying units already exist within rural communities but this technique can be improved in hygiene, nutrition and productivity. If increased productivity is introduced in agriculture and fisheries, then there will be an even greater need to accelerate the present methods of drying. Several designs are presently available for drying. However, work should be done in choosing local raw materials for constructing these units and reducing the cost keeping the performance constant.

Solar Cooling/Refrigeration

Application of solar energy for cooling and refrigeration is a very important area of consideration. Simple evaporative coolers in rural areas can be useful keeping dairy produce cool while awaiting collection.

The cheapest and simplest refrigeration arrangement is one, based on a non-focussing heat collector and intermittent operation. This system would seem to offer possibilities for rural application in developing countries. The absorption refrigeration system is aptly appropriate to solar energy utilization. This system can operate by a solar input via flat-plate or focussing collectors making use of an intermittent or continuously operated arrangements. Work should proceed in optimising components, improving efficiencies and developing more economic units which could be used in rural areas where appropriate.

Rural Industries & Small-scale Power Systems

Many rural industries may be set up which require solar energy as a heat source to boil water, produce steam or hot air. Possible application of solar energy to rural industrialisation are in fruit/vegetable processing, honey, crop, fruit and fish-preservation, baking, algae-culture, brewing of beverages, herb medicine, soap manufacture, ceramics etc.

In village industries, solar energy can be useful in getting the power with a low-cost installation and maintenance. The solution to the problems of the economics of solar power for villages could well lie in only an integrated approach, with solar energy combined with other techniques i.e. inter-disciplinary approach. Production of methane gas by anaerobic fermentation of animal, human and vegetable waste requires temperature of the order of 30°C in order to promote fermentation well, solar energy can be used for heating the slurry in winter. Furthermore, methane gas production in rural areas of developing countries has the added advantage of contributing to improvements in waste disposal and fertiliser use. The economics of the process with local manufacture of equipment in developing countries would require to be considered.

Solar energy can be contributed to the improvement of facilities in rural institutions such as clinics, hospitals, there can be a need for both heating and cooling. Hot water is necessary, steam would also be useful for sterilizing and refrigeration is required for vaccine storage. Distilled water might also be required for certain purposes. Solar operated water heaters, stills, steam cookers and refrigerators should be introduced where appropriate and where funds are available to cover the initial costs. It may be the case that, in order to provide the energy for several of these units, the most economical arrangement would be methane plant with solar energy heating when required. If storage of the gas was provided then a more dependable set up could also be achieved.

International Co-operation Needed

The basic requirement is the communication of the recent developments in the field of solar energy via governmental/private agencies involving themselves in the service of mankind. In formulating research projects, solar scientists should take care of the fundamental needs and limitations. There is a great requirement of education and training on the potential use of sun energy within the sectors of developing countries. The government should adopt the policy of subsidies so that propagation of solar appliances becomes more popular, which will definitely accelerate to achieve the aims of developing world.

Solar energy has a great potential as well as an important part to play in rural development programmes of developing countries, provided certain steps are taken to ensure its place within such programmes.

Development work in solar energy, for the rural communities in mind, should aim to make low cost and application oriented devices. Intensive considerations are essential to keep the economics of solar energy for particular rural development programmes, viable before taking up the projects.

REFERENCES

1. Cashman, T., the new alchemy institute small-scale ecosystem farming, *Appropriate Technology.*, Vol. 2(2) : 20-22, 1975.
2. Revelle, R., Energy use in rural India, *Science.*, Vol. 192: 969-975, 1975.
3. Revelle, R., Energy Sources for rural development, *Energy*: Vol. 4:969-987, 1979.
4. Tiwari, S. K. and Srinath, L. S.: A methodology for evaluating appropriateness of new energy resources in rural applications.
   Proc. Indian Acad. Sci., Vol. 4(C2): 507-520, 1979.

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Perspective of Foreign Collaboration in India

DR. R. R. AZAD

Foreign collaboration is one of the basic needs for the industrial development and economic growth of a country. The present era of scientific and industrial advancement is such wherein no country, developing or developed, do without it. The countries of world at large are generally seeking and providing collaboration to each other in one form or the other.

This paper studies pros and cons of two types of foreign collaboration in India, the Government's policy and the recent terms and conditions. It gives a brief account of foreign collaboration agreements approved in various industries since Independence and its future prospects as a catalyst of Indian Economy. The objective of this paper is to give a clear understanding to the investors as well as collaborators.

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Need for Foreign Collaboration

Foreign collaboration plays an important part in the development of economic potentialities in underdeveloped countries like India. The low rates of income in underdeveloped countries result in small or negligible savings and small savings in turn result in low rate of capital formation. Thus an underdeveloped country is deficient in capital resources. Capital in such countries usually remains shy and the investment for the exploitation of natural resources suffers a great deal. Underdeveloped countries are, hence, deficient as far as the availability of capital is concerned. They also lack in technological advancement, know-how, skills, modern scientific and research facilities. All these factors make such countries industrially backward. It is, therefore, very essential to augment domestic savings by making use of external resources. Foreign collaboration may, by bringing in technical experts and technical know-how, bridge the vital gap between the demand for and the supply of technical knowledge and also of trained personnel to carry through the programmes of industrialisation.

Forms of Foreign Collaboration

Foreign collaboration is a wide term. It covers (a) oint venture involving equity participation by foreign collaborator, (b) out right purchase of technology or licensing arrangements.

In India, equity participation exists either in the

form of entrepreneurial capital by way of share holdings or in the form of loans and advances by way of financial investments. It has taken place through the branches of foreign companies controlled by a foreign appointed Board. It is also found that such participation is done through subsidiaries which were incorporated in India but majority control on them vested in a single foreign company. Foreign collaboration by way of outright purchase of technology or licensing arrangement is sought by the import of foreign technology and capital goods or by the import of technical know-how. Technical collaboration is required in the field of such industries where Indigenous technology has not yet developed to the desired extent or where it is not available in India at all.

Pros and Cons

The question arises as to which form of foreign collaboration should be adopted in India. The protagonists of joint-ventures involving equity participation feel that it ensures foreign collaborator's interest in the profitability of the joint venture. This would mean continuous supply of fresh technical know-how, updating of technology, assistance and co-operation of the collaborator in securing internal and external markets. Antagonists of this form of foreign collaboration are of the view that the joint-venture agreement involves perpetual outflow of foreign exchange in the form of rapatriation of dividends, supply of inferior or out moded technology, exploitation by the foreign collaborator through tied purchase of machinery and components, restrictions on diversifications of the joint-venture, constraints on modifications, adaptation, constraints of reverse flow of technology etc. It is also pointed out by them that the concept of flow of fresh technology from the collaboration is also a myth because under most of the foreign collaboration agreements separate payment is required to be made every time new technology is obtained from the collaborator.

On the other hand, some people feel that the outright purchase of technology or licensing arrangements serve the interests of a country better than the joint technology, a country becomes able to build a self-reliant economy through the better utilisation of its material and human resources. The outright purchase of technology adds to human and intellectual capital of the importing country. Doubts have been expressed in certain quarters that the exporter of machinery and technical know-how sometimes deceive the importing countries by sending them second-hand machinery and equipment. They also do not impart uptodate technical knowledge to the persons in the importing country so that the dependence of the importing country on them may continue.

In view of the facts stated above we can conclude that it will be better if a country adopts a combination of both the forms of foreign collaboration. The share of each of these forms of foreign collaborations will depend upon the requirements of the country or of the industry or of the unit for which foreign collaboration is required. It will also depend on the nature of technology, the possibility of getting the required technology locally, the extent of foreign equity involved, the capacity of the Indian Associate to absorb the technology and other alternatives available.

Policy for Foreign Collaboration

In view of the success achieved by a number of developed countries through the adoption of both the aforesaid forms of foreign collaboration, India adopted a form which combined the good points of both. Foreign Investment in India has always been viewed as an instrument of policy for the transfer of technology. In other words, need for foreign technology determines whether foreign investment should be allowed or not. The Government of India allowed foreign investment only on selective basis. It allowed foreign investment in certain fields where expertise or know-how was not available in the country. When it became available in those fields, it stopped allowing foreign investment there. Foreign investment not accompanied by transfer of technology or not promoting export oriented production is not being allowed.

An exception has been made in respect of Oil Exporting Developing Countries to the obvious reason that they have substantial surplus financial resources but do not have the type of technology needed in India.[1]

It has been the policy of the Government to ensure

non-discriminatory treatment for foreign collaborators, The post-entry regulations governing foreign investment are by and large, the same as are applicable to Indian investors. These investments are governed by the provisions of the I (D&R) Act, 1951; The Companies Act, 1956; The MRTP Act, 1970, and the FERA, 1973. The Government of India has always been making it clear that it will not resort to the policy of nationalisation of the units where foreign collaboration existed. If nationalisation is considered imperative in the overall interest of the nation, appropriate compensation will, invariably, be paid.

The Government has also been notifying since 1969 for the convenience of the collaborators (both Indian and Foreign) lists of industries where foreign collaborations were permissible and were not permissible. A list of 22 categories of industries,[2] for example, was notified by the Government of India in 1978 where no foreign collaboration was to be permitted. This implies that in all the other categories of industries outside the list, foreign collaboration would be permitted on merit.[3] In view of the constant technological advancements taking place in the developed countries, there will be a need for updating our technology and production from time to time. The Government has, therefore, decided to permit technological collaboration subject to the fulfilments of the following conditions[4] even in the 22 categories of industries where such collaboration was banned :

1. Indigenous technology for items in the list developed/exported is too closely held and is not available for use by the entrepreneurs on competitive terms;
2. Technology is required for up-dating the existing technology in India to fulful the domestic requirements most efficient or to become competitive in the export market;
3. Such import is required for manufacture of items with substantial exports backed by buy-back guarantees.

The Standard Terms

Most of the agreements for the supply of the technical know-how are either against lump sum payments or on royalty payments or partly on lump-sum and partly on royalty payments. The lump-sum payment is allowed to be made in 3 instalments. Royalty should ordinarily not exceed 5% of the net ex-factory value of production. However, in exceptional cases a higher royalty payment may be approved. The duration of royalty agreements is normally restricted to 5 years from the date of commencement of production or 8 years from the date of agreement. Renewal or extension of the royalty agreements may be considered on merits.[5]

As far as equity participation is concerned, foreign investment should ordinarily not exceed 40% or the total equity capital. However, higher foreign equity can be allowed in priority industries involving higher or sophisticated technology or those involving export oriented schemes. While in the case of export oriented industries foreign equity can go up to 100% in the case of priority industries requiring sophisticated technology but catering to the needs of the domestic market, foreign equity investment may go up to 74%.[6]

It will not be out of place to mention that all proposals for entry of foreign collaborations into Indian industries in the form of equity and transfer of technology require the approval of the Government of India. Foreign collaboration proposals involving investment not exceeding Rs. 2 crores with equity participation upto 40% are now considered by the Foreign Investment Board for their disposal. Proposals exceeding the above limit of investment and foreign equity participation are referred to the cabinet committee on Economic Policy and Coordination. In order to streamline the procedure for disposal of foreign collaboration proposals, the Government has recently delegated additional powers to the Administrative Ministries subject to has fulfilment of the following conditions[7] :

1. That there is no foreign equity participation in the proposal;
2. That the applicant is not a company with existing foreign equity investment;
3. That the item proposed to be manufactured is consistent with the priorities set out in the Industrial Policy Statement: and

4. That the foreign exchange out go in each case on lump sum, if any and royalty together should not exceed Rs. 50 lakhs in aggregate.

A Brief Analysis of Foreign Collaboration Agreements

It is worth noting that the Government of India has preferred foreign collaboration proposals for the transfer of technology to those involving foreign investment. During the recent period of 13 years (1969-81) 3,748 foreign collaboration agreements were approved out of these agreements 645 agreements were technical-cum-financial, and 3,103 agreements were for the supply of technical know-how (Table-I). It is, thus, clear from Table-I that about 83% of the agreements approved belonged to the transfer of technology group. This is an ample proof of the fact that FERA have not adversely affected the inflow of foreign technology into India. Although, the area of foreign technology has shrunk, yet the number of foreign collaborations has gone up. It increased from 135 in 1969 to 359 in 1974 and further to 525 in 1980. However, it decreased to 389 in 1981 but the volume of investment toned up. We can, therefore, conclude that more technology is being imported into India than ever before. Besides the quantum of foreign investment has also increased. It was Rs. 3.62 crores in 1969. It rose to Rs. 6.23 crores in 1973 and to Rs. 9.41 crores in 1978. It however showed a small decline when it was Rs. 8.92 crores in 1980 but it went up again to Rs. 10.87 crores in 1981.

Table—I. Number of Foreign Collaborations Approved from 1969 to 1981

Year	No. of Foreign Collaboration Approved			Amount of Foreign Equity Investment Involved (Rs. Crores)
	Total	Technical	Technical-cum-Financial	
1969	135	106	29	3.62
1970	183	151	32	2.45
1971	245	199	46	5.84
1972	257	220	37	6.23
1973	265	231	34	2.82
1974	359	304	55	6.71
1975	271	231	40	3.20
1976	277	238	39	7.27
1977	267	240	27	4.00
1978	307	263	44	9.41
1979	267	235	32	5.63
1980	526	424	102	8.92
1981	389	261	128	10.87
Total	3748	3103	645 (17% of the total Approx.)	76.97

Source : Indian Investment Centre, New Delhi.

During the process of planned economic development Government of India has approved a large number of foreign collaboration agreements with various countries in various industries. Between 1957 and 1981 over 6,700 agreements were approved. The highest number of collaborations approved was from U.K. (1,552) followed by U.S.A. (1,304), F.R.G. (1,182), Japan (564), Switzerland (392), France (321) and so on (Table-II).

The statistical data of Table-II depicts that there is an over-all increase in the number of foreign collaboration agreements approved over the years up to 1981. But the comparative study of preceding two years (1980 & 1981) shows an overall decline in the number of foreign collaboration agreements approved except in case of France, Sweden, Netherlands, Austria, Canada, Hungary and Poland where the number has gone up to a little extent. Moreover, a country like Czechoslovakia is showing reducing trend of agreements perhaps due to non-implementation of one agreement. If we have deep concern on it, we find two important reasons behind it viz. (i) preferential weightage to the modest and technical collaborations, and (ii) avoidance of the agreements involving higher element of foreign investment. It has also widened our capacity of self-reliance, adaptability of modern technology and advancement of scientific and industrial research. It is also remarkable that while the Government of India has been quite liberal in allowing inflow of foreign technology, it has followed a selective approach with regard to foreign investment.

It is more intersting to note that the total number of foreign collaboration agreements approved in 1981 is 470 (Table-II) while out of these 389 were implemented

Table—II. Countrywise Foreign Collaboration Approved by Government of India

Country	Number Approved			Total of Cols. 2,3 & 4
	From 1957-79	1980	1981	
1	2	3	4	5
U.K.	1345	110	97	1552
U.S.A.	1096	125	83	1304
F.R.G.	998	100	84	1182
Japan	502	35	27	564
Switzerland	328	37	27	392
France	272	24	25	321
Italy	179	25	22	226
G.D.R.	113	8	—	121
Sweden	104	6	16	126
Netherlands	89	8	20	117
Czechoslovakia	68	4	(—)1	71
Denmark	58	6	1	65
Belgium	50	2	1	53
Austria	43	5	8	56
Canada	41	—	2	43
Hungary	31	2	3	36
Poland	24	2	4	30
Yugoslavia	17	3	1	21
Finland	16	5	2	23
Others	332	19	48	399
Total	5706	526	470	6702

Source : Indian Investment Centre, New Delhi.

(Table-I). Out of these 389 approved and implemented agreements 261 were purely technical and 128 were technical-cum-financial. The rest of the agreement e.g. 81 either remained unimplemented or were disapproved later on for one reason or the other.

From the industries wherein foreign collaboration is approved, the pattern of foreign participation reveals that the proportion of technical collaboration is higher. From the Table-III, it can be easily observed that the highest number of agreements is approved in Industrial machinery (2,642) followed by Electrical Industries

Table—III. Industry-wise Foreign Collaborations Approved.

Industry	No. As on 31st Dec. 1981
Industry machinery including Agricultural machinery.	2642
Metallurgical equipment and other machinery Machine tools, accessories, instruments including medical & Surgical Instruments	
Electrical Industries including telecommunication	1236
Chemicals, Drugs and Pharmaceuticals and allied industries.	1034
Transport Equipment and material handling construction equipment.	576
Technical Consultancy.	97
Others e.g. Ceramics, Cement, Fuel, Food industries etc.	1117
Total	6702

Source : Indian Investment Centre, New Delhi.

(1,236), Chemical durgs & Pharmaceuticals (1,024), Transport equipment (576) etc. A recent trend of Technical Consultancy has also been evolved wherein 97 agreements are approved. It includes even cement and food industries. Thus, it is very much clear that between two proposals for foreign collaboration the one involving outright purchase of technology has been preferred to that involving equity participation.

Hence, it can be concluded that our policy for foreign collaboration is a pragmatic and flexible one. The Government of India is well aware of the true significance of both types of foreign collaboration. The present healthy trend towards the foreign collaboration agreements covers a very wide range of Indian industries. It also indicates that a large number of foreign collaboration agreements has been approved in well planned industries even after the enforcement of FERA-1973. This trend will not only provide a great success to the industrial economy of India but project a better image with regard to her technological capability and self-reliance along with a fair and firm dealing with foreign collaborators.

REFERENCES

1. Press Note dated 26th Oct., 1980, issued by Govt. of India, Ministry of Finance, Deptt. of Economics Affairs, New Delhi.
2. Press Note 26th Dec., 1978, Govt. of India, Ministry of Industries, New Delhi.
3. Guidelines for Industries (1979), Part I, Govt. of India, Ministry of Industries, p. section I-27.
4. Ibid, p. Section I-23.
5. Ibid, p. Section 1-23.
6. Ibid, p. Section 1-23.
7. Ibid, pp, Section 1-23, 24.

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Productivity
1983, XXIV, 1, 31-34

Utilization of Forest Wastes for Production of Useful Fuels

ALI M. ASLAM

Utilisation of waste for any useful purpose particularly as an alternate source of energy needs a highly motivated workforce and an innovative technology.

Mr. Ali M. Aslam is working with Karnataka Carbons (P) Ltd., Bangalore.

Forest Outputs

In forests, the output per employee per year in India is very low. Although the number of employees per unit of forest produce in India is high, when compared to American or European counter parts, the forest produce obtained per person is very low. So it is the need of the hour to find out ways and means as to how to achieve more productivity; it is important to think of producing something useful that one needs immediately to solve the problems arising out of the energy crisis. Both people and machines should be put on work to increase the return on investment, resulting in more productivity. Another factor which is forcing both the developed and the developing countries to concentrate on waste utilization and to think seriously to resort to the alternative sources to overcome the energy crisis, is the worldwide restrictions put on the supply of crude oil, for the first time imposed in the year 1973. Many countries took immediate steps to develop nuclear, solar and other forms of energy to keep up the industrial growth but the results are not encouraging. The world economic growth slowed down, slackening the energy demand. The projected figure for the energy growth in 1980 shows considerably low rate of economic growth. Even though coal remains to be the major energy source, there are many problems to the industries sector during transportation, handling and combustion. Cheaper ways of liquefying coal is still under development stage wherein coal would be converted directly from the solid state to petroleum like liquid without

gasification. It is therefore desirable to develop an energy producing device based on renewable ingredients like the forest waste. The forest wastes include discarded wood, leaves, branches, lops and tops, bark, roots and twigs. It is easier to get these ingredients rather than the wood itself which has higher economic value for the production of pulp and paper, plywood and important wood based chemicals. At present the forest waste is not being utilized anywhere and these wastes are creating disposal problems for both the forest and the industry people. The waste utilization also contributes to a cleaner environment. The most ideal use in the present circumstances for forest waste would be to produce such chemicals which have more energy value and forms an alternate source for energy generation.

Using the Wastes

The wastes represent a lot of potential fuel. A random estimate carried out in the State of Karnataka showed that enough energy could be grown out of these wastes available in the State to substitute the use of LPG, lignite and fire wood used for the domestic purpose. The wastes can be delivered in big tonnages to processing plants to scale up the maximum efficiency. In other words these wastes would probably remain a major source for a long time to come.

To produce useful products, all these waste materials are first subjected to low temperature carbonization and then to high temperature carbonization. During the process a synthesis gas composed of carbon monoxide and hydrogen is produced and then passed over a catalyst to form methanol. Now techniques are under development to implement it.

The Process from Wastes to Useful Products

The waste material is first converted into pulverized material then transported to the processing plants when acid/alkali treatment is given to reduce the ash content. Unlike the wood, these waste materials contain more ash, sometimes attaining as high a percentage as 10. The solvable substances present in the ash are carbonic acid, sulphuric acid, hydrochloric acid, silicic acid, potash and soda. The insolvable substances present in the ash are carbonic acid, phosphoric acid, silicic acid, lime, magnesium, Fe_2O_3 and MnO_2. It is very difficult to arrive at a particular figure which gives the definite percentage of ash present in wood or the wood waste, as considerable variations have been reported in the experimental determinations wherein there is practically no agreement even amongst the trees of the same species. It is for this reason the ash percentage in waste materials could be taken right from 0.5 to 10. The average being 0.5 to 5. With the pre-treatment, waste material ash content could be reduced in most of the cases to an average figure of 0.5 to 1.0%. This treated waste material forms one of the most important basic raw-materials for production of useful industrial products or domestic fuels.

The treated pulverized material is highly compressed by using a hydraulic press using pyroligneous liquor as a binder. This highly compressed material could be obtained either in the form of square blocks of size 10 cms. height. The weight of each block will be approximately 2 to $2\frac{1}{2}$ times more when compared to the weight of wood of equal size.

The pelletized blocks can now be conveniently packed in trollies and taken inside the long cylindrical furnaces, where the blocks are subjected to low temperature carbonization. During this, the vapours that are evolved in the furnace are taken out through the process pipe line, passed through condensors and the condensate which is nothing but the pyroligneous liquor forms the source for liquid tar, acetone and methanol. The liquid tar is separated out by decantation process. After decantation, the liquor is treated with lime to remove acetic acid in the form of acetate. The acetate of lime is treated with sulphuric acid to get back the acetic acid. The acetic acid vapours (95-97%) are then passed over magnesium acetate impregnated with Fe_2SO_4 prepared by mixing Fe_3O_4 and magnesium acetate solution and dried into 4 mtrs. length and 5 to 6 cms dia. tubes, placed horizontally or vertically or impregnated with $FeSO_4$ at 420 to 500°C. Thus acetone from acetic acid is obtained. The liquor after the removal of acetic acid and liquid tar is subjected to distillation to remove methanol. The strength of this methanol will be around 75%. In other words it will only be a crude methanol. This crude methanol contains about 75% alcohol, 15% acetone and 10% water including some neutral oils. This crude methanol is

refined/rectified in a still to get 97% methanol. This 99.5% white methanol still contains acetone which can then be refined in fractionating column to get almost pure methanol.

The uncondensable gases are passed through scrubbers and hydrocyclones to separate the liquid vapours. The gases which contain carbon-di-oxide, carbon mon-oxide, methane, hydrogen and oxygen are passed through lime water to remove carbon-di-oxide. The combustible gases are then stored in gas holders for further use.

The temperature of the furnaces could either be increased to carry out high temperature carbonization or stopped at about 450-500°C. If the process is stopped at low temperature carbonization level itself then the loose carbon blocks left out in the furnaces are immediately removed and cooled in coolers with water circulation over the surface of the coolers. The cooling takes almost 50% of the time taken for low temperature carbonization. The product after cooling is taken out, grounded in a ball mill, binders are added and then high density carbon pellets obtained by compressing the material in hydraulic vertical press. The pellets are cured in the same furnaces which have been used for carbonization. The carbonization results obtained for some of the forest wastes are tabulated in Table No. 1 along with the corresponding energy value. The products obtained are very useful both in industry and domestic.

The methanol obtained in the process could be used as cheaper domestic fuel, fuel for boilers, as a source material for running automobiles, to run the energy producing devices and can be used in power plants such as turbines and fuel cells.

The high density carbon pellets could be used as cheaper domestic fuel, fuel for turbines and power plants, as an industrial raw material for the production of calcium carbide, silicon carbide, ferro-silicon,

Table No. 1. Average percentage yields of Tectona Grandis (Teak Wood)

Sl. No.	Particulars	Percentage
1.	Charcoal	33.00
2.	Gas	14.00
3.	Methyl Alcohol	01.35
4.	Liquid Tar	06.90

Table No. 2. Average percentage yields of Lagerstroemia Lanceolata (Nandi Wood)

Sl. No.	Particulars	Percentage
1.	Charcoal	34.20
2.	Gas	18.30
3.	Methyl Alcohol	00.90
4.	Liquid Tar	06.10

Note : Both Teak & Nandi woods used in the form of dust.

Table No. 3. Energy obtained per Metric Tonne on Teak & Nandi Wood Dusts

Sl. No.	Product	Yield in Kgs.		Heat of Combustion Cals/Kg	Total Energy Obtained in K. Cals.	
		Teak	Nandi		Teak	Nandi
1.	Charcoal	330	342	7,000	2,210	2,394
2.	Gas	148	183	1,600	236	292.8
3.	Methyl Alcohol	13.5	9	5,300	71.55	47.7
4.	Liquid Tar	69	61	10,000	690	610

ferrow-alloys, activated carbons, steel and iron, carbon disulphide and carbon tetrachloride.

The liquid tar obtained in the process can well be used as a substitute for furnace oil and hence serves as one of the major liquid fuels in processing industries.

It is therefore desirable to conclude that the forest wastes obtained from the renewable sources, give rise to the most logical fuels which are yet to capture the economic world. When once it is proved as most promising alternate source of energy, there will be no fear for depleting fossil fuels and increase in petroleum prices. These products will help to meet the ever growing demand of the world's energy requirements.

REFERENCES

1. Ali Aslam M., Studies on wood distillation and its products, M.S. Research Thesis, Ind. Inst. of Tech., Madras, May—1978.
2. Ali Aslam M., and Rao A.P.: Products of carbonization as an alternate source of energy; IIT Seminar on Wood Science & Technology, 13-14 March 1980; IIT, Madras-36.
3. Baron A. Piret De Bihain and Padaki P.B.: Wood distillation and its products, Technical Monograph Series : No. 1; Chemical Age, Oct. 1950.
4. Bradley, Chem. Met. Eng. 13, 841 (1915).
5. Ali Aslam M and Rao A.P.: Plant design for the production of high density carbon pellets from forest waste material, IIT Seminar on Wood Sc. & Tech., 13-14 March 1980, IIT, Madras.

Productivity
1983, XXIV, 1, 35-39

Education and Agricultural Productivity

S. S. RANDHAWA

The agriculture of modern times is no longer the traditional way of producing farm output. The dependency on nature has been considerably reduced by technological breakthrough which has taken place in the last two decades. The added use of technology brings in its wake, the higher requirement of higher level of education and management of farms. The better and efficient use of available resources and technology can certainly lead to higher productivity.

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The Relevance of Education to the Farmer

The education of the farmer enhances the skill of farming operations and hence the increased efficiency of the farmers by allocating the limited resources in a better way leading to higher returns from agriculture. Education increases efficiency by importing knowledge and skill and thus adds to productive capacity from the individual and national point of view.[1] In agriculture the education enhances the allocative ability in the sense of selecting the appropriate input combinations and efficiently distributing inputs between competing uses.[2] The educated farmers make the best use of agriculture inputs such as, best quality of seed, balanced dose of fertilizer, insecticides and pesticides, weedicides and herbicides etc. Besides the optimum use of material inputs he decides the proper time of sowing, irrigation, inputs application, harvesting and threshing etc. The agricultural productivity and strategic input like chemical fertilizer are significantly influenced by the education of the farm workers.[3] The education of the farm decision maker sharpens his managerial skill and thus has positive impact on farm production.[4]

1. T. W. Schultz, "Capital Formation by Education", *J.P.E.*, University Chicago Press, Illinois, December, 1960.
2. F. Welch, "Education in Production", *J.P.E.*, Vol. 78, No. 1 January, 1970.
3. D. P. Chaudhary, "Education and Agricultural Productivity", *Ph.D.*, University of Delhi, 1968.
4. Baldev Singh, "Impact of Education on Farm Production", *Eco. and Pol. Weekly*, V.9(39) Sept., 28, 1974.

In this paper an attempt is made to explore the effects of education of decision maker on the agricultural productivity at micro level.

Research Methodology

Present study is based on the one hundred and fifty farmers with different sized holdings, selected randomly from Amritsar district. While selecting the sample a multi-stage stratified sampling technique was used. Five blocks, one from each tehsil, and two villages from each selected block were selected randomly. The lists of the farmers of selected villages was prepared along with their educational level obtained from electoral rolls with the help of village officials. Then the list of farmers of each sampled village was categorised according to the level of education achieved by the farmers such as Graduate in Agriculture, Graduate and above, under Graduate, under Matric, up to Primary and uneducated. Then this list was used to select the sample farmers by adopting the proportional allocation method. Special weightage was given to the Graduates in Agriculture, Graduate and above category of farmers, because of their lesser number, but has significant role in determining the productivity.

The null hypothesis that the incidence of education of farmer and agricultural yield (per worker and per acre) are independent of each other was tested with the help of Chi-square method. This test enabled to test the association between farmers education and agricultural productivity.

In case the hypothesis was rejected then the influence of education in the presence of various other variables affecting productivity was measured with the following regression model :

$$Y = f(C, I, F, F, Ex, FI, MF)$$

where

Y is yield per acre and per worker,

C is area cultivated,

I is area irrigated per cent of area sown,

E is education,

F is availability of fertilizer,

Ex is experience in farming,

FI is availability of finance, and

MF is mode of farming operations.

Measurement of Variables

Productivity—measured in per acre yield and per worker yield.

Per acre yield—net returns per acre in a year.

Per worker yield—net returns per worker in a year.

Education—number of years of schooling, Graduate in Agriculture are attending four years in degree course so they are measured as 15 years.

Area cultivated—total area used for cultivation during the year under different crops on a particular farm.

Area irrigated per cent of area sown—total area irrigated on a farm as percentage of net sown area.

Experience—Number of years from which the farmer is engaged in agriculture/farming.

Availability of fertilizer—dummy variable—easy and local availability weight 1 otherwise 0.

Availability of Finance—dummy variable—sufficient availability on a farm weight 1 others weight 0.

Mode of farming operations—dummy variable—fully mechanised weight 1 others weight 0.

Findings

Agricultural productivity is based on many material factors such as area cultivated, area irrigated, per cent of area sown, availability of fertilizer, mode of farming operations, availability of finance etc. These material factors prove better only when there are better management practices. Better management practices can only be possible when the decision maker is educated and experienced one. But education of decision maker plays a major role in the efficient management of the farm.

The casual relationship between education and agricultural productivity was studied with the Chi-square

test. To estimate and test the effect of education in the presence of other explanatory variables, different regression models such as linear regression model, semi-log regression model and double log regression model were tried.

Per Acre Yield

A significant relationship was observed between education and per acre yield, the value of Chi-square was 37.23 (Table 1) and is statistically significant at one per cent level. The best fit regression model was the linear regression model, the value of coefficient of determination (R^2) in linear model was 0.3548, semi-log model was 0.2467 and double log model was 0.2484. The value of R^2 was statistically significant (F-value was 11.2666). The value of adjusted R^2 comes out to be 0.3230. The value of R^2 was low, because, all the factors responsible for yield could not be included in the model and beside this, nature also plays a vital role in the yield.

Table 1. Expected Distribution of Yield Per Acre

Education (in Yrs.)	YIELD PER ACRE			Total
	Up to Rs. 500	Rs. 500 to Rs. 1000	Rs. 1001 or above	
Zero	33.00 (23.00)	11.00 (16.80)	01.00 (05.10)	45.00 (45.00)
1— 5	18.00 (16.43)	13.00 (11.95)	01·00 (03.63)	32.00 (32.01)
6— 9	16.00 (16.43)	13.00 (11.95)	03.00 (03.63)	32.00 (32.01)
10—13	10.00 (13.86)	11.00 (10.08)	06.00 (03.06)	27.00 (27.00)
14	00.00 (05.13)	06.00 (03.73)	04.00 (01.13)	10.00 (09.99)
15	00.00 (02.05)	02.00 (01.49)	02.00 (00.45)	04.00 (03.99)
Total	77.00 (77.00)	56.00 (56.00)	17.00 (17.00)	150.00 (150.00)
		Chi-Square	37.23	

Tabulated value significant at .01 level 23.209
Tabulated value significant at .001 level 29.588
Note : Figures in parentheses are expected frequencies.

Linear regression analysis (Table 2) shows that education depicts a positive and highly significant (at one per cent level of significance) impact on the per acre yield. The coefficient shows that when there is increase in educational level by one year then there is subsequent increase in per acre yield by Rs. 21.54. All other factors show a positive and significant impact except the area irrigated, per cent of area sown and experience in agriculture. In the Amritsar district almost whole of area is irrigated, so it is not effecting so much. The aged decision makers are using the old traditional ways so due to this reason it shows insignificant impact.

Table 2. Linear Model Regression Coefficients

Dependent Variable / Independent Variables	Yield per acre	
	Regression Coefficient	t-value
Area Culitivated	20.4659	1.3764*
Area Irrigated per cent of Area sown	15.8063	0.3957
Education	21.5359	2.5959***
Experience	23.0384	0.8676
Availability of Fertiliser	406.5642	2.8746***
Availability of Finance	362.7741	3.0098***
Mode of Farming Operations	177.5495	1.8856**
Constant	1286.7010	
R^2	0.3548	
R^{-2}	0.3230	
F	11.2666	

* t-value significant at .10 level.
** t-value significant at .05 level.
*** t-value significant at .01 level.

Per Worker Yield

The relationship between per worker yield and education level is studied in Table 3. The value of Chi-square reveals that there exists a significant association between education and per worker yield. The value of Chi-square was 43.16, significant at one per cent level of significance. Linear regression model was again

Table 3. Expected Distribution of Yield Per Worker

Education (in Years.)	YIELD PER WORKER Up to Rs. 2000	Rs. 2501 to 5000	Rs. 5001 and above	Total
Zero	36.00	08.00	01.00	45.00
	(24.60)	(12.00)	(08.40)	(45.00)
1— 5	18.00	11.00	03.00	32.00
	(17.49)	(08.53)	(05.97)	(31.99)
6— 9	16.00	11.00	05.00	32.00
	(17.49)	(08.53)	(05.97)	(31.99)
10—13	10.00	06.00	11.00	27.00
	(14.76)	(07.20)	(05.04)	(27.00)
14	01.00	04.00	05.00	10.00
	(05.47)	(02.67)	(01.87)	(10.01)
15	01.00	00.00	03.00	04.00
	(02.19)	(01.07)	(00.75)	(04.01)
Total	82.00	40.00	28.00	150.00
	(82.00)	(40.00)	(28.00)	(150.00)
		Chi-Square	43.16	

Tabulated value significant at .01 level 23.209
Tabulated value significant at .001 level 29.588
Note : Figures in parentheses are expected frequencies.

Table 4. Linear Model Regression Coefficients

Dependent Variable Independent Variables	Yield per Worker Regression Coefficient	t
Area Cultivated	27.1358	2.6240***
Area Irrigated per cent of area sown	57.5754	0.2853
Education	143.6476	3.4268***
Experience	8.8448	0.6592
Availability of fertiliser	1050.5619	1.4700*
Availability of Finance	3017.4050	4.9544***
Mode of Farming Operations	1384.8560	2.9106***
Constant	−6721.7600	
R^2	0.5434	
R^{-2}	0.5209	
F	24.25	

* t-value significant at .10 level.
** t-value significant at .05 level.
*** t-value significant at .01 level.

found to be the best fit, the value of R^2 being 0.5434 whereas in semi-log regression model R^2 was 0.2952 and in double log regression model R^2 was 0.2669. F-value for the linear model was 24.25 which shows that the value of R^2 was statistically significant. The results of linear regression model were shown in Table 4.

Table 4 reveals that education has a positive and significant impact (at one per cent level of significance) on the per worker yield. Per worker yield increases by Rs. 143.65, when there is increase in educational level by one unit i.e. one year. All other variables included in the model show a similar effect as observed in the per acre yield.

Education improves the efficiency and skill of the farmer which help in the scientific management of farm. Educated farmers have the better vision about deciding the input proportion, cropping pattern, cropping intensity, marketing operations etc. Educated farmers read market news and use the progressive techniques of marketing process which leads to the better price in the market.

Conclusions

The discussion in the previous sections of the paper leads to some general conclusions and policy implications. The most important conclusion being that the level of farmer's education has a very significant impact on both per worker and per acre yield. The significance of the coefficient of education level in the presence of all other variables affecting yield further underlines the importance of farmer's education. Although the present study has been conducted on the farms where the technology is at a high level, the results of the study may be true even for the other situations. In fact, the role of farmer's education is multifarious in the sense that it helps the farmer in deciding the cropping pattern, the optimal use of inputs as well as proper marketing.

Thus to further increase productivity levels in agriculture the farmer's education through more facilities for education in rural areas is highly desirable.

BIBLIOGRAPHY

1. Chaudhri, D.P., "Education and Agricultural Productivity in India" *Ph.D. Thesis*, University of Delhi, 1968.
2. Frank, A.G., "General Productivity in Soviet Agriculture & Industry, *The Ukraine J.P.E.*, LXVI, Dec., 1958, pp. 498-515.
3. Gary, S. Backer, "Investment in Human Capital" *J.P.E.*, Supp. Oct., 1962, Vol. LXX, No. 5, p. 2.
4. Pandit, H. N., "Measurement of Cost Productivity and Efficiency of Education", *National Council of Educational Research and Training*, New Delhi.
5. Schultz, T.W., "Reflexions on Agricultural Production, Output and Supply", *Journal of Farm Economics*, XXXVII Aug., 1956, pp. 753-54.
6. Schultz, T.W., "Capital Formation by Education", *J.P.E.*, University of Chicago Press, Illinois, Dec., 1960.
7. Sen, A.K., "Aspects of Indian Education" in P. Chaudhry ed. *Aspects of Indian Economic Development* (George Allen and Unwin, 1971.
8. Singh, Baldev, "Impact of Education on Farm Production", *Eco. and Pol. Weekly*, Vol. 9 (39) Sept., 28, 1978, PP. A92-A96.
9. Warburton, H., "Education and Agricultural Development" (Mimeographed).
10. Weisbrod, B.A., "Education and Investment in Human Capital", *J.P.E.* LXX No. 5 (Supp.) Oct., 1962, pp. 106-23.
11. Welch, F., "Education in Production" *Journal Political Economy*, Vol. 78, No. 1, (Jan. 1970), pp. 35-39.

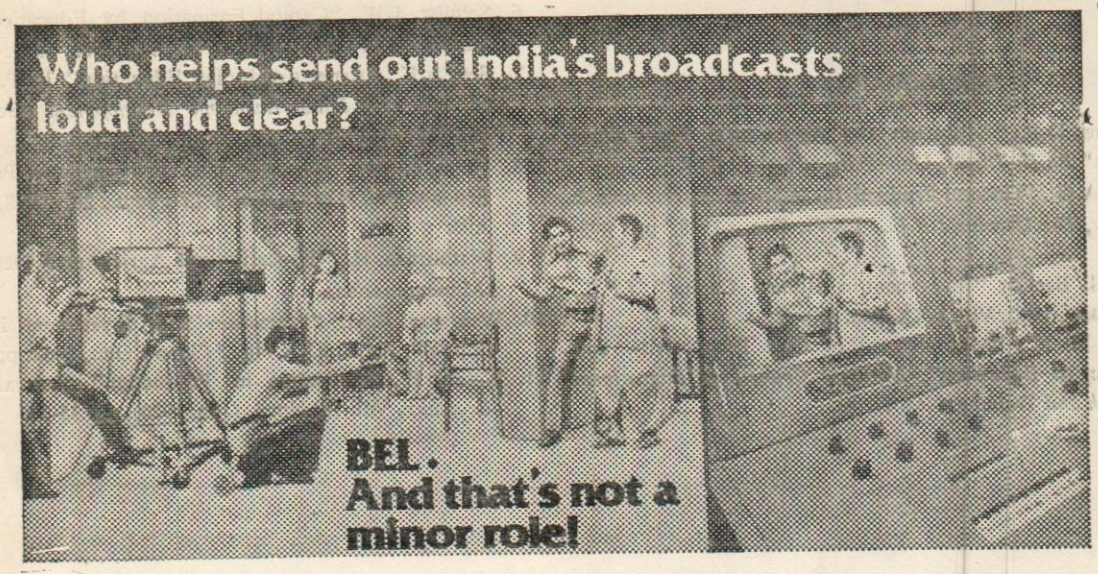
Expertise—Know-How & Know-Where

An important and complicated machine in a factory mysteriously stopped working. Machinists and engineers strived desperately to locate the trouble and correct it, but all failed. Meanwhile production in the plant had to be suspended until an expert could be called to fix the all-important pieces of equipment. The expert arrived, tinkered with the machine briefly, tapped here and there with a hammer, and the machine resumed operation.

When the expert submitted his bill for Rs 250, the plant manager was aghast and said to him: "All you did was tap the machine a few times. Please itemize your bill."

The expert took the bill and wrote at the bottom of it the following :

Tapping machine with hammer	Rs 1.00
Knowing where to tap	Rs 249.00



Undeniably! BEL's role in developing radio communication and telecasting enabled India to achieve technological self-reliance. Its transmitters, tape recorders, cameras and other related studio equipment send out India's message through the length and breadth of the country. Building for India, a contemporary communication network with an effective reach.

And the story doesn't end there. BEL is also tuned in to other diverse manufacturing activities like fire control systems, radars, defence communication systems, weather monitoring radars, vacuum tubes, semiconductors, ICs and crystals among others.

Today, BEL's turnover is Rs.128 crores. Further investment around Rs.90 crores is planned. Its record—profits since 1960, a steady 12% dividend since 1970, order books full for four years—owes much to its 17,000 dedicated, goal-oriented people. People who have made it a company equipped more than adequately, to confront the challenges of the future.

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Productivity
1983, XXIV, 1, 41-49

Job Strain As A Measure of the Job Value for Strenuous Manual Jobs

DR. E. UNNI KRISHNAN

A novel method for the evaluation of strenuous manual jobs is summarised in this article. This method was found to be capable of classifying jobs with consistency and is particularly suitable for the evaluation of jobs in Indian industries. Jobs were evaluated under this system based on the job induced strain arising from the ergonomic and environmental stressors. The results given in this paper are based on the analytical and the experimental research conducted by the author in a foundry.

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Need for Job Evaluation

Good industrial relations depend upon a sound system of remuneration. Good job evaluation provides a strong foundation, on which a sound pay system can be built. The primary objective of this research was to develop an effective method for the evaluation of jobs in a cast iron foundry. The study was restricted to shop floor jobs.

In conventional systems of job evaluation such as, points system, factor comparison and job ranking methods, the factor values and the factor rankings are based on the judgement of the analyst. The later developments, like, the 'Time Span of Discretion' (Jaques 1968), 'The Hay Guide Chart' (Van Horn 1972) and similar methods, have a heavy bias towards high technology industries, where a high degree of man-machine interaction exists. Such methods have not been able to provide an effective solution for the evaluation of the jobs in industries, where considerable physical and mental strain is involved in performing the jobs. Good recent research is lacking in this area.

Based on a sample survey of the job evaluation practices in urban and near-urban industries in India and the research conducted in a medium-size cast iron foundry, a model has been developed by the author for the evaluation of jobs. This model could be extended to other economically developing countries, where similar job characteristics exist.

Developing a job evaluation model

This was done in two phases. The first phase was concerned with the determination of the job factors and the factor weightings, the second part with the evaluation of the individual jobs based on the job factors and the factor weightings determined in the first phase. The above phases of the job evaluation as developed by the author are briefly summarised in the following pages.

Job factors and factor weightings by the Delphi technique

The Delphi technique was used in combination with the paired-comparison method for the identification of the job factors and determination of the factor weightings in the foundry jobs studied. Flow chart of the Delphi paired-comparison method used in this research is given in Fig. 1. Delphi technique provides a method for obtaining expert opinion in a systematic way. The advantages of Delphi technique over the conventional group or committee approach to decision making can be listed as follows :

* It is possible to obtain a convergence of the group opinion.
* Direct interaction of the panelists could be avoided.
* Anonymity of the panelists could be maintained.
* Results could be statistically analysed.
* Controlled feedback could be maintained.

Delphi technique has been used all over the world for many futuristic studies in the areas of economics, transportation, education, national planning, etc. (Martino 1972, Sackman 1974, Linstone and Turoff 1975). The research presented here is the first attempt, where the Delphi technique has been used for the evaluation of jobs.

The procedure involved in Delphi technique could be summarised as follows : The organisation chart provided an effective guide in choosing the panel of experts. The Delphi panel chosen for this study is given in Fig. 1. Panelists were shown the methods of operation and the conditions under which the jobs were performed.

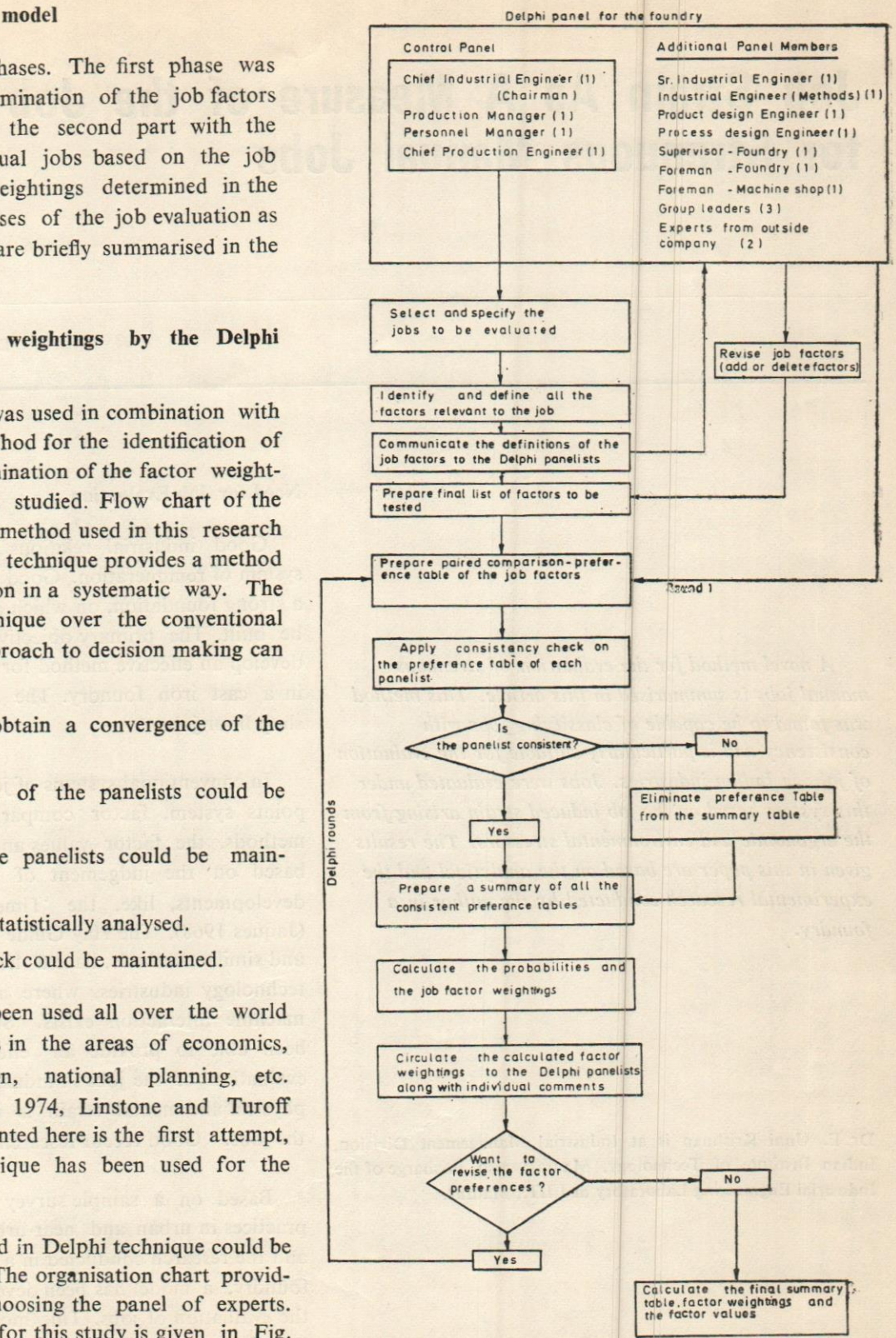

Fig. 1 Flow chart for Delphi using the paired comparison method for determining the job factor weightings and the factor values.

The paired-comparison technique used in Delphi enabled sensitive comparison of the job factors and their weightings. The 'consistency check' used in the paired-comparison method provided a means to minimise inconsitent judgements by the panelists. An 'open-ended' approach (Martino 1972) was used in the Delphi technique in the selection of the job factors and their weightings. In this case, the panelists had a choice of a wide range of factors (15 factors were included in the final list in this study—Table 1) in the determination of the factor weightings for the preparation of the job evaluation scale. The results of the Delphi study for the foundry jobs are given in Tables 1 and 3. An illustration of the paired-comparison preference table and consistency check is given in Table-2.

The steps involved in the determination of the factor weightings using the Delphi technique could be listed as follows :

1. Prepared the paired-comparison preference Tables and estimated the coefficient of consistency (Table 2).
2. Prepared the cumulative preference tables.
3. Tabulated the binomial probabilities of the preference of each factor over the other factors.
4. Converted the probabilities into factor weightings (Table 1).
5. Classified the weightings into appropriate groups (Table 3).

Delphi Results are Superior

An analysis of the factor weightings for the foundry jobs shown in Table 1 revealed how misleading it could have been if the first round of Delphi results were used for the determination of the job factor weightings instead of the final round. This shows the superiority of the Delphi technique and the deficiency of the conventional single round factor weighting techniques. It should be noted here, that most of the industries the author surveyed, were using only a single round of paired-comparison study in seeking the panel decision on the factor weightings. It could be seen from Table 3 that the ergonomic and environmental stressors have the greatest weightings in the job evaluation scale derived for the foundry jobs from the Delphi studies. Heat stress tops the list with a weighting of 17.55 per cent followed by physical strength demands with a weighting of 14.23 per cent. The traditional high ranking job factors like, education, experience, training and responsibility used in the point methods and the factor comparison methods of evaluation have been pushed down the list. The primary reason for this observation was that the foundry jobs studied did not call for much formal education, training, responsibility etc. Most of the employees had come up from the lowest rank jobs joining the industry as helpers or assistants and over the years had taken up higher value jobs. This is also

Table 1. Comparison of the Factor Weightings in the Delphi Rounds for the Foundry Jobs

S. N.	Job Factors	Delphi Round I	Delphi Round II	Delphi Round III (Final)
1.	Education	4.82	3.48	3.41
2.	Experience and Training	2.97	3.48	3.52
3.	Physical Strength Demands	14.20	14.59	14.23
4.	Body Posture Demands	11.51	9.36	8.92
5.	Sensory Acuity	7.72	5.22	5.20
6.	Alertness and Attention	2.09	2.98	2.91
7.	Coordination	4.75	3.60	3,51
8.	Complexity of decisions	5.00	7.70	7.54
9.	Responsibility	3.07	3.29	3.17
10.	Heat	14.59	14.95	17.55
11.	Noise	10.35	10.38	10.08
12.	Vibration	10.00	10.47	9.81
13.	Dust, Fumes and Gases	6.91	8.65	8.35
14.	Team-Work	1.47	1.23	1.20
15.	Monotony	0.55	0.61	0.61
	Total	100.00	99.99*	100.01*

*rounding errors

Table 2. An Illustration of the Paired-Comparison Table and the Consistency Check

Delphi Round No. 1 *Dept : Studied : Foundry*

Sl. No.	Job Factors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	E=ΣR	(S−E)²
1.	Education	—	1	0	1	1	1	0	0	1	1	0	0	1	0	1	8	0.073
2.	Experience and Training	0	—	1	1	1	1	1	1	1	0	1	0	1	1	1	11	7.453
3.	Physical strength demands	1	1	—	1	1	1	1	1	1	1	1	1	1	1	1	14	32.833
4.	Body posture demands	0	0	0	—	1	1	1	1	1	0	0	0	1	1	1	8	0.073
5.	Sensory acuity	0	0	0	0	—	1	1	1	1	0	0	0	1	1	0	6	5.153
6.	Alertness and attention	1	1	0	0	0	—	0	1	1	1	1	1	1	1	1	10	2.993
7.	Coordination	0	0	0	0	1	0	—	1	0	1	0	1	1	1	1	7	1.613
8.	Complexity of decisions	0	0	0	0	0	1	1	—	0	0	0	1	1	1	0	5	10.693
9.	Responsibility	1	0	1	1	1	1	1	0	—	0	1	1	1	1	1	11	7.453
10.	Heat	0	0	1	1	1	1	1	1	1	—	1	1	1	1	1	12	13.913
11.	Noise	0	0	1	1	0	1	0	1	0	1	—	0	1	0	1	7	1.613
12.	Vibration	0	0	0	0	0	0	0	0	0	0	0	—	0	0	0	0	68.393
13.	Dust, fumes and gases	0	1	0	1	0	1	1	1	1	1	1	1	—	1	1	11	7.453
14.	Team-Work	0	1	0	1	0	1	0	1	1	1	1	1	1	—	1	10	2.993
15.	Monotony	0	0	1	0	1	0	0	0	0	0	0	1	0	1	—	4	18.233
	Totals :																124	180.935 (T)

Means (s) = 8.67

Note : A '1' against a row indicates that the panelist attaches greater weighting for the row factor over the column factor and '0' indicates that [the panelist attaches greater weighting for the column factor over the row factor in the job evaluation scale. Coefficient of consistency for the data given in the above table,

$K = {}^{1-}\left(\frac{24d}{n^3-n}\right) = 0.646$, which is low and required revision. A consistency of above 0.8 was considered good.

In the above expression,

'n' corresponds to the number of factors = 15, $d = \frac{T_{max} - T}{2}$ and $T_{max} = \frac{n^3 - n}{12}$

Table 3. Classification of the Job Factor Weightings Obtained for the Foundry Jobs using the Delphi Studies

Job Factors	Weightings (Per cent)		Maximum Factor Values** (FV_{max}) points
A. Ergonomic Stressors :			
(Psycho-physiological factors)			
1. Physical strength demand	14.23		
2. Body posture demands	8.92		
3. Complexity of decisions	7.54	42.31 per cent =	211.55
4. Sensory acuity	5.20		
5. Coordination	3.51		
6. Alertness and attention	2.91		
B. Environmental Stressors :			
1. Heat	17.55		87.75
2. Noise	10.08		50.40
3. Vibration	9.81		49.05
4. Dust, fumes and gases	8.35		41.75
C. Skill and Miscellaneous Factors :			
1. Education	3.41		17.05
2. Experience and Training	3.52		17.60
3. Responsibility	3.17		15.85
4. Team-Work	1.20		6.00
5. Monotony	0.61		3.05
Total :	100.01*		500.05*

**Maximum factor values have been assigned on the assumption that the maximum value a job can take is 500 points.
*Rounding errors.

true with most of the other jobs in Indian industries. It could be concluded from the Delphi studies summarised here that the job stressors and the resultant strain could be considered as the primary contributors to the job value for industries, such as the foundries, where jobs involve a considerable amount of physical and environmental strain and also a certain amount of mental strain. Next factor weightings were converted into job values.

Job Induced Strain as a Criterion

The Delphi study identified that the ergonomic and the environmental stressors were the primary job factors, which contribued to the job value. The best method to evaluate the stressors would be to measure the resultant strain on the workers. Due to limitations in instrumentation and the desired simplicity of the type of measurements, the author has chosen the following indices of strain for assessing the level of strain arising from each of the foundry jobs studied (Table 4).

The highest of the three indices of strain, Relative Oxygen Consumption (ROC), Relative Pulse Rate (RPR) and psycho-physical index, was used as a measure of

Table 4. Criteria used for the Determination of the Job Induced Strain

A. Job Factors	Criteria used for the determination of the Job Induced Strain	References
A. Ergonomic Factors	1. Psycho-physical criteria, Index of strain $= \frac{\text{Weight handled on the job}}{\text{Safe weight}}$	Snook (1978) Ayoub et. al. (1980)
	2. Relative oxygen consumption Index (ROC) $= \frac{\text{Oxygen consumption during the job}}{\text{Maximum oxygen consumption of the worker}}$	Aunola et. al. (1978, 1979) Astrand and Rodahl (1970)
	3. Relative pulse rate index (RPR) $= \frac{\text{Pulse rate taken during the job} - \text{Resting pulse rate}}{\text{Maximum pulse rate} - \text{Resting pulse rate}}$	-do-
B. Environmental Factors	1. Heat strain Index	Hancock and Chaffin (1977) and Belding and Hatch (1955)
	2. Noise strain Index	Federal Register (1971), Yerges (1978)
	3. Vibration Strain Index— Measured based on an opinion survey of the workers	
	4. Dust, Fumes and Gases— Assessed based on an estimate of the atmospheric contents	
C. Skill and Miscellaneous Factors (Education, Experience, Responsibility, Teamwork and Monotony)	Assessed based on the level of the factor required in order to perform the job effectively.	

the Index of strain (Is) for a job. Job factor value is a function of the Index of strain.

$$FV = FV_{max} \times I_s^x$$

where, FV = Factor value for the job

FV_{max} = Maximum factor value assigned using the factor weighting

I_s = Index of strain for the factor

x = An exponent

It is very common to assume the value of O for x, i.e. factor value is assumed to vary in direct proportion to job difficulty. As an example, consider Job 1.

Job 1. Prepare Pattern Boxes on the Floor

Job Factor	$FV_{max} \times I_s$		Factor Value
1. Ergonomic factors	211.55×0.6175	=	130.63
2. Heat	87.75 × 0.95	=	83.40
3. Noise	50.40 × 0.1	=	5.04
4. Vibration	49.05 × 0.1	=	4.905
5. Dust, fumes and gases	41.75		19.0
6. Education	17.05		8.0
7. Experience and Training	17.60	Assessed values	13.0
8. Responsibility	15.85		13.0
9. Teamwork	6.0		3.0
10. Monotony	3.05		1.0
	Total job value :		280.975

Similarly, values for other jobs could be calculated based on the data given in Tables 5 and 6 using the relationship $FV = FV_{max} \times I_s$ for the ergonomic and the environmental factors (where FV is the factor value and I_s is the index of strain) and assessed factor values for the remaining factors. The results are given below :

By varying the values of the exponent 'x', job clusters could be simulated and variations in the market value of the job could be taken care of to some extent in this model. Measurement of the existing strain of a job factor and relating it to the factor value very often help to perceive the importance attached to that factor and make any necessary adjustments in the factor value.

Job Evaluation in the Context of Situation

A sample survey of the job evaluation practices in

Table 5. Indices of Strain for the Ergonomic Factors for Cast Iron Foundry Jobs

Sl. No.	Job Title	Operator Title	No. of Operators Studied	Relative Oxygen consumption Index (ROC)	Relative pulse rate Index (RPR)	Psycho-physical Index	Index of Strain for the job (Is)
1	2	3	4	5	6	7	8
1.	Prepare pattern boxes on the floor (CI Pipe castings)	Core maker (floor)	10	0.595	0.6175	—	0.6175
2.	Prepare pattern boxes on the bench (CI engine head)	Core maker (bench)	8	0.580	0.643	—	0.643
3.	Transfer finished pattern boxes to the drier (CI engine head)	Loader	14	0.66	0.58	0.714	0.717
4.	Tap metal from cupola furnace to ladle and pour to mould (CI engine head)	Furnace Attender	15	0.365	0.335	—	0.365
5.	Pour metal to mould using hand ladle (CI engine parts)	Moulder	14	0.44	0.494	—	0.494
6.	Grind, chip and clean castings (CI engine head)	Grinder Operator	14	0.27	0.30	0.628	0.628
7.	Drill holes (CI engine head)	Drilling Machine Operator	14	0.262	0.248	0.628	0.628
8.	Inspect parts (CI engine parts)	Inspector	45	0.25	0.28	—	0.28
9.	Assemble parts (CI engine body and head)	Assembly Operator	12	0.50	0.492	—	0.50
10.	Transport—assembled units to store (CI engine units)	Loader	12	0.590	0.524	0.775	0.775

Table 6. Indices of Strain for the Environmental Factors and Assessed Factor Values for the Skill—Responsibility Factors for the Cast Iron Foundry Jobs

Sl. No. of the Job	Heat Strain Index	Noise Strain Index	Vibration strain	Dust, Fumes and Gases	Education	Experience and Training	Responsibility	Team work	Monotony
				←——————(Assessed factor values)——————→					
1.	0.95	0.10	0.10	19	8	13	13	3	1
2.	0.90	0.13	0.10	16	8	13	13	3	1
3.	0.88	0.15	0	14	5	5	10	5	1
4.	>1	0.10	0	18	5	9	9	3	1
5.	>1	0.10	0	15	5	9	9	3	1
6.	0.95	0.42	0.49	19	10	10	9	3	1
7.	0.97	0.35	0.38	8	10	10	9	3	2
8.	0.85	0.10	0	8	12	13	14	3	2
9.	0.98	0.15	0.05	8	13	13	13	4	1
10.	0.97	0.15	0.10	9	5	5	10	5	1

Table 7. Job Values for Ten Selected Foundry Jobs

Sl. No.	Job Title	Job Value (points)
1.	Prepare pattern boxes on the floor	281.0
2.	Prepare pattern boxes on the bench	280.5
3.	Transfer finished pattern boxes to the drier	275.8
4.	Tap metal from cupola furnace to ladle and pour to mould	215.0
5.	Pour metal to mould using hand ladle	239.3
6.	Grind, chip and clean castings	313.5
7.	Drill holes	296.3
8.	Inspect parts	190.9
9.	Assemble parts	253.8
10.	Transport assembled units to store	296.6

Indian industries revealed the inadequacies of the existing 'universal', 'standard' or 'ready-made' job evaluation scales. Studies using the Delphi technique in a foundry showed the significance of the ergonomic and the environmental factors in determining the job values. They showed that factors such as education, experience and responsibility, which are given high weightings in the job evaluation scales used in the economically developed countries made comparatively minor contributions. Thus a 'job induced strain' criterion for the evaluation of jobs was developed.

Summary of the job values for a cast iron foundry using the 'job induced strain' criterion are given in Table 1. In the absence of a high degree of man-machine interaction in a majority of jobs and the jobs being primarily manually handled and manually controlled in nature, the traditional job evaluation scales tended to underestimate the jobs. The 'job induced strain' criterion provided a methodology for sensitive differentiating of job values in foundry jobs. This methodology also provided much greater recognition of the strain from the environmental factors, which was quite an important aspect of job evaluation in many of the industries the author surveyed. Evaluating the jobs and compensating for the job value is a must, but that does not excuse engineers and managers from

ignoring the importance of the job design function and be content with a compensatory high job value. In this context, the higher job values derived by using the 'job induced strain' model, was an eye-opener to take a second look at the existing job designs and improve it ergonomically and environmentally in order to reduce the job induced strain. Low job values are always economically desirable for any industry.

It should be noted that the job clusters arrived by using multi-dimensional scaling and clustering provides much more meaningful grouping of jobs compared to mere arithmetic addition of the factor values for comparing the job values. Good industrial relations very much depend on a sound system of compensation. The job strain based job evaluation model presented here provides a strong foundation on which a sound compensation system could be built.

REFERENCES

Astrand, P. and Rodahl K: Text Book of Work Physiology. McGraw Hill-Kogakusha, Tokyo, 1970.

Aunola, S., Nykyri, R., and Russo, H. : "Strain of employees in the machine industry in Finland", *Ergonomics*, Vol. 21, 1978, pp. 509-519.

Aunola, S., Nykyri, R., and Russo, H. : "Strain of employees in manufacturing industry in Finland", *Ergonomics*, Vol. 22, 1979, pp. 29-36.

Ayoub, M.M., Mittal, A., Baken, G.M., Asfour, S.S., and Bethea, N.J.: "Develepment of strength and capacity norms for manual material handling activities. "The state of the art", *Human Factors*, Vol. 22, 1980, pp. 271-282.

Belding, H.S., and Hatch, T.F. "Index for evaluating heat stress in terms of resulting physiological strains", *Heating, Piping and Airconditioning*, August 1955, pp. 129-136.

Federal Register, Department of Labour, U.S. Government, Occupational Safety and Health Administration (OSHA), 1971, p. 10518.

Hancock, M.M. and Chaffin, D.B. : "A practical method for industrial heat stress allowance determination", *AIIE Transactions*, Vol. 9, 1977, pp. 144-154.

Jaques, E. : Time span handbook, Hineman Educational books, London, 1968.

Linstone, H. and Turoff, M. : The Delphi Method, Addison Wesley, London, 1975.

Martino, J.P. : Technological forecasting for decision making, American Elsevier, New York, 1972.

Sackman, H. : Delphi assessment : Expert opinion, forecasting and group process, Report 1283, Rand Corp. Santa Monica, California, 1974.

Snook, S.H.: "The design of manual handling tasks", *Ergonomics*, Vol. 21, 1978, pp. 963-985.

VanHorn, C.W.G. : The Hay Guide Chart Profile Method, in Rock, M.L. (Ed.), Handbook of Wage and Salary Administration, McGraw Hill, New York, 1972.

Yerges, L.F. ; Sound, Noise and Vibration Control, Van Nostrand, New York, 1978.

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Recruitment Practices in Indian Manufacturing Industries

GOPAL JI

The article discusses corporate enterprise practices in so far as adopting different sources of recruitment for various categories of personnel is concerned. While an increasing use of job analysis and specification for recruitment purposes is noticed, its use seems to be more with higher category of job positions. An analysis of sources of recruits reveals the greater use of recommended labour for lower category of personnel. Promoting or transferring present employee is noted to be widely practised source of recruitment. Advertisement in newspaper and journals, employment exchanges, educational, professional, and technical institutes, unsolicited applicants, and unions are noted to be potential source of recruitment for various categories of personnel.

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Survey of Personnel Practices

This paper, which is based on a survey of personnel practices in manufacturing industries in India, examines corporate enterprise practices as regards recruitment of personnel. The data for study purposes was collected through a questionnaire followed by personal interview method. A sample of 31 organisational units in various industry groups, and located in different parts of the country is studied. The study is restricted to 31 units for the investigator could collect data from these. However, an attempt is made to generalise and conclude about the recruitment practices in the manufacturing sector of industries, though this may not be true in case of a particular unit.

Changing Milieu

Five-year plans, through their development programmes, have released forces that have resulted in increasing the number of those engaged in wage employment in organised sector. The rate of increase in employment at present works out to be 3 per cent per annum. The concept of wage employment has given rise to the task of procuring suitable persons for the purposes of achieving organisation goals. A study of recruitment practices becomes relevant in this context. In the past in the absence of standardised practices, recruitment

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was unorganised and employment opportunities unequally distributed. While the practices at present cannot be said to have been standardised, after independence factors such as industrialisation of the country, growth of trade unionism, larger labour markets, widespread communication net-work, and a high propensity for mobility, have given rise to forces creating conditions for modern and depersonalised recruitment practices. An equal access, both on the part of the employer and the worker, to the labour market and job market information shows a tendency on the part of former to recruit the best available personnel at a competitive rate, and on the part of employees to go for the companies job of their choice.

The present discussion, which is based on a survey of 31 large size corporate establishments (Units), located in important industrial belts of the country, and scattered in various industry groups e. g., Chemical and Pharmaceuticals, Engineering, Textile, Food and Processing, examines the enterprise recruiting practices in so far as adopting different sources of recruitment for various categories of personnel is concerned.

Use of Job Study/Analysis

A systematic programme of recruitment begins by job study or analysis and laying down of precise specification. Precise job specification not only determines the nature of required skills and other attributes necessary for job performance but also contributes to the development of selection and placement criteria. No amount of interviewing or testing could ever produce high calibre employees from indifferent candidates, unless the candidate who meets the job specification has been prompted to apply. It is essential, therefore, to attract candidate in a systematic and well informed way : this presupposes that the job has already been clearly defined, that the attributes needed for successful performance have been specified, and that valid criteria for assessing the attributes has been established. Failure to do this leads to unnecessary qualification being prescribed for certain jobs that could as well be performed by less qualified persons. This was noted by the Administrative Reforms Commission to be a major defect in recruitment programmes of public sector undertakings. A change on the part of enterprises is certainly witnessed as regards use of such devices for recruitment purposes. This change which may be due to realization of growing need for management devices to achieve efficiency has not helped employer in choosing employees but employees also in going for the organisation/job of their choice.

Job analysis/specification which emerges from the initial stages of analysing the job, has practical relevance at each stage of personnel procurement, e. g., (a) to attract candidates, the job advertisement should be a distillation of the job specification, written in a style which will attract suitable readers and deter the unsuitable ones (this is at the recuriting stage), (b) in assessing candidates, the job specification serves as the yard stick against which the recruiter judges the relevance and adequacy of the candidates' attributes (this is at the selection stage); and (c) in placement, the job description forms the basis of the candidates' placement, serves as a guide to his induction training and indicate the criteria against which his subsequent performance be assessed.

Job specification in perspective

Since development and change are features of most successful organisation, a job specification must be in tune with time. To be effective in the recruitment process, it must be reviewed regularly to specify new targets and new areas of challenge. Observation indicates that the scope and nature of a job can change overtime, even from day to day. The priorities get reassessed in the light of new organisational needs or because of pressure from management. A job specification need to be adjusted accordingly. A job specification may have to be adjusted to meet the realities of the labour market—personnel demand and supply. Job analysis is required for the tasks associated with both demand and supply. Through job analysis the particular skill levels needed by employees are determined. Personnel demand analysis involves determining the number and type of employees required to achieve the cnterprise's objectives. Labour supply analysis also uses job analysis as the enterprise searches for workers who will be capable of satisfying its employment needs.

The use of job analysis and specification seem to vary with the category of personnel as is revealed by

the findings of the survey. For instance, 17 units out of 31 were found to be using job descriptions and specifications for workers, 19 units for clerks, and 22 units each for supervisory and managerial personnel. The number of units found to be using job descriptions and specification for supervisory and managerial personnel was higher than the number of units using it for workers. It seems that, the higher the category of job, greater was the use of job analysis and job specifications. This could presumably be due to critical importance of supervisory and managerial job and the need for attracting them through relevant sources.

Sources of recruits

Having clearly defined and specified the attributes needed for successful performance of the job, the question of attracting suitable applicants arises. Through recruitment sources, we are able to determine where the potential job applicants are located. The need for choice in between different sources of recruits here arises. A decision in this regard reflects the practices followed. Source of recruits are broadly divided into two categories viz., (i) internal; and (ii) external. Whereas the former consist in recommendations from existing/retired employees of the organisations and promoting and transferring present employees, the latter of the labour markets which can be tapped by way of advertisement in newspapers and journals, employment exchanges, and educational, professional, and technical institutes. Recommendations of employees union may also be included in this category.

The findings of the survey in this connection reveal that 22 units out of 31 considered recommendations from existing/retired employees, while filling job vacancies for workers. In case of clerks, 17 units did so; 10 units did it in respect of supervisors and managerial personnel. The number of units which used this source for recruiting supervisory and managerial personnel was less than one-third (10 out of 31) of the total number of units surveyed. This was stated to be due to the higher level of specialization required for supervisory and managerial personnel, and the need for originality and initiative which the recommended employees might not possess. The survey results are shown in Table No. 1. From an analysis of our findings, it esems that lower the category of employees, grenter was the use of recommended labour as a source of recruiting and vice-versa. It seems here that the need for specialization, originality and initiative in employees forces the enterprise to go for sources other than the employee referral for supervisory and managerial personnel. This may also speak of the weaknesses on the part of establishments to prepare employees with such attributes to fill future vacancies. But it may not appear so, when one analyses the other internal sources of recruitment i.e., the policy of promoting or transferring present employees to new positions.

Promoting or transferring employees

The practice of recruitment from within the organisation confers several benefits: (a) it is easier to fill

Table No. 1. Sources of Recruitment of Employees

(No. of units)

Sources	Workers	Clerks	Supervisors	Managers
1	2	3	4	5
A. *Internal*				
(a) Recommendations of existing/retired employees.	22	17	10	10
(b) Promoting or transferring present employees.	23	25	28	25
B. *External*				
(a) Advertising through newspapers and journals.	9	17	25	30
(b) Notifying employment exchanges	25	21	14	2
(c) Notifying educational, professional and technical institutes.	7	—	17	6
(d) Employee Unions	10	4	—	—
(e) Unsolicited applicants.	11	15	11	6
(f) Others (at the gate etc.)	18	1	—	—

vacancies from within; (b) organisations have records on employees' effectiveness; (c) employees know the organisation; and (d) it is considered to be good for employees morale. In the course of survey, it was noticed that 23 units out of 31 had the practice of promoting or transferring present employees to fill current job vacancies for workers; 25 for clerks; 28 units for supervisors; and 25 units for managerial personnel. An analysis of Table No. 1 reveals that this was the most popular source of filling vacancies for supervisory personnel followed by managerial and clerical staff. In establishments where the process of production was automatized and only experienced personnel were required to man the vacant positions, it was stated that such a practice had become the obvious outcome of the nature of production techniques for placing an outsider on the jobs may simply affect the production process adversely. The practice of understudy was found to be in vogue in such units. Further, even where the policy of internal recruitment was not formally stated, practice often indicated its general acceptance. In 9 units out of 31, promotions were linked with transfers. Employees were subject to a systematic programme of training before they were promoted/transferred to new positions to fill the vacancy. This was true particularly of supervisory and managerial employees.

Advertisement in Newspapers and Journals

An analysis of Table No. 1 indicates advertising vacancies in newspapers and journals was the practice in 9 units for recruiting workers; 17 units used this method for recruiting clerical staff; supervisory personnel were recruited through advertisement in 25 out of 31 units; and managerial positions were filled up through open advertisement in almost all the units (30 out of 31). Clearly, higher the category of job positions, greater was the use of advertising to invite candidates for recruitment.

Employment Exchange

A non-traditional source of recruiting in India, employment exchanges' primary function is that of registration of work seekers and their placement against demand notified by employer. A general idea of work carried out in this regard during the period 1961 to 1980 is indicated in the Table No. 2. The enactment of Employment Exchange (Compulsory Notification of Vacancies) Act, 1959, was aimed at rationalizing the system of recruitment and meeting the requirements of employees from a pool of registered candidates. It will be seen from Table No. 1 that for workers and clerical grade personnel, this was the most preferred and for managerial personnel, the least popular source of recruitment. Findings of the survey suggests that the use of employment exchanges as a source of recruitment decreases with higher categories of job-positions.

Union as a Source

Survey results in this connection reveal that 10 out of 31 units considered the recommendations of unions for the recruitment of workers and 4 did it for recruitment of clerks. Findings of the survey indicate that where unions do not actively engage in providing employment information service, they invariably take an interest in seeing that members laid-off are given preference in rehiring. Union agreement in some units contained a reference to the responsibility of the employer to rehire former employees, usually in some order of seniority. During the course of survey,

Table No. 2. Employment Exchanges and Activities

Year	Number of exchanges	Registrations	Placements	Percentage of placements to Registrations.
1	2	3	4	5
1961	325	3,230	404	12.5
1966	396	3,871	507	13.1
1971	437	5,130	506	9.9
1976	517	5,619	497	8.8
1977	528	5,325	462	8.7
1978	535	6,144	461	7.6
1979	546	6,127	466	7.6
1980	567	6,157	478	7.8

Source : Statistical Outline of India, 1982, p. 134.

in some units, rules for filling up certain job positions up to the supervisory personnel by promoting/transferring present employees were found to be in collective bargaining agreements while in others, it formed a part of Standing Orders. In no unit, as per survey results, was the recruitment of supervisory and managerial staff done in consultation with unions. Eight out of the 10 units incorporated recruitment matters in the contract they had entered into with the union. Such recruitment matters mainly pertain to company's recognition of the policy of internal recruitment, whenever possible, to ensure maximum opportunities to workmen subject to their qualification, competency, past conduct and performance, and regularity in attendance. Such stipulations were stated to have important bearing on recruitment practice.

Unsolicited Applicants

Survey findings suggest that this source being less adhered to for managerial personnel than for other categories, it was relatively more common for clerical grade personnel, workers, and supervisors in order. Similarly, recruitment of supervisory cadre of personnel was attempted through notifications and interviews in the educational, professional, and technical institutes. This source did not seem to be much in vogue as far as recruitment of workers and clerical personnel is concerned.

A change in pattern needed

An analysis of the internal source as per Table No. 1 shows that for supervisory and managerial positions advertisements in newspapers and journals was the most popular method of inviting candidates in the units surveyed. It was found to be productive source and was the first choice. Notifying technical and professional institutes was the second common source for supervisory and managerial personnel; employment exchanges and unsolicited applicants were third and fourth respectively in order of preference for supervisors. Unsolicited applicants happened to be the third most preferred source for managerial recruitment. As regards workers and clerical grade personnel notifying the employment exchange was the most widely used source, followed by unsolicited applicants. It seems that labour market conditions in local area and impact of such policies like 'sons of the soil' for recruitment purposes are of primary importance for non-managerial job. However, recruitment for supervisory and managerial positions may be concerned with the national market. Hence the difference in degree of importance of sources like advertising in newspapers and journals and employment exchanges for various categories of jobs. Unions played an important role only in the case of workers' recruitment. Another important source for this category was recruitment at the factory gate. It can thus be inferred that with gradual industrialisation of the country, the channel of job information and sources of recruitment have tended to be more varied, modern, and depersonalised. Incidentally, the National Commission on Labour also noted a marked change in the pattern of recruitment practices, although the traditional practices of recruiting with its dependence on itermediaries (Sardars, jobbers and others) were noted to be in vogue till in the late sixties.

In this connection, it is worth noting the findings of a paper by Bhatt and Mahajan on manpower planning presented at NATO Conference of 'Manpower Planning and Organisation Design', held in Italy in

Table No. 3. Per cent distribution of Workers by Sources of Job Information for Present Job and Preference for Future Job

Sources	Present	Future
1	2	3
Friends and Relatives	42.9	48.1
Factory gate	13.8	6.2
Jobber or Contractor	33.2	0.6
Newspaper ads.	3.3	24.9
Employment Exchange	1.9	12.2
Others	4.9	8.0
Total	100	100
Sample Size	575	575

Source : Paper by Bhal J. Bhatt and Vijay Mahajan, on "Institutional Considerations For Macro Manpower Planning, in less Developed Countries."

June, 1977. The authors compared sources of job information used for present job and preferred sources for the future job. For workers, it was pointed out, that the "proven" informal channels friends, and 'relatives' constitute primary source of job information. It was found out that if social or communal ties with jobber or contractor are accepted, a dominent use of informal and personal channels for present job is noted. A study of preferred sources of job information for future job as is shown in Table No. 3 points out a significant decline in preference for jobber—Contractor and an increased preference for Employment Exchanges and Newspapers advertisements.

REFERENCES

1. Bhal J. Bhatt and Vijay Mahajan: "Institutional Consideration for Macro Man-power Planning in Less Developed Countries," in Donald T. Bryant and Richard J. Niehaus (Eds), *Manpower Planning and Organisation Design*, Plenum Press, New York, 1978, pp. 463-465.
2. Carroll L. Shartle, "What is job analysis" in Herbert G. Heneman Jr., and John G. Turnbull (Eds.): *Personnel Administration and Labour Relations*, Prentice Hall, Inc., New York, 1952, p. 111.
3. Michael J. Jucius: *Personnel Management*, Richard D. Irwin. Inc. Homewood, Illinois, 1975, p. 99.
4. Milton M. Mandel, *'Recruiting and Selecting Office Employees'*, Research Report No. 27, American Management Association.
5. *Report of the National Commission on Labour*, 1969, Ministry of Labour and Employment and Rehabilition, Government of India, pp. 67-69.
6. *Report of the Study Team on Public Sector Undertakings*, Administrative Reforms Commission, p. 129.
7. R. Wayue Mondy and Robert M. Noe III: *"Personnel : The Management of Human Resources*, Allyn and Bacon, Boston, 1981.
8. William F. Glueck: *Personnel : a diagnostic approach*, Business Publications Inc. Dallas, Texas, 1974, p. 153.
9. Statistical Outline of India, 1982.
10. Gopal Ji, *"Personnel Management in Indian Industries"* (Unpublished thesis), approved by the University of Delhi, 1982.
11. Clement J. Berwitz, *'The Job analysis approach to Affirmative Action"*, John Wiley & Sons, Canada, 1975.

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Planning for Batch Production: The Case of a Distillery Plant

DR. R. P. MOHANTY

This study, conducted in a major distillery plant in the Netherlands, reports the characteristics of operational system relating to production and inventory subsystems of the plant. It has been experienced that production programmes of distillery plant have distinct dissimilarities when compared with other batch production type of systems. The distillary plants operate under the complex product structure characterised by varieties in relation to ingredients, and also under the complex market environment shaped by customer's changing preferences in relation to bottle size, shape, and price. This paper attempts to understand the complexity of the operational problem and formulates a rationalistic production programme so as to be implementable in a production plant having semi-automated facilities. The results of this study, although specific to the plant described, are transferable to similar other production situations such as textile and electronic industries where varieties and preference changes are the demands of the situation.

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Problem Description

A new distillery plant established in September, 1979, replacing the company's former small distilleries at different places, at present faces some typical problems relating to the production planning in order to meet the growing market demand for various products.

The activities of production have been grouped into four major departments, namely, Energy, Alcohol, Distillation and Bottling. The production technology that are followed in the plant can be enumerated as follows :

Process of Alcohol Preparation

The alcohol preparation process consists of three different stages; namely : brewing, fermentation, and distillation. The sequences for alcohol preparation are :

(i) grains (raw materials) are stored in storage tanks,

(ii) cleaning operation is performed to remove dusts, and other particles from the grains,

(iii) weighing operation is performed to prepare specified quantity of alcohol,

The author gratefully acknowledges the guidance rendered by Mr. F.A. Kroes, the Plant Manager of Gedestilleered En Wijn Group, Zoetermeer (Heineken International) while he was conducting a study in the plant at the insistence of the Research Institute for Management Science Delft, The Netherlands.

(iv) boiling the weighted grains in a pressure vessel under a pressure of 7 bars and at a temperature of 150 C for a time interval of approximately 1 hour,

(v) the boiled grains are blown off and taken to a different tank where some additives are added, and then allowed to cool to 30°C. Air is blown over it and yeast is added; the fermentation process takes place at least for 48 hours,

(vi) after the fermentation, the alcohol is brought to distillation tanks for rectification,

(vii) in the distillation units, some special spices, and specific additives are added to the tanks, and steam is allowed to pass to make the additives boiled fully,

(viii) the vapours after boiling are allowed to pass through a condenser, and the condensates are graded according to different concentrations of alcohol contents and stored in different product tanks.

Depending upon the requirements for the products as ordered by the order-taking department (sales department), the product tanks are connected to the filler tanks through a filtration process. To make production control easier, buffer tanks are provided to store products to fill the fillers of the bottling lines.

The plant under study, is having four bottling lines. The first three lines are automatic transfer lines the fourth one being a manual transfer line.

All these lines have the following six basic functional work elements :

(i) depelletisation of bottles

(ii) filling up the bottles with the product

(iii) closing up the bottles

(iv) labelling up the bottles

(v) filling carton with the bottles

(vi) pelletising the cartons.

The first bottling line can handle only one type of bottle (square shape, 1 litre capacity) specified only for one type of product. The capacity of the filler tank in this line is 14,400 litres. The second line has at present provisions for two types of bottles (1 litre capacity), and filler tank capacity is 9,600 litres. This line can accommodate ten different products. The third line can accommodate three different types of bottles (1 litre, 0.7 litre, and 0.35 litre) for only one type of product. The filler capacity of this line has 6,000, 8,000, and 9,000 litres according to bottle sizes. The fourth line, which is a semi-automatic assembly line can handle 13 types of various shapes and sizes of bottles, and has provisions for filling twenty types of products. This line has got a capacity of 2,400 litres per day.

It can only be recognised at this stage that the bottling section is the nerve-centre of this plant because this section serves the coordination function between the production department and sales department. Hence, the planning and control of production, as well as the planning and control of inventories of products so as to meet the demands of the markets, depend largely on the effectiveness and efficiency of this section.

During a detailed conversation in a problem-finding session with the plant manager the following pertinent points were observed :

(i) This plant is part of an international company, operating in a global market.

(ii) The company contemplates to transfer line number 4, to another plant, where there are a lot of underutilised labour force. As a result of this step, the products being handled by line number 4 at present, are to be shifted for production to other three lines.

(iii) As a sequence to point (ii) above, the future production possibilities and constraints are envisaged as follows :

(a) Line 1 will be occupied for one type of product,

(b) Line 2 will be occupied for four varieties of bottles. Let us designate these varieties as models of the lines, such as: L_2B_1, L_2B_2, L_2B_3 and L_3B_4. In model type L_2B_1 four types of products, in model type L_2B_2 ten varieties of products and in case of L_2B_3, and L_3B_4 only one type of product will be filled in.

(c) Line 3 will be occupied with three types of bottles, such as L_3B_1, L_3B_2, L_3B_3, but they will be filled in by only one type of product.

Problems in Production Planning

The following problems were identified for the plant's production planning :

(i) There are varieties of models competing for allocation of time in a single production facility (bottling line).

(ii) Since each model is different entirely, the set-up cost and product change over cost are considerably significant.

(iii) With the existing level of work force, whether the future conditions envisaged will be feasible or not.

The above-mentioned problems can formally be stated as follows :

S1: What will be the production batch size of the models so as to maximise the utilisation of production facilities and minimise the costs of manufacturing and inventorying ?

S2: In what optimum frequency the products should be changed in a model cycle ? Or, in other words, how to balance the batch of a particular model among various products in one cycle ?

Problem Analysis :

To develop a suitable mathematical model which can be implemented for production planning, the following assumptions were made :

(i) A batch must be started and be completed before that model runs out.

(ii) A re-order point on each individual product of a particular model type is available, and the stock is replenished by a quantity equal to the optimum batch size.

(iii) Consumption or order-taking is continuous and follows a linear pattern.

Three different kinds of costs are considered for incorporating in the analysis :

(i) The stocking costs which are the costs resulting from the holding of stocks. These costs increase as the batch size increases and conversely.

(ii) The set-up costs have the following components :

(a) cost of administration for model changes

(b) cost of maintenance for model changes

(c) cost of cleaning and preparation for model changes

(d) cost of brekaing up for model changes

(e) cost of losses resulting from the system, such as liquid losses, and packing material losses etc.

(iii) Product change-over cost have the following components :

(a) costs associated with the system losses

(b) costs associated with the administration

(c) costs associated with the starting up.

To calculate the economic batch size the following model is considered to be the appropriate one.

$$Q_i = \sqrt{\frac{2r^2_i \, (\Sigma_i \, C_{si})}{\sum\limits_i C_{1i} \, r_i \, (1 - r_i/q_i)}} \qquad \ldots\ldots(1)$$

where,

Q_i = batch size for model type i

C_{si} = set up cost for model type i

C_{1i} = stocking cost per unit of time for model type i

q_i = production rate for model type i

r_i = consumption rate for model type i

N_j = the number of complete production cycles, each consisting of the manufacture of a batch of each product j, is given by

$$N_j = \sqrt{\frac{\Sigma_j \, C_{ij} \, r_j \, (1 - r_j/q_i)}{2 \, \Sigma_j \, C_{sj}}} \qquad \ldots\ldots(2)$$

Various model types considered, their consumption rates per year, production rates per day in any line and

the price of each model are mentioned in Table 1. It has been observed that for each model change in a particular line the following times and costs are to be taken into account :

(i) 7.5 hours for preparation of the line,

(ii) 0.8 hour for picking up production to the full working capacity of the line,

(iii) 0.5 hour for breaking up the line for another model,

(iv) 2 hours for maintenance of the line; with one maintenance mechanic engaged during the time.

(v) administrative costs are approximately Dfl 39 = 00,

(vi) system lose costs are approximately Dfl 30=00,

(vii) interest cost of capital is at the rate of 13% per unit of product,

(viii) total number of working days are 250 days per year, with 7.5 hours per day.

(ix) the crew size/line = 6 skilled workers.

Table 1. Demand and Cost Data for Various Models and Products

Model type	Consumption per year	Production rate per day	Holding Cost/ item/year	Set-up Cost Batch
L_1B_1	5419060	91800	0.195	181.50
L_2B_1	3459400	57600	0.182	466.50
L_2B_2	4527310	61200	0.130	466.50
L_2B_3	263572	57600	0.156	466.50
L_2B_4	339000	57600	0.130	466.50
L_3B_1	488800	44625	0.494	811.50
L_3B_2	2581000	51000	0.377	811.50
L_3B_3	214286	51000	0.221	811.50
Product type	**Consumption per year**	**Production rate per day**	**Holding Cost/ item/year**	**Changeover cost**
$L_2B_1P_1$*	3121600	57600	0.182	164.00
$L_2B_1P_2$	60300	57600	0.182	164.00
$L_2B_1P_3$	263600	57600	0.182	164.00
$L_2B_1P_4$	13900	57600	0.182	164.00
$L_2B_2P_5$	3038900	61200	0.130	164.00
$L_2B_2P_6$	94100	61200	0.130	164.00
$L_2B_2P_7$	27600	61200	0.130	164,00
$L_2B_2P_8$	8500	61200	0.130	164.00
$L_2B_2P_9$	1239100	61200	0.130	164.00
$L_2B_2P_{10}$	28000	61200	0.130	164.00
$L_2B_2P_{11}$	73100	61200	0.130	164.00
$L_2B_2P_{12}$	5000	61200	0.130	164.00
$L_2B_2P_{13}$	1010	61200	0.130	164.00

*L refers to the line; B refers to the model of the line; P refers to the product variety.

Table 2. Results for Various Models

Model type	No. of Optimum cycles/year	Optimum Batch size/cycle	No. of days per cycle	No. of day per year
L_1B_1	47	114908	1.25	59
L_2B_1	16	216213	3.75	60
L_2B_2	16	282957	4.60	74
L_2B_3	16	16473	0.29	5
L_2B_4	16	21188	0.37	6
L_3B_1	15	32586	0.73	11
L_3B_2	15	172067	3.37	51
L_3B_3	15	14286	0.28	4.2

Findings

Results for the economic batch size of each model have been presented in Table 2, using the mathematical model given by Eq. 1; and the minimum cost number of change-over for each production using Eq. 2 is given in Table 3.

Table 3. Results for Various Products

Product type	Minimum Cost No. of Changeovers in a year
$L_2B_1P_1$	13.0
$L_2B_1P_2$	6.0
$L_2B_1P_3$	12.0
$L_2B_1P_4$	3.0
$L_2B_2P_5$	20.0
$L_2B_2P_6$	6.0
$L_2B_2P_7$	3.0
$L_2B_2P_8$	2.0
$L_2B_2P_9$	19.0
$L_2B_2P_{10}$	3.0
$L_2B_2P_{11}$	5.0
$L_2B_2P_1$	2.0
$L_2B_2P_{12}$	2.0
$L_2B_2P_{13}$	1.0

The following discussions are considered relevant here for interpreting the obtained results :

(i) Excluding the set-up times, the total production time required for line 1 and line 3 are 59 days per year and 66.2 days per year. If set-up times are superimposed over these times, the total number of days are well within the available working days. Hence, it can be recommended here that maximum productivity line 1 and line 3 should be operated jointly by one set of crew. Similarly, for line 2, the production time is only 145 days per year. This line, therefore, should be operated by another crew set.

(ii) The results presented in this study are only applicable for the circumstances where the usage rates are deterministic. Usually, however, usage rates are not known with certainty, rather demand will fluctuate from day to day. Under such circumstances, it is not possible to set a production schedule for cycling the products, and calmly live with it, except at the cost of substantial inventories to protect each item against stock-outs. It will be much more economical, therefore, to set up an inventory sufficient to provide for such fluctuations in stocks of individual products, plus protection against fluctuation in total demand for products. This can be approached in the following manner :

(a) Establish a ratio for the maximum inven-

tory of an individual product to the total inventory of all the products in the same model type. Rank these ratios from the highest to the lowest. For example, in the model type L_2B_1, we find the product P_1 is having the highest ratio, and then P_3 and P_4. Based on these ratios, the highest ranked product, (P_1) be accepted as a flexible demanded product, for which we can assume that enough safety stock is always available.

(b) Let the flexible product be manufactured in all the cycles, i.e., all 16 of them. P_3 should be manufactured 6 times in the year, P_4 should be manufactured 3 times in a year. To do this, all the demands of these products be divided by their optimum number of change-overs; and the production be adjusted to these quantities. So in a particular cycle, either of these three products, or all together, or combinations of them, sbould be manufactured to keep the inventory of all these products at the level determined by their individual ratios, and depending upon the quantity of these productions, the balance (optimum batch size of the model—the summation of all manufactured products except the flexible product) be manufactured for the flexible product.

(iii) Similarly production plans can be established for the model type L_2B_2. Here, it is suggested to take P_5 and P_9 as flexible products, which can be manufactured in all the 16 cycles per year; and a schedule be established for all other products to keep the inventory at the level of their ratios.

Produetivity
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Salesman Potential vis a vis Territory Potential

K. R. RAO

A balance between the potential of territories and the productivity of salesmen is critical to achieve the optimal performance in sales turnover. Such a balance becomes essential to keep the productive salesmen motivated with a constant challenge. A quantitative approach is proposed here, with three simple steps in it :

1. *Assessing the growth potential of the territory based on past data;*
2. *assessing the productivity of salesmen, based on their achievement against targets and the relative importance of these achievements to the company; and*
3. *comparing the ranking of territories with the productivities and reassigning to build coherence.*

The model accommodates abnormal territories through a statistical evaluation of the deviation and elimination of the contribution from abnormalities.

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Productivity in Sales

A Sales Manager's primary objective is to achieve the targeted sales. But the achievement of targeted sales is the outcome of a number of factors, including the identifying of territory potentials and matching the best salesmen with the best territories. Often the best salesmen remain under-utilised because of the low potential of the territory. Similarly, the optimal sales are not achieved in certain territories of high potential, because the salesman's productivity is relatively less. Such mismatches lead to suboptimal performance of the company in the market and also hinder the advancement of salesmen with better abilities.

In addition, sometimes re-assigning of salesmen takes place when targets are not achieved. Such re-assignments are also done on a random basis and may not result in optimal performance. When sales targets are not achieved even after re-assignment, additional salesmen are added without due consideration being given to marginal productivity of the salesmen.

This Paper describes a simple quantitative model to determine the territory potentials and match the productivity of the salesmen with territory potential. The model can be computerised to obtain periodic statements in the desired form and can be utilised—

(i) for measuring territory potential;

(ii) for measuring the productivity of salesmen; and

(iii) for insuring that the right salesmen are assigned to territories based on their potentials.

The Model

The model involves two parallel measurements. These are :

1. The territory potential assessment and ranking; and
2. the measurement of salesmen productivities on criteria relevant to the appropriate firm/industry, and determining the mean productivity scores of each territory under the current assignment of salesmen. The territories are then ranked based on their mean productivity scores.

The final step consists of testing the coherence between the ranks obtained in the first step, with the ranks obtained in step two. Where there is a mismatch, the model offers two alternate approaches to create coherence.

1. Territory Potential Assessment involves

(a) Measuring growth rates of—

(i) Normal territories

The territory potential assessment consists of the following steps :

(i) (i) Identify all the territories of relevance to the State/Country;

(i)(ii) Using the Sales data in units for the past years, compute the mean growth rate (reject abnormal growth rates influenced by uncontrollable factors). The formula for this computation is :

$$\bar{g} = \frac{1}{n-1} \sum_{x=1}^{n-1} \frac{S(x+1) - Sx}{Sx}$$

Where $\bar{g}$ = the mean growth rate for the years under consideration

n = number of years

Sx = sales for the base year in units

$S(x+1)$ = sales for the year next to base year, in units

and

(ii) Abnormal territories

The growth rates ($\bar{g}$) of the territories are sometimes influenced by extraneous factors. The extraneous factors may be of the nature of over-stimulation of sales in some states due to tax differences or extraordinary promotional efforts by the company or the competitors. As a result, the ($\bar{g}$) of these territories may be unusually high or low and warrants special treatment. The growth rates of these territories are calculated as follows :

(ii) (i) The territories without the extraneous influences are isolated and the ($\bar{g}$) is calculated for each of these teritories as described above for normal territories.

(ii)(ii) The Grand mean ($\bar{G}$) of growth rates of these territories is then obtained as follows :

$$\bar{G} = \frac{1}{N} \sum_{l=1}^{N} \bar{g}$$

where N is the number of normal territories and $\bar{g}$ is the growth rate of each territory.

The standard deviation of the growth rates is then calculated, using the standard procedures.

(ii)(iii) The abnormal portion (k) of the ($\bar{g}$) is measured as follows :

When abnormal $\bar{g} > (\bar{G} + SD)$

$$k = \bar{g} - (G + SD)$$

When abnormal $\bar{g} < (\bar{G} - SD)$

$$k = \bar{g} - (G - SD)$$

The k value thus obtained is either positive or negative (that is $k > 0$ or $k < 0$)

If $k > 0$ the $\bar{g}$ of abnormal territory $= \bar{g} - k$

and when $k < 0$ the $\bar{g}$ of abnormal territory $= \bar{g} + k$

thus the $\bar{g}$ calculation for abnormal territory is modified as follows :

If $k > 0$

$$\bar{g} = \left[\frac{1}{n-1} \sum_{x=1}^{n-1} \frac{S(x+1) - Sx}{Sx} \right] - k$$

when $k < 0$

$$\bar{g} = \left[\frac{1}{n-1} \sum_{x=1}^{n-1} \frac{S(x+1) - Sx}{Sx} \right] + k$$

(b) Ranking the Territories :

The territories are then ranked in declining order of their growth rates. This ranking may have to be done for each state if the assignment of salesmen cannot be done outside the state. Where the transferability is not a limiting factor, the ranking can be extended to larger regions than a Single State.

2. Sales Force Productivity Measurement

(a) The key parameters for a salesman's productivity measurement are listed. In this example, the three parameters taken are :

(i) Achieved Sales;

(ii) Achieved new accounts; and

(iii) Achieved collections

(b) Percentage achievements are calculated using the formula :

$$\text{Percentage achievement} = \frac{\text{Target achieved}}{\text{Assigned target}} \times 100$$

Therefore, in this example, three percentage achievements become relevant :

S_A = Per cent sales achievement

$$= \frac{\text{Achieved Sales}}{\text{Assigned target}} \times 100$$

S_B = Per cent new accounts achieved

$$= \frac{\text{obtained new accounts}}{\text{assigned new accounts}} \times 100$$

S_C = Per cent collections achieved

$$= \frac{\text{achieved collections}}{\text{targeted collections}} \times 100$$

(c) Assign weights based on the order of importance to the Company.

(d) Multiply the per cent achievements of each Salesman with the weight coefficient and add the resulting scores for each achivement to obtain the total score of each salesman :

$$S\lambda = \alpha (S_A) + \beta (S_B) + \gamma (S_C)$$

Where $S\lambda$ = Score of the appropriate salesman

α = Weight coefficient of Per cent Sales Achievement

β = Weight coefficient of Per cent New Accounts Achieved

γ = Weight coefficient of Per cent Collections Achieved

(e) Calculate the Mean Productivity Score (MPS) for each territory, which is :

$$MPS = \frac{\text{Sum of the Scores of all Salesmen in that Territory}}{\text{No. of Salesmen}}$$

$$= \frac{1}{n} \sum_{i=1}^{n} S\lambda$$

where n = No. of salesmen in that territory

(f) Rank the territories in declining order of mean productivity scores

(g) Compare these ranks with the ranking of territories on growth potential basis. If both rankings do not match, corrective action is suggested.

Corrective Actions :

(i) If the territory sizes are not significantly different, the sales groups with high scores are sent to territories with high potentials. Thus, the territory ranking first in the $\bar{g}$ score is assigned the Sales Group ranking first in the MPS ranks.

(ii) However, if the territory sizes are different, and the number of Salesmen must be maintained as before, the assignment is done by assigning each salesman on the basis of his individual score to each territory based on its requirement, insuring that the $\bar{g}$ scores match the individual scores. If, for example, a territory that ranked first in $\bar{g}$ score had only two salesmen, whereas the highest ranking MPS reflects the score of three salesmen, then the MPS ranking is ignored. Instead, the salesmen holding rank 1 and Rank 2 in their independent scores are assigned to this territory.

HYPOTHETICAL EXAMPLE

The following data are based on a hypothetical example and present a step-wise demonstration of the computations :

1. Territory Potential Assessment

(a) Growth rate of—

(i) Normal Territories

In the example (Table 1), the Sales in Units for the past five years are given for five territories. The Mean Growth Rate ($\bar{g}$) is the mean of the growth rates between years 2 and 1, 3 and 2, 4 and 3, and 5 and 4. The growth rate for years 2 and 1 is calculated as follows :

$$\frac{200{,}000 - 100{,}000}{100{,}000} = 1.0$$

The mean growth rate for years 1—5 would be :

$$\frac{1}{4}\left[\left(\frac{200{,}000-100{,}000}{100{,}000}\right) + \left(\frac{400{,}000-200{,}000}{200{,}000}\right) + \left(\frac{600{,}000-400{,}000}{400{,}000}\right) + \left(\frac{1000{,}000-600{,}000}{600{,}000}\right)\right] = 0.79$$

Similarly, $\bar{g}$ is calculated for all the five territories, as shown in Table 1.

Table 1. Unit Sales and $\bar{g}$ Ranking for Territories

Territory No.	Sales in Units of Years $\bar{g}$ 1	2	3	4	5	Score
1	100,000	200,000	400,000	600,000	1000,000	.79
2	50.000	100,000	150,000	250,000	300,000	.59
3	80,000	160,000	280,000	340,000	537,200	.63
4	100,000	200,000	600,000	800,000	1200,000	.95
5	200,000	800,000	1200,000	600,000	396,000	0.66

(ii) Abnormal Territories

The grand mean ($\bar{G}$) growth rate of territories 1—5 would be

$$\frac{0.79 + 0.59 + 0.63 + 0.95 + 0.66}{5} = 0.724$$

and the Standard deviation is 0.149

and the $\bar{G} = 0.724 \pm 0.149$

Thus $\bar{g}$ scores under 0.575 and above 0.873 need adjustment

For example, if there is a territory with a $\bar{g}$ score of 0.9, K will be .027 and the

corrected $\bar{g}$ will be 0.873; and for a territory with $\bar{g}$ scores 0.5 the K will be 0.075. and the corrected $\bar{g}$ will be 0.575. These two territories will be assigned the maximum and minimum ranks respectively. If there is a tie between two such territories the territory with minimum K among the tied territories is given a superior rank, or the Sales Force assignment is adjusted to equalise MPS between these territories.

(b) Ranking the Territories :

The territories are then ranked based on the growth rate, as depicted in Table 2.

Table 2. Ranking of Territories based on $\bar{g}$

Territory	$\bar{g}$	Rank
1	0.79	2
2	0.59	5
3	0.63	4
4	0.95	1
5	0.66	3

2. Sales Force Productivity Measurement

(a) The key parameters are :

(i) Achieved sales in units;

(ii) Achieved new accounts in units; and

(iii) Achieved collections

(b) Percentage achievements are calculated as follows :

For example, Salesman No. 1 was assigned total targets of 10,000 units for all products with the existing customers, 5,000 units from new accounts and collection of at least Rs. 50,000 out of the outstanding Rs. 1,00,000. His achievements were 9,000 Unit Sales from existing customers, 4,000 units from new customers and Rs. 35,000 were collected from outstandings.

Therefore :

$$S_A = \text{Sales achievements} = \frac{9,000}{10,000} \times 100 = 90$$

$$S_B = \text{New Account Achievement } \frac{4,000}{5,000} \times 100 = 80$$

$$S_C = \text{Outstanding Collections} = \frac{35,000}{50,000} \times 100 = 70$$

The percentages calculated similarly for all the Salesmen for the three parameters are shown in Table 3, columns 3, 4 and 5.

Table 3. Achievement and Mean Productivity Scores

Territory	Salesman No.	Percentage Sales Achievement (Weight =0.6)	Per cent New Account Achievement (Weight β=0.3)	Per cent Collection Achievement (Weight =0.1)	Score of Salesmen	MPS
1	1	90	80	70	85	
	2	80	70	60	75	78
	3	80	60	80	74	
2	4	70	90	20	71	
	5	100	50	80	83	83.3
	6	100	90	90	96	
3	7	20	80	100	46	
	8	60	50	100	61	53.5
4	9	73.6	30	60	59	
	10	50	50	50	50	54.5
5	11	100	30	40	73	
	12	40	80	100	58	55
	13	25	40	70	34	

(c) In the example, the Manager/Company assigned the following weights to each of the parameters of measurement :

Weight for

S_A Sales Achievement $\alpha = 0.6$

S_B New Account Achievement $\beta = 0.3$

S_C Outstanding Collection $\gamma = 0.1$

(d) Therefore, the score of Salesman No. 1, calculated according to the formula

$$S\lambda = \alpha (S_A) + \beta (S_B) + \gamma (S_C)$$

$$= 0.6 (90) + 0.3 (80) + 0.1 (70) = 85$$

The weighted scores similarly calculated for all other salesmen are shown in Table 3, column 6.

(e) The Mean Productivity Score of the territories is calculated according to formula

$$MPS = \sum_{i=1}^{n} \frac{S\lambda n}{n}$$

For territory No. 1, No. of salesmen

$n = 3$

S λ of Salesman No. 1 = 85

S λ of Salesman No. 2 = 75

S λ of Salesman No. 3 = 74

$$MPS = \frac{85 + 75 + 74}{3} = 77$$

(f) MPS is calculated similarly for all the territories and shown in column 7 of Table 3

(g) The territories are then ranked assigning the highest rank to the highest MPS

In the example—

Territory 2 gets Rank 1

Territory 1 gets Rank 2

Territory 5 gets Rank 3

Territory 4 gets Rank 4 and

Territory 3 gets Rank 5

(h) The potential $\bar{g}$ ranks are compared with the above ranks. See Table 4 for this comparison. These two rankings, as evidenced in the Table, are not coherent.

Table 4. Comparison of $\bar{g}$ Ranks and MPS Ranks of Territories

Territory	$\bar{g}$ Rank	MPS Rank
1	2	2
2	5	1
3	4	5
4	1	4
5	3	3

Corrective Actions

Alternative 1 :

If the territory sizes are approximately the same, the salesmen in the territory with the highest MPS (MPS rank = 1) are assigned to the territory ranking 1 in the $\bar{g}$ ranks.

Thus, Salesmen Nos, 4, 5 and 6 responsible for the high MPS of territory No. 2 are assigned to territory 4 ranking first in the $\bar{g}$ rank and Salesmen Nos. 1, 2 and 3 responsible for the second highest MPS assigned to teritory No. 1 ranking second in $\bar{g}$ rank.

Table 5. Reassigning of Salesmen according to Alternative 1 (Territory Sizes are not Different)

Rank Based on $\bar{g}$ score	Territory Number	MPS Rank	Salesmen	
			Old Assignment	Revised Assignment
1	4	4	9	4
			10	5
				6
2	1	2	1	1
			2	2
			3	3
3	5	3	11	11
			12	12
			13	13
4	3	5	7	9
			8	10
5	2	1	4	7
			5	8
			6	

Alternative 2 :

Where the territory sizes are different and the number of salesmen assigned must be maintained, the MPS is ignored, but individual scores are taken into consideration.

For example, territory 4 had only two salesmen, presumably assigned due to smaller size. But this territory ranks first in potential ($\bar{g}$) rank and is therefore assigned the top two salesmen, Salesman No. 6 and Salesman No. 1, based on their scores in Column 6 of Table 3.

The revised assignments based on this approach are shown in Table 6.

Table 6. Matching $\bar{g}$ Scores with MPS through Reassignment Based on Alternative 2 (Difference in Territory Sizes)

Rank based on $\bar{g}$ Score	Territory Number	Salesmen Revised Assignment	Salesmen Scores	Old MPS	New MPS	Number of Salesmen Assigned
1	4	6	96	54.5	90.5	2
		1	85			
2	1	5	83	77.0	77.3	3
		2	75			
		3	74			
3	5	11	73			
		4	71	55.0	68.3	3
		8	61			
4	3	19	59			
		12	58	53.5	58.5	2
5	2	10	50			
		7	46	83.3	43.3	3
		13	34			

Discussion

The quantitative approach attempts to match the territory potential and salesman potential. The constraints to this approach are factors that contribute to non-transferability such as linguistic barriers. However, where selling is done in a medium common to the country (e.g. pharmaceutical detailing), this constraint is not applicable. Where linguistic barriers do exist, the model has to be applied to each State level, rather than National level.

Where extraordinary factors may influence the growth rate of a territory, necessary coefficients can be built into the equation. When the extraordinary factors do not influence the growth rate, the mean growth rate is a factor to consider for minimising risk.

The $\bar{g}$ rate of the company, rather than the market growth, is used to improve the weightage of acceptance enjoyed by a company in each territory. The $\bar{g}$ rate of the total market may be substituted in the model if the salesmen must be assigned based on market potential. This may become necessary when the $\bar{g}$ rate of the company is significantly different from the $\bar{g}$ rate of the total market.

The objective of this Paper has been to keep the model simple, and therefore, situations where the relative stress on the selling of each product by a given salesman must be different are not included. In such situations, "S" measurement must be modified to reflect the relative importance of target achievement for each product by each salesman. For example, if a salesman is taking care of three products and the importance of target achievement for each of these products is different then :

$$S\lambda = \left[\theta \left(\frac{T_A}{T_{AG}} \right) + \Delta \left(\frac{T_B}{T_{AB}} \right) + \phi \left(\frac{TC}{T_{AC}} \right) \right] \times \frac{100}{n}$$

Where T_A T_B and T_C are the target achievement for the products A, B and C and T_{AG}, T_{AB} and T_{AC} are the targets assigned for products A, B and C respectively. Theta, delta and phi are the weights attached to the achievement of targets for these products. The term 'n' is the number of products.

The concept after computerisation can be rendered useful to eliminate subjective assessments of productivity and territory assignments. Thus a consistency can

be achieved in decision making and periodic reporting of these mismatches will help decision making.

The present model has certain implied assumptions in it, the key facts being the weights assigned to each of the subunits of the salesman's performance assessment. These weights must be established at the company level, based on the company's priorities and policies to eliminate subjectivity. Linear programming models for assigning factor weights on performance are published in the literature and modification of these models is possible to suit sales management.

An assumption is also made that the territorial assignment of salesmen has a high degree of flexibility in the interest of optimization of performance. The model obviously cannot be applied to relatively new territories if the sole contributing factor to poor growth rates of a territory are the salesmen assigned there.

Conclusion

A quantitative approach to optimising the assignment of salesmen to territories, based on their potential, is proposed. The concept calls for matching the productivity of salesmen with the territory potential, as opposed to random assignments. The concept also offers an approach to measuring the performance of salesmen.

REFERENCE

1. Kalro, A. H; Korgaonker, M. G; and Gohil, M. M. : Determining factor weights in job evaluation by linear Programming Productivity; 1981; 22(3); 33-37.

Productivity
1983, XXIV, 1, 71-80

Planning Graph—A Model for Corporate Planning

R. M. NARCHAL

This paper describes a model called 'planning Graph' designed based on the principles of systems approach to corporate planning. The Model indenifies two types of variables—called strategic variables and environmental variables and has the capability of evaluating the strategies of an organisation through strategic variables. It also gives an early warning to the Management about the organisation. The Model has the capability of simulating the behaviour of the corporate objectives of an organisation with a reasonable accuracy.

R.M. Narchal is a Senior Consultant in the Corporate Planning Cell of National Productivity Council. He has considerable experience of designing and implementing Corporate Planning System with Computer based Models in a number of public and private organisations. Also he had the opportunity of studying the corporate planning practices used in a number of multinationals such as Diamler Benz, IBM, Volkswagen etc.

Introduction

Corporate Planning is the process of translating Corporate Objectives into Policies of the organisations. Strategies are worked out through these policies which then are transformed into resources related to action plans that will achieve the objectives.

The Corporate Planning activity in any organisation should provide the executives with an opportunity to understand strategic problems of the organisation. These problems cannot be understood and solved in the course of day to day operational activities. These problems mostly relate to the business of the organisations and environment in which the organisation is existing and have long-term repercussion and tend to deviate the organisation from achieving its objectives.

The severity of such strategic problems can even threaten the existence of the organisation and is often realized at such a late stage that revival of the organisation is very difficult. Under this competitive environment it is very essential for every organisation to have a comprehensive long-term planning and monitoring system through which the managers are forewarned about the strategic problems of the organisation and its corrective actions can be monitored through the system. Whenever a planning system for understanding the long-term strategic problems has to be developed one has to simultaneously look into the three systems.

The Company:—this is the system, whose long-term

behaviour has to be forecast indicating the strategic problems.

The Market system :—this is the system with which the company is having business transactions. These business interactions could be in the form of transfer of Goods/Services, information, materials, cash etc.

The Environment from the company's point of view, everything, except company and its market, is called environment. This includes Government, suppliers, competitors etc.

The environment being very big, normally the study of entire environment is not only time consuming, but also is very expensive. Moreover the entire environment does not have a direct effect on company or its market system. Only a selective portion of the environment which directly affects the company or its market system is identified for the purpose of understanding.

The interactions between these systems are shown in fig (i). A joint system consisting of the company and its market is called Business system. The environment often acts as controller factions for the business system. In order to understand the behaviour of the business system, one has to make assumption regarding the environment.

Figure - 1.

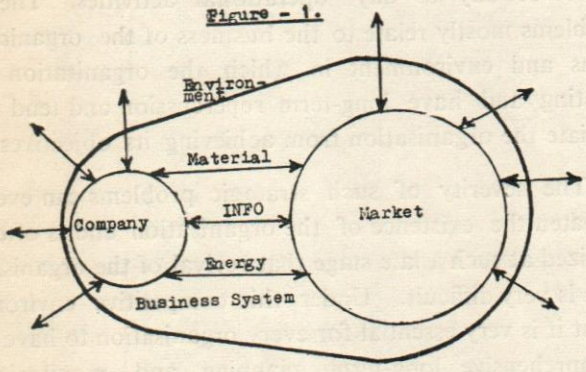

Fig. 1

It is therefore essential to develop an intergrated planning system to understand the future of the company under different conditions of market and environment. The planning system should have the capability to produce alternative scenarios under different set of assumptions of the environment and must provide a built-in intelligence in the system to manoeuvre the behaviour of the system in the desired direction.

Corporate Planning Process

The corporate planning process in any organisation attempts to answer the questions related to purpose of the organisation, the business in which it is operating, and the chances of achieving certain desired results under different environmental conditions. An illustrative model of corporate planning process is indicated in fig. (ii).

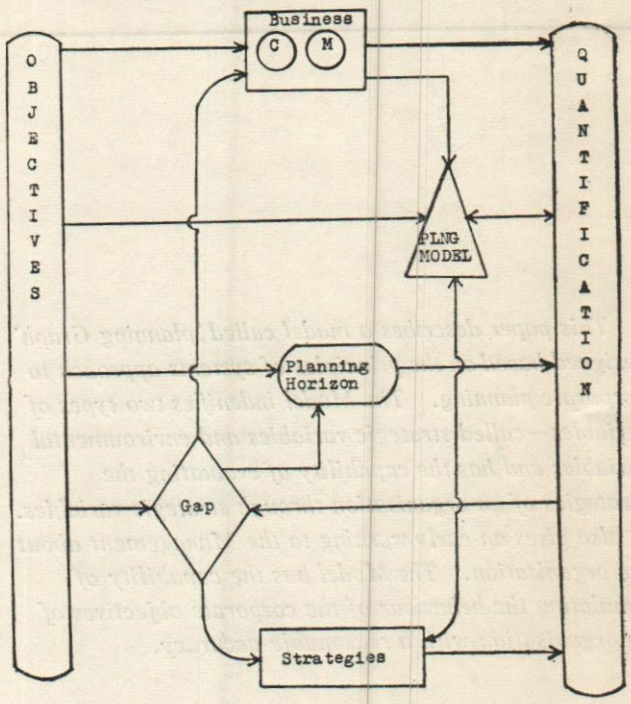

Fig. 2

The corporate planning process as indicated in the fig. (ii) clarifies that the primary element for starting the process of corporate planning is the purpose of the organisation leading to objectives of the company. These objectives have to be stated in quantified terms, because the corporate planning process is leading to achievement of these objectives. The company is operating in a business environment indicated by its products or services, by its markets in which the company is operating and by its customers. For developing a system of Corporate Planning all these business elements of the company are to be identified and should be stated in quantified terms. The company has to

understand the planning horizon depending upon the product life cycle, lead time for launching a new product etc. Once these three items viz. objectives, business and horizon for planning are identified the company has to understand three states of the system.

Present State : This state indicates the present quantified values of the company policy and business variables. The environmental constraints are also identified. The past trends of all these variables generate the behaviour of the company system and the present value of all these variables reflects the present state of the company. The present state of the company is understood thoroughly and its behaviour in the past is also known through a set of trends of its characteristic variables.

Prabable State : Once the present state of the company is known with its past behaviour, the probable state of the company is identified by using any of the forecasting models. The probable state gives the values of the companys' objective and business variable in future which the company is likely to achieve under different set of policies and environmental assumptions.

Desired state of the Company : The desired state of the company is the desired values of the objective variables identified earlier. The desired values of the objective variables is often fixed taking into account the following factors.

(i) Past trend of the objective variables indicating the direction in which the values of these variables are likely to move.

(ii) The capabilities of the company indicated through its strengths and weaknesses, carry a heavy weight in fixing the desired values of the objective variables.

(iii) Environmental opportunities and threats also must be considered while fixing the desired values of the objective variables. These also have direct relationship with the desired values of the company's objectives.

(iv) Business Averages, often the company wants to know, how it stands in comparison to its competitors. Comparing the average value of the objective variables in the business with company's desired values provides sufficient guidelines for fixing the desired values.

(v) Ambitions, the factors indicated above are the guidelines used for fixing the desired value of objectives. As all these factors may operate simultaneously the strength of this chain may be in its weakest link. Under such circumstances the ambitions play a vital role in fixing the desired values of the objective attributes.

Once the desired state of the company is known, it is compared with the probable state. In case there is a gap between the desired state and the probable state of the company, one has to develop strategies to close the gap. The strategies are then translated into action plan and resource plans and budgets for its implementation.

In the Corporate Planning process stated above the identification of probable state play a vital role. As incorrect identification of the probable state of the company may result in assessment of a gap which will not exist in practice. In practice the actual gap may be more or less than the gap identified. This may result in either wastage of resources or the objectives may not be achieved. It is therefore very essential that the planning models used to work out the probable state must be accurate enough to identify the correct probable state of the company, market and environmental variable.

The second aspect in which the company's face a problem is assessment of the result of any strategic programme. In other words the company needs a model which can simulate the result of any strategic action programme. A planning model which can work out an optimised strategic action programme will be an ideal one.

Planning Model—Its Role and Essential Characteristics

In the corporate planning system of any company, the planning model may relate to company system, market system and environment. In most of the cases, there should be at least two separate models, one for the market system to understand the behaviour of the markets, customers and its characteristics. The second model mostly relates to the company and this model

forecasts the probable state of the company variables to meet the demand indicated by market model. These two models can then be coupled together to understand the behaviour of the business system. As regarding environment, the assumptions are made for behaviour of the environment. The assumption may be monitored on continuous basis to know changes in environment having an effect on company's behaviour.

In order to develop such a model, one has to understand what characteristics of the system has to be understood in future. Once all the characteristics are identified and built into the model, it represents the real system to understand these characteristics. The model then can be used to simulate the probable state of the system.

In case of models developed for the purpose of corporate planning, one has to ensure that at least the following characteristics are taken care of by the model.

(*i*) *Corporate objective of the system*

The entire process of Corporate Planning is carried out to achieve the corporate objective of the system. It is therefore essential that when the model is developed, it must centre around forecasting the values of corporate objective of the system. Many times the corporate planning models do not relate to corporate objective of the company. These models cannot be directly used to understand the behaviour of Corporate objective of the system.

(*ii*) *Sub objectives of the system*

In a system corporate objective is the most important to be achieved. However this objective is built of many sub-objectives. These sub-objectives are built from functional objectives, business objectives and unit objectives or a combination of all depending upon the Syntax of the organisation. The Corporate objective of the system has all these objectives built into it with the help of another syntax called objective structure. It is essential to control the sub-objective in order to achieve the corporate objectives. It is therefore essential that Corporate Planning Model has subjective variables built into it.

(*iii*) *Goal & Targets*

For achieving the value of corporate objectives for any future date one has to determine the path leading to the final value to be achieved. There are various possible paths leading to the final value and one has to choose the path suited to him. The values of objectives for intermediate time lying on the path chosen are called intermediate goals or targets. The planning model should be able to generate various alternative paths and should take care of intermediate goals leading to corporate objectives.

(*iv*) *Key Environmental Variables*

While looking into the future one has to understand the environmental behaviour. The environmental behaviour is understood through a set of environmental variables which affect the corporate objectives of the system. In the planning model the relationships of these environmental variables have to be identified with the corporate objectives so that with a set of assumptions for the environmental variables the model should be able to generate a set of scenarios for the corporate objectives.

(*v*) *Key internal Constraints*

In most of the companies there are certain constraints with in which the system is operating. It is essential to identify these constraints and build them into the planning model to understand the effect to these constraints on the system behaviour.

(*vi*) *Strategic Variables*

There are a set of variables of the company which are strategic in nature. Through the planning model one should be able to identify these variables and develop action programme to change the values of these variables. This action programme is called strategic action programme. The planning model should be able to test any strategic action programme before its actual implementation.

(vii) *Probability of Success*

Since the future is not known one has to make assumptions of the environment to understand the likely behaviour of the system. By understanding the chance of any assumption coming true it should be possible to work out the probability of success of any strategic action programme through an effective planning model.

(viii) *Response Time*

It is very essential for a planner to understand the effect of any action and its result. However there is always a delay built into it. A planning model should have any system of early warning to inform the response from any environmental or strategic variables.

Planning Graph

Planning graph is a model, based on the concepts of system approach to corporate planning. This model is always developed for the objective attribute which a company wants to achieve. This model has two constitutents.

(a) Key Variable

(b) Linkage between Key variable

Key variable : It is a part of the system and accomplishment of its value is critical in achieving company's objective. It has first level direct relationship with the objective for which planning graph is to be developed.

Example : Objective : Higher Sales

Key Variable : Market share

A key variable indicates the key result area. Key result area is the functional area in which the key variable lies. In the key result area one can identify the factors influencing the key variable directly. These factors are called key influencing factors.

Example : Key variable : Market share

Key Result Area : Sales function
— Product area
— Market Area
— Customer Area

Key Influencing factors :

In Product Area : — Product Price
— Product Quality
— Product availability
— Product Knowledge etc.

In Market Area : — Market Coverage
— Advertisement in Market
— Sales Promotion in Market
— Sales Force Deployed
— Market Growth & Development etc.

Customer Area : — Customer Requirement
— Customer Behaviour
— Customer Habits etc.

Linkage : Linkage indicates relationship between any two variables.

It Indicates : — What flows between two variables ?
— What is the direction of flow ?
— What is the quantum of flow ?
— What change it brings in succeeding variable with this flow ?

Methodology for developing planning graph

The development of planning graph is a creative process in any company however a systematic approach as given in the following steps helps an individual in developing this model systematically

Step 1. Identification of planning units of the company.

Step 2. Define the objective attribute for each of the planning unit and its relationship with other planning units.

Step 3. Identify the key variables for each of the objective attributes in each planning unit.

Step 4. Locate the key result area for each of key variables and identify the key influencing factors in each key result area.

Step 5. Determine linkage and relationship between the key variables & key influencing factors.

Step 6. Develop system equations for each planning unit and check if actions, responsibilities and resources can be identified to make a change in the state of key variables and influencing factors.

Step 7. Interconnect all the planning units to get the total planning graph.

In order to develop planning graph in a company the problem comes in identification of the planning unit and its objective variables. A planning unit is a self-contained part of the organisation chosen for the purpose of planning. The planning unit should be such that the inputs to the planning units and contribution or output from the planning units can be very clearly defined. This will lead to understanding of objective variable of the planning unit to be achieved. The factors influencing these planning units leads to a set of equations for each of the planning units.

In general, for any organisation, return on assets is one of the objectives to be achieved. In order to develop a planning graph model for ROA, the objectives of all the planning units must contribute to either sales, assets or expenses of the company. For illustration purpose let us think of a company selling a number of products — P_1 P_2 ..... P_n.

The products are sold in different markets M_1, M_2 ——— M_n and in each of the markets there are potential customers who can buy these products.

Then the sales model of the company with system equations can be derived as follows :—

Model I

INPUTS ——→

Tolal Sales = Sales P_1 + Sales P_2 + ... + Sales P_n

Sales P_1 = Sales P_1 M_1 + Sales P_1 M_2 + ... Sales P_1 M_n

Sales P_2 = Sales P_2 M_1 + Sales P_2 M_2 + ... + Sales P_2 M_n

Sales P_n = Sales P_n M_1 + Sales P_n M_2 + ... Sales P_n M_n

OUTPUTS ——→

Model II

INPUTS ——→

Sales of P_1 M_1 = Qty Sold × Price

Qty Sold = Number of customers × Qty sold per customers

Number of customers = Customer approached × maturity ratio

Customer Approached = Customers identified × Approach Ratio

Customers Identified = Potential customers × Identification Ratio

OUTPUTS ——→

In a similar fashion the model for assets can also be developed. An illustrating total asset model for an engineering company is explained below :

For developing the model of expenses, in planning graph, we take up one by one every planning unit and identify the function the planning unit is supposed to perform. In order to perform this function the inputs required are identified. The corresponding expenses incurred on these inputs are called primary expenses to perform the function.

Model III—Total Assets

Total Assets	= Fixed Assets + Current Assets
Fixed Assets	= Machine Assets + Building Assets + ... etc.
Machine Assets	= Number of Machines × Average Price
Number of Machines	= Total Time required/Time available per m/c
Total time required	= Total operation time + Total Set up Time + Total idle Time
Total operation Time	= Units to be produced × Operations per unit × Time per operation
Total set up Time	= Units to be produced × Number of set ups per unit × Time per set up
Total idle time	= Idle time due to m/c + I.T. due to m/c not available, No power + ... etc.
I. T. due to m/c not available	= Break down time + Preventing maintenance time
Break down time	= Number of Break downs × Av. time per break down
Preventing Maintenance time	= No. of preventing Maintenances × Time per occasion.

INPUTS ——→

OUTPUTS ——→ Total Assets

Primary Expenses ——→ [Planning Unit] ——→ Secondary Expenses

Once the function is performed certain outputs in the form of decision and informations come out of the function. These outputs generate certain new types of expenses called secondary expenses.

The primary expenses model will determine the expenses required to be incurred to carry out the function determined by the planning unit. These inputs may be in the form of men and facilities. An example of primary & secondary expense model for a planning unit performing purchase function is given below :

Primary Expense Model

INPUTS ⟶

Primary Expense	= No. of Men required × Personal rate
No. of Men	= Work load ÷ Time/men
Work load	= Working time + idle time
Working time	= No. of activities × time per activity

⟶ OUTPUTS

Once the function is performed and the decisions are taken it results into certain secondary expenses as well as informations leading to change in sales or assets.

The total expense model, asset model as well as sales model when are aggregated we get financial model. The outputs of these models become input to the financial model as given below :

Secondary Expense Model

INPUTS ⟶

Secondary Expense	= ICC + Stock out Cost + Obsolescence Cost + Rejection cost
Inventory carrying cost	= Inventory Value × Interest rate
Inventory value	= Av. working stock + safety stock
Average working Stock	= Order Qty ÷ 2
Order Quantity	= Value of Purchase ÷ No. of Orders

⟶ OUTPUTS

Total Expenses Model

INPUTS ⟶

Total Expenses	= T. E. (U_1) + T. E. (U_2) + ... T. E. (U_n)
Total Expenses (U_1)	= Primary Expense (U_1) + Secondary Expense U_1

⟶ OUTPUTS

INPUTS

ROA = Sales Profitability × Turnover Ratio

Sales Profitability = Profit ÷ Sales

Turnover Ratio = Sales ÷ Assets

Profit = Sales — Expenses

राष्ट्रीय उत्पादकता परिषद पुस्तकालय नई दिल्ली

OUTPUTS

Once all the models are interlinked with financial model the planning graph is complete. This model can now be used for the purpose of long range planning after validation.

Validation of the Model

The planning graph model will have three types of variables built into it. These variables are :

(i) Top most variable : It is the objective for which the planning graph is developed and which the organisation wants to control.

(ii) Intermediate variable : It carries the intermediate value of lower level variables.

(iii) Open variable : These are the lowest level variables and are independent in nature. The corporate objective is a function of these open variables. These variables can be classified into two types.

(a) Strategic variables : These are within the control of the company. The company executives, through their decisions and actions, can change the value of these variables.

(b) Environmental variables : These variables are affected by environmental changes and the company has no control over them. The company has to monitor the environment and make realistic assumptions about these variables. In order to validate the model, post data for the open variable for the last few years has to be collected and the behaviour of the systems corporate objective generated by running the model after feeding the data for the open variables. Over this behaviour the actual values of the corporate objective of the system has to be plotted to check the model behaviour of the system with the actual behaviour. Once the model generates a behaviour within 15% of accuracy of the actual behaviour, the model is reasonably accurate to forecast the system behaviour on long-term bases as given in the Fig. 3 below :

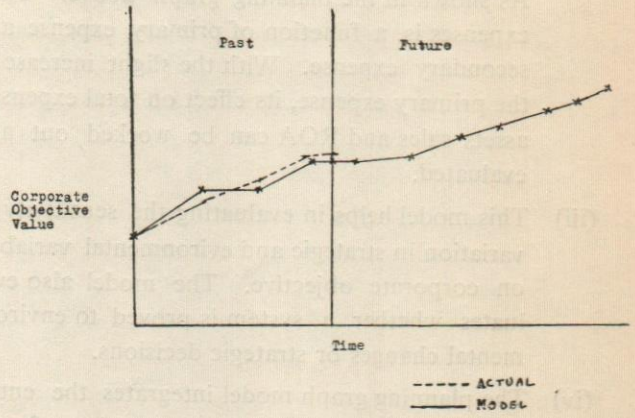

Fig. 3

Characteristics of Planning Graph Model

The planning graph model has lot of characteristics which can be used in the process of corporate planning. Some of the characteristics are listed below :

(i) Planning graph provides a relationship between corporate objectives of the company and its key variables. The relationship helps in identifying

and controlling the functional objectives of the system.

(ii) The planning graph model can be used to test input-output linkage to a function. It classifies the functional expenses into input expense and output expense. The input expense resulting from inputs if changed should improve the functional performance of the unit.

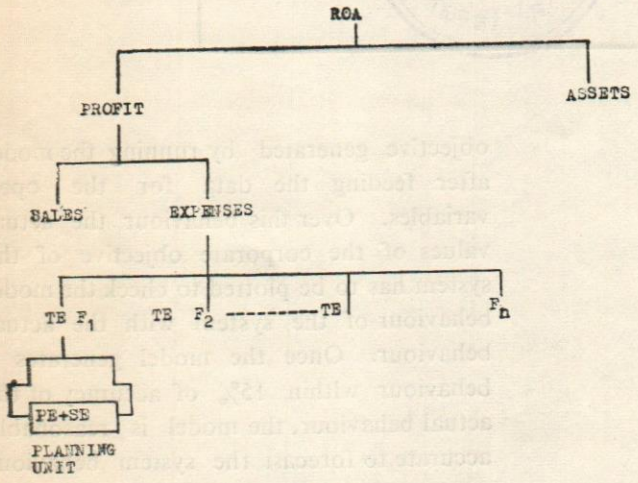

Fig. 4

As shown in the planning graph above. Total expenses is a function of primary expense and secondary expense. With the slight increase in the primary expense, its effect on total expenses, assets sales and ROA can be worked out and evaluated.

(iii) This model helps in evaluating the sensitivity of variation in strategic and evironmental variables on corporate objective. The model also evaluates whether a system is proved to environmental changes or strategic decisions.

(iv) The planning graph model integrates the entire system and by adopting a suitable software programme, the optimisation of system can be carried out.

(v) In a system there are open variables which may be interrelated to each other. Through the planning graph model the synergic effect of these variables on corporate objectives can be worked out.

(vi) Planning graph model identifies the strategic variable of the system and the effect of any number of strategies can be simulated with the help of the model.

Conclusions

In the process of preparation of corporate long range plans, it is very essential that forecasting of probable state of the system is done with the help of a suitable model. An ad hoc forecasting may only result in unrealistic value of the probable state of the system indicating a gap which may not be realistic. Hence the development and implementation of strategies wili result in consumption of more resources and still the gap may not be closed and objectives may remain unachieved.

REFERENCES

— King W.R. & Cleland DI (1978) : Strategic Planning & Policy Chs 3, 6-9, Van Nostrand Reinhold, New York.
— King W.R. : Implementing Strategic Plans through Strategic Programme Evaluation—Long Range Planning Journal (July 1979)
— Liam Fahey, William R. King : Vadake K. Narayanan, Environmental Scanning and Forecasting in Strategic Planning—The State of Art, Journal of Long Range Planning Feb. 1981.
— William R. King : The importance of Strategic Issues—Journal of Business Strategy VI Winter 1981.
— Kleine Olaf & Rakesh Kumar: Corporate Planning—A Management Tool Nov. 1982.

Productivity
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Designing A Modern Range of Pressure-Gauges

PAUL S. HESLOP

A highly original use of moulded polycarbonate aided by careful value-analysis of all components and operations, has enabled Budenbergs to reduce manufacturing costs by over 30%, while creating a distinctive modern look and extending the range of pressures measured.

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In designing their new range of small dial pressure-gauges—63mm (2½ in) in diameter—Budenberg Gauge Co. set themselves two main tasks.

The first was to reduce manufacturing costs by drastically cutting the number of parts and operations, while retaining the high-quality sensor and movement and the resulting 1% accuracy of the previous range.

The second was to modernise an external appearance little changed for several decades, in order to accord with the increasingly modern lines of the industrial, medical and agricultural equipment in which these small gauges are chiefly used.

Thick-Section Moulding

The concept chosen was to use a one-piece polycarbonate moulding (Bayer's 'Makrolon') to form a combined window and case. Besides providing an instrument of distinctive and attractive appearance, this would eliminate a number of components (window, inner ring, bezel, bezel screws and pointer stop), plus the considerable costs of storing and fitting them and of spray-painting the case.

Polycarbonate's strength and toughness compared with other transparent materials have found numerous applications—notably, as a direct replacement for fragile

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items such as glass windows or lenses; as one component in a composite sandwich; and to form lightweight moulded covers for electrical equipment.

Budenbergs had themselves used flat polycarbonate windows for six years, during which time the number of gauges returned with windows broken, cracked, crazed or scratched was considerably lower than one would expect for comparable instruments with glass windows. This was encouraging. But a design using polycarbonate alone for the chief structural component had few precedents. Consideration of Young's Modulus and ultimate tensile strength indicated that, to give the case the necessary stiffness, a 3.5-mm-thick (0.14 inch) section was required for the front and sides, with local reinforcement for attaching the internal components. This was well beyond the normal maximum section—thickness for polycarbonate, and it proved quite difficult to find a moulding company confident enough to take on the task.

Another design feature also created moulding problems. To reduce the number of different dials required, it was proposed to use a separate polycarbonate slip printed with the pressure-units. This would snap-fit into a recess in the front window, acting also as an opaque cover-plate concealing two screw-heads. The recess had to be slightly smaller at the front than at the rear to give the snap-fit, and being located near the edge of the domed front surface, was several degrees away from being at right-angles to the opening direction of the mould. The moulders used great mechanical ingenuity to withdraw the core without damaging the edge of the recess.

Keeping Light Out

A moulding problem that defied solution was to provide an opaque finish on the sidewalls of the case to prevent the internal components being seen. For surfaces viewed reasonably square-on, axial serrations inside will provide total reflection of light from outside. But when the surfaces of a circular case are viewed *obliquely*, e.g. when the top of the case is viewed from the side, light is refracted through a near right-angle giving the observer a clear view of the instrument internals.

Coarse and fine etch finishes were also tried on the inside walls, but internal components were still visible. The final solution was to insert a strip of plastic foil (normally grey) round the inside of the sidewalls. Although this adds an extra part, the greatly improved appearance makes it worthwhile. It also makes it easy to change the instrument's colour-scheme—a useful option for OEM customers wishing to 'individualise' their equipment.

Externally, hot-foil machines can apply a logo or other decorative finish in silver, gold or other colours to the polycarbonate front or side surfaces.

Increased Pressure-Range

Inside the case, further savings of components were achieved. A single screw secures the dial and movement to the instrument body during calibration, and two additional screws (those covered by the snap-fit plate) then attach the case through the dial and movement-workplate to the body, giving great rigidity. The movement, following Budenberg's established design, is all-metal, with self-lubricating sintered bronze bushes. Optional features include pressure-overload stops, 'aluminium free' construction for use in mines, and a viscously damped movement to resist vibration.

A bonus not originally looked for was that the extra space created in the case allowed room for a coiled Bourdon-tube sensor as an alternative to the usual C-shaped tube. This enabled the range of pressures measurable with 63-mm (2½-inch) gauges to be more than doubled, from a normal maximum of around 0-4000 lb/in² (0-250 bar; 0-25 MPa) to 0-10000 lb/in² (0-600 bar; 0-60 MPa). Coiled tubes are made of stainless steel; C-tubes of phosphor-bronze or beryllium-copper.

Strength and Safety

The gauge has a back-panel of 0.17-mm (0.007-inch) stainless steel, retained by a single recessed screw—the only screw visible on the instrument. The panel is sufficiently rigid to withstand normal handling, but to protect operators is easily bent outwards by internal pressure if the Bourdon tube fails following an oil/oxygen explosion. This energy-release safeguard is one

requirement of ISO Standard 5171 for pressure-gauges for use on welding-bottles, with which the new gauge complies.

Another requirement is a bending test on the connection—a 1-kN (220-lb) force applied to the face or side of the instrument.

The geometry of the movement linkages ensures a linear response, allowing scales to be preprinted. Gauges are then 100%-inspected at all numbered points on the scale, after which—to minimise subsequent handling—the inspector places them straight into storage-and-transit tray which form part of the final protective packaging.

Following the production launch of these first 'polycarbonate' gauges, designs are now complete for a 60-mm diameter (2¼-inch) flush-mounting version and an 80-mm (3-inch) liquid-fillable version, which will start production shortly.

Notes

value analysis — the techique of analysing the function of each individual component and operation with the object of rationalising design and reducing costs.

movement — the system of gearing connecting the Bourdon-tube pressure-sensing element to the indicating pointer. The word is used in this sense throughout the article and does *not* mean 'motion'.

bezel — a retaining-rim for an instrument window.

pointer stop — against which the pointer rests when at zero.

crazed — having the surface covered with many fine cracks.

core — a removable insert used to create a cavity in a moulding.

OEM customers — original equipment manufacture — i.e. companies who will incorporate the gauges as components in the products they manufacture and sell.

hot-foil machines — these use heated print-heads applied to a reel of foil to transfer designs into products.

logo — a company emblem.

instrument *body* — also known as the gauge-block—the solid brass block incorporating the entry-port, and to which the Bourdon-tube sensor is soldered or brazed.

movement-workplate — the brass plate on which the movement is mounted.

self-lubricating ... bushes — rather than the plain bearings often used.

pressure-overload stops — these protect the gauge from damage if it is subjected to higher pressure than it is designed to indicate.

viscously damped movement — the pinion rotates in a small cup filled with thick oil.

Bourdon-tube sensor — a flattened hollow tube, closed at one end and bent into a C-shaped curve or a spiral, which tends to straighten when filled with fluid under pressure.

to protect operators — operators are assumed to be viewing the front of the gauge, so the deliberately weak back-panel directs any blast safely away from them.

100%-inspected at all numbered points — i.e. every gauge is tested with known pressures corresponding to each of the numbers printed on the dial.

flush-mounting — for instrument panels.

liquid-fillable — this is an alternative way of obtaining vibration-resistance.

Productivity
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Indian Jute To Go Indigo Way?

DR. BADAR ALAM IQBAL

Few decades ago, Indian jute was one of the prestigious crops constituting 18 per cent of the country's total export earnings. The decline then set in and the same in recent decade has dwindled to a meagre 3.6 per cent of our total exports. In 1950-51 we exported nearly 76 per cent of our total production and the same declined to 46.8 per cent in 1980-81. The main objective of this study is to highlight the trends in area, production, productivity, exports, pattern of exports and share of production in exports as well as share of exports in country's total exports. The study also analyses the major constraints and suggests suitable measures to overcome them.

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The production of jute is confined to West Bengal, Assam, Bihar, Orissa, Tripura, and Uttar Pradesh. Among these states, West Bengal is the biggest producer of jute in the country. This is because of the availability of soil and climate suitable and essential for best harvest of jute. Table I indicates trends in area under cultivation of jute, production and productivity between 1950-51 and 1980-81.

Table 1. Area, Production and Productivity of Jute from 1950-51 and 1980-81

Year	Acreage (Lakh hect.)	Production (Lakh bales)	Productivity (Hect./bales)
1950-51	5.7	33.1	5.8
1955-56	7.0	42.8	6.1
1960-61	6.3	41.4	6.4
1965-66	7.6	44.8	5.8
1970-71	7.5	49.4	6.6
1975-76	5.6	44.4	7.6
1980-81	9.4	65.2	6.9

Source : Annual Survey of Jute statistics, 1980-81.

Data set out in Table I reveal that the total acreage under cultivation has increased from 5.7 lakh hectares in 1950-51 to 9.4 lakh hectares in 1980-81, indicating an over all rise of more than 64.9 per cent. Similarly, the total output of jute went up from 33.1 lakh bales in 1950-51 to 65.2 lakh bales in 1980-81, showing a rise of nearly 97 per cent. Likewise the yield per hectare

has increased to 6.9 bales per hectare in 1980-81 from 5.8 bales per hectare in 1950-51 i.e, an increase of nearly 18.9 per cent during the period under review. This all shows that the rate of increase in acreage and yield per hectare is much lesser than the rate of increase in production. This rise in production is due to an increase in acreage and not because of increase in the yield per hectare. Although there has been considerable scope for improvement in yield per hectare by undertaking intensive cultivation programmes. Table also shows that the production of jute has been erratic resulting in instability in prices of raw jute, thereby upsetting the jute economy. Table II indicates trends in compound growth rate of acreage, output and yield of jute from 1949-50 to 1980-81.

Table II. Compound Growth Rates of Area, Output and Productivity of Jute From 1949-50 to 1980-81

Periods	Per cent per annum		
	Acreage	Production	Productivity
1949-50 to 1964-65	3.0	3.5	0.5
1967-68 to 1978-79	0.6	1.5	0.6
1960-61 to 1979-80	−0.6	−0.10	0.4

Source : The Economic Times, Bombay, May 21, 1981.

Statewise data on area, output and yield of jute reveal that the cultivation of jute is confined to the Eastern and North-Eastern region of the country. West Bengal constitutes nearly 61 to 64 per cent of the total country's acreage and production and ranks first both in area and output in the country. Assam comes next to West Bengal and the share of the same is sizeable at 14 per cent in all India output. Bihar holds third place and its share comes to nearly 13 per cent of the total output of jute. But it is surprising to note here that Bihar ranks second in total acreage and third in output. Orissa holds fourth place in acreage and production accounting for nearly 6 and 7 per cent respectively, followed by Uttar Pradesh, Meghalya and Tripura.

Production is Concentrated in few Districts

If we throw a glance on the major jute growing States, we find that even in these States, the cultivation of jute is by and large concentrated in a few districts. In West Bengal the five districts of Nadia, Murshidabad, 24-Parganas (North), Hoogly and West Dinajpur account for nearly 80 per cent of the State's crop. In Assam, the only four districts given in Table III account for 90 per cent of the State's output. Similarly, three districts of Bihar and Orissa constitute 95 per cent of the total States. Likewise in Uttar Pradesh, which is a relatively minor State so far as jute cultivation is concerned, Kheri and Bahraich produce as much as 76 per cent of the total jute output. Table III indicates major-jute growing districts in India in 1979-80.

Table III. Major Jute Producing States of India in 1979-80

State/Districts	Production ('000 bales)	Share in total output in each State
Assam :	*544.8*	*100.0*
Goalpara	174.6	32.0
Nowgong	135.2	24.8
Kamrup	125.0	22.9
Darrang	56.8	10.4
Other districts	53.2	9.9
Bihar :	*831.9*	*100.0*
Purnea	462.8	59.6
Saharsa	145.1	18.7
Katihar	141.0	18.2
Other districts	83.0	3.5
Orissa :	*439.7*	*100.0*
Cuttack	323.7	77.1
Balassore	71.2	16.9
Keonjhar	12.8	1.0
Other districts	31.3	5.0
Uttar Pradesh :	*96.0*	*100.0*
Kheri	60.1	57.5
Bahraich	12.7	18.2
Other districts	23.2	24.3
West Bengal :	*4223.9*	*100.0*
Nadia	930.8	22.0
Murshidabad	780.2	17.2
24-Parganas (North)	560.0	14.7
West Dinajpur	520.3	13.4
Hooghly	509.6	12.0
Other districts	923.0	20.7

Source : Same as table I.

Production and Productivity

Table IV presents an index of production and productivity between 1950-51 and 1980-81.

Data set out in table IV reveal that the yield per hectare has not been commensurate with the increase in area and output. It is very much below the rate of growth in acreage and output during the period under review. This implies that the production of raw jute has come more from extension of area than from increased productivity. It is surprising to note here that this trend is in contradistinction with that in food production in which increased production has come more from higher productivity than from extensive acreage.

Table IV. Index of Production and Productivity of Jute

Year	Index of Output	Index of Area	Index of Productivity
1950-51	100.0	100.0	100.0
1955-56	129.9	122.9	105.1
1960-61	125.0	110.5	110.3
1965-66	135.3	103.7	101.7
1970-71	149.2	131.5	113.8
1975-76	194.3	98.3	131.6
1980-81	196.9	164.9	118.9

Note : These figures have been computed by the author on the basis of statistics given in table I.

Production Composition

In regard to the product composition, the relative share of hessian, sacking, carpet backing, cotton baging and others has been given in Table V.

It is evident from the Table V that the share of hessian in the total production of jute goods has come down from 38.75 in 1960-61 to 31.40 per cent in 1980-81, showing a decline of 7.35 per cent. But the share of sacking in the total went up by 5.54 per cent i.e. from 47.67 per cent in 1960-61 to 53.21 per cent in 1980-81. Similarly, the share of carpet backing in the total jute products showed a marginal increase of 2.78 per cent i.e. from 3.02 per cent to 5.80 per cent during the same period. While the share of cotton baging has decreased to the lowest of the ladder i.e. 0.08 per cent in 1980-81 from 4.22 per cent in 1960-61, indicating a considerable decline of 4.14 per cent. The share of other goods in the total output of jute goods went up to 9.51 per cent in 1980-81 from 6.44 per cent in 1960-61, a rise of 3.06 per cent.

With the partition of the country, a new phase in the growth and development of jute was started. This phase characterised by instability of raw jute supply, resulted in sharp increase in the prices of jute. The availability of raw jute became so critical that in 1947-48, the supply of the same became limited to only 1.7 million bales, which was barely enough to keep the industry going for nearly four months. This situation created an urgent need of self-sufficiency in raw jute. Therefore, in the First Five Year Plan, concerted efforts were made to enhance the production of jute. Because of these steps there was a production of 5.4 million bales in 1952-53 consisting of 4.7 million bales of jute and 0.7 million bales of mesta.

In the Second Five Year Plan, the acreage increased to nearly 1 million hectares and production to 6 million bales. In the Third Five Year Plan, notwithstanding the low production of 5.8 million bales in 1965-66 there were about 1.2 million hectares and nearly 7.3 million bales. During three annnal plans, the annual acreage declined to 1.0 million hectares with a corresponding decline in the average to nearly 6.1 million bales. In Fourth Five Year Plan, the annual acreage remained nearly 1.1 million hectares, with the average production to nearly 6.2 million bales. The same pattern was repeated in the next plan, with an average area of nearly 1.1 million hectares and average annual output of 6.9 million bales. The improvement recorded in regard to production during Fifth and Sixth Five Year Plans was attained mainly because of an increase in yield per hectare in general and acreage in particular. The yield per hectare of jute, which was nearly 6 bales in the First and more than 6 bales in Second Five Year Plan, improved marginally to nearly 6.5 bales in Third Five Year Plan. But during the Three Annual Plans, yield per hectare of jute declined marginally to 6 bales, but recorded an improvement in the Fourth and Fifth Five Year Plans i.e: 7 bales and 7.4 bales respectively. But in the early

years of Sixth Five Year Plan it again came down marginally to 6.9 bales in 1980-81. The acreage under cultivation of raw jute is sensitive to the direction of movement of prices with a one year time lag. A rise in the price of raw jute leads to more acreage under jute cultivation in the years. Conversely lower market price of raw jute leads to decrease of the area under cultivation in the next year. This means, it is essential to stabilize the prices of raw jute and this would not lead to ups and downs in acreage of jute.

Export trends

Indian jute industry has been export oriented since the early days of East India Company and of late its performance has not been upto the mark. Although the export of jute goods rose from Rs. 113.8 crores in 1950-51 to Rs. 243.3 crores in 1980-81, their share in India's total export earnings, after reaching to a peak level of 23 per cent in 1965-66 has declined considerably to nearly 3.63 per cent in 1980-81.

The falling trend in exports of jute was reversed in 1971-72 mainly due to the disturbance in Bangladesh. Prior to disturbance, Bangladesh was exporting 4 lakh tonnes of jute goods per month. Besides 35 lakh bales of raw jute were also exported every year. Due to the extensive damage to the crop and to the jute mills, the affairs of jute in Bangladesh were in bad shape in 1971-72. This induced overseas consumers to take shift in favour of India for meeting out their requirements. As a result, India's total exports of jute increased significantly from Rs. 190 crores in 1970-71 to Rs. 265 crores in 1971-72. However, this improvement was shortlived in as much as exports declined to Rs. 249.9 crores in 1972-73 and further to Rs. 201 crores in 1976-77 and further to the lowest of the ladder i.e. Rs. 161 crores in 1978-79. Thereafter, they went up to Rs. 275 crores in 1979-80. But in 1980-81 the total exports of jute goods came down to Rs. 243.3 crores. Yearwise exports of jute and jute goods between 1950-51 and 1980-81 can be observed from Table V.

Data set out in Table V show that the total quantity of jute goods exported when down from 6.7 lakh tonnes in 1950-51 to 5.6 lakh tonnes in 1980-81, indicating decrease of 16.3 per cent. Whereas the total value earned has gone up from Rs. 113.8 crores in 1950-51 to Rs. 243 crores in 1980-81, showing an over all increase of more than 113 per cent. This is mainly because of the sharp increase in the unit value realisation of jute goods in internal market.

Table V. Trends in Jute Goods Export from 1950-51 to 1980-81

Year	Quantity exported (Lakh tonnes)	Value earned (Rs. in crores)
1950-51	6.7	113.8
1960-61	8.9	118.2
1965-66	8.0	135.1
1970-71	5.6	190.4
1971-72	6.7	265.3
1972-73	5.8	249.9
1975-76	5.2	249.3
1976-77	4.5	199.0
1977-78	4.9	231.0
1978-79	3.1	161.0
1979-80	4.4	275.0
1980-81	5.6	243.3

Source : Same as table I.

Between 1950-51 and 1980-81, the country's total export earning rose by more than 1,016 per cent i.e. from Rs. 600. crores to Rs. 6,708 crores, showing a rate of growth of 33.8 per cent. Whareas the export earnings from jute products went up by more than 115 per cent i.e. from Rs. 113.8 crores in 1950-51 to Rs. 243.3 crores in 1980-81 with an annual rate of rise of nearly 3.8 per cent. Consequently, the share of jute goods in country's total export earnings has declined from 18 per cent to 3.6 per cent in 1980-81 over 1950-51. It is mainly due to higher rate of increase in the export earnings in case of other commodities as compared to the increase in export earnings from jute products.

Keeping in mind the decreasing trend, very recently, the Central Government has asked State Trading Corporation (STC) to provide all possible help to jute industry to enhance the relative share of jute goods export. The STC has come forward to help in the interest of increasing foreign exchange for the country

and in line with the Government policy. Thus, unless aggressive export efforts are not made out, the situation would become more worse as compared to Bangladesh, an eager exporter of goods and China making greater efforts and impact on European and African markets with products at lower prices. As a result, according to Mr. P.K. Dasgupta, the Chairman, State Trading Corporation, the Corporation has started playing a more active role in the export of jute goods, so that foreign exchange earnings in the country could be maximised in line with the Government's stress on a crash programme of exports. Trends in export earnings of jute goods and their relative share in country's total export earnings can be observed from Table VI.

Table VI. Value of Jute Goods Export 1950-51 to 1980-81.

Year	Total export (Rs. in Crores)	Total Jute export (Rs. in Crores)	% share in total
1950-51	600.6	113.8	18.0
1955-56	593.3	118.2	19.2
1960-61	642.3	136.1	21.0
1965-66	805.6	182.8	22.7
1970-71	1535.2	190.4	12.4
1975-76	3041.6	248.3	6.2
1980-81	6708.8	243.3	3.6

Source : Same as table I.

Pattern of Export

Recently, it has been noticed that the pattern of jute goods export has been changing since 1955-56. In the year 1955-56, hessian accounted for nearly 45 per cent of the country's total jute exports. Whereas, sacking constituted nearly 51 per cent of the total. The carpet backing formed 1.2 per cent and other goods accounted for 3.8 per cent. But in 1980-81. These items constituted nearly 53 per cent, 11.5 per cent, 29.2 per cent and 6.5 per cent of the country's total jute goods export. This means, between 1955-56 and 1980-81 the share of sacking has declined by 34 per cent, while the share of hessian, carpet backing and others went up by 2.3, 2.5 and 2.7 per cent respectively. This all shows that there has been a marginal diversification among the export of jute goods, which is a healthy sign of development. But it is important to note here that the diversification in favour of one item should not be at the cost of major items. There should be steady diversification among the items. The percentage share of each item in India's total exports of jute goods from 1955-56 to 1980-81 can be judged from Table VII.

Table VII. Relative Share of each Item in Total Exports of Jute 1955-81

Year	Hessian	Sacking	Carpet backing	Others	Total
1955-56	44.5	50.5	1.2	3.8	100.0
1960-61	47.0	43.0	3.0	7.0	100.0
1965-66	51.0	27.7	11.2	10.1	100.0
1970-71	46.0	16.1	29.1	8.8	100.0
1975-76	48.3	14.9	29.2	7.6	100.0
1980-81	52.8	11.5	29.2	6.5	100.0

Source : Same as table I.

Domestic Market

The traditional stronghold of Indian jute is gradually shifting from the international market to domestic market. As a result we are loosing steadily our international market year after year. However, between 1950-51 and 1980-81, export as percentage of domestic production has declined considerably from 75.4 per cent to 46.8 per cent. It was only 34.8 per cent in 1978-79 and 32.2 per cent in 1979-80. Hence, it has become imperative that, this trend should immediately be checked and studies should be carried out to know the causes of this state of affairs. The need of the day is to stabilise the regularity of supplies to traditional buyers and more and more new markets should be explored. This could be achieved if we produce goods of better quality. Table VIII indicates trends in production and exports and the relative share of exports in the total production between 1950-51 and 1980-81.

It has been clear from the above analysis that the relative good performance of Indian jute during fifties and early sixties has followed by a decleration in the rate of growth of jute production and productivity. Today, Indian jute attracts much attention for being

Table VIII. Trends in Production and Exports of Jute Goods From 1950-51 to 1980-81

Year	Production (lakh tonnes)	Exports (lakh tonnes)	% Col. 3 to Col. 2
1950-51	8.7	6.6	75.5
1955-56	10.9	8.1	80.6
1960-61	10.2	9.5	76.5
1965-66	12.2	8.9	63.5
1970-71	9.8	6.5	66.8
1975-76	11.4	5.1	44.0
1980-81	11.9	5.6	46.8

Source : Same as table I.

backward and crisis-ridden. The stagnation, was accompanied by a virtual cessation of all investment in the jute.

Indian jute is currently faced with multi-pronged constraints and as a result, the jute mills are incurring heavy losses at the rate of Rs. 10 to 12 crores a month. Hence, it is of paramount significance that we should study all the facets of jute in depth and make concerted efforts to take out this vital crop from the period of severe crisis and again put the same on sound footing.

It is surprising to note that more than 9/10 of the global output of jute is confined in six Asian countries namely, Bangladesh, India, Burma, China, Nepal and Thailand. The five nations excluding China which consumes all its production, constitute nearly 97 per cent of the global exports. It is interesting to note that if India is the leading producer of jute, Bangladesh is the leading exporter of jute. Similarly, so far as composition of exports is concerned, India has more finished products while Bangladesh has much more raw jute. As a result both the nations are on top in their respective horizons.

Indian jute has entered a phase of crisis after recording an improved performance in 1979-80 both in terms of production and exports. The output of jute recorded the highest level of 13.4 lakh tonnes by making full use of the existing capacity. Similarly, 4.9 lakh tonnes of goods were exported during the same period. The main factors responsible for the sudden change in the jute affairs are slackening of demand built up during the period of disruption in supplies due to strikes at various levels, imposition of export duty on hessian at Rs. 1,000 a tonne in February 1,980, inroads by synthetics, sharp fall in the exports of carpet backing due to emergence of Bangladesh, notable decrease in the purchase of sacking by DGS&D for food packing, lack of adjustment of output condition to changes in composition of demand as well as undue dependence on the American market.

Similarly, because of the present recession which the industry is facing, the quantum of exports as well as domestic off-take has declined to a considerable extent. For example, export of jute carpet backing cloth (CBC) has come down to 4,000 tonnes a month as against of an annual average of 8,000 a month. Added to this, the hessian offtake by the USA is still at the low level. The continuing losses owing to low prices on sales over the last 20 months have further added fuel to fire.

Indian jute is also facing varying levels of excess capacity, essentially because of the existing capacity was greater than the total supply of raw jute on the one hand and on the other hand, total demand of gunny. This excess capacity escalated the cost of production which led to further shrinkage of the export market.

The shrinking market of Indian jute has not been compensated by the growth as well as expansion of internal market. The vast global changes taking place have been completely ignored by the jute exporters with continued neglect of modernisation, lack of efficient management personnel and the absence of research and development programmes. In this regard the role of Jute Corporation of India (JCI) is not as effective as it should have been.

Among the most important problems, the rising cost of output as well as the declining trend in global prices of jute goods are of immediate concern. These trends have emerged due to the existing heavily subsidised competition from the rival jute exporting nations such as Bangladesh, Burma, Nepal and Thailand. The

urgent and timely modernisation may help the jute to breakthrough on the international front. The public sector banks should come forward and must provide needed finances to such a vital facet of our economy.

Due to the piling up of the huge stocks of raw jute, efforts are being made to export raw jute through Jute Corporation of India (JCI). India has not been exporting raw jute since many years with the result the export channels would have to be developed all over the world again. It is pertinent to note that at present JCI's commercial intelligence system is far from streamlined. This is partly due to dependence on middlemen and its inability to find out the primary markets which have already impaired the price support manoeuvres. It is, thus, the need of the hour that some life should be enthused so that it can play its role within the economy as well as on the export horizon. Added to this, there is an urgent need for stabilising the prices of raw jute. For this, JCI has to maintain an effective link with the growers of the crop and should ensure them about the timely price support.

It is high time to decide whether the Indian jute should be allowed to die or avenues should be found for its healthy living. The Central Government should treat the jute on par with core crops and must accord due priority as the other core crops receive in different context. There has been an immediate need for establising a separate financial institution for meeting out the credit needs effectively and efficiently, keeping in mind the short and long-term requirements.

Intensification of research and development programmes are the two vital aspects which require immediate attention so that industry should become viable and face severe competition on international front. Well thought out export policy and strategy have become imperative and the crop should gain a foothold in non-traditional regions. Market development and promotional operations should be undertaken in a business like way. Productivity as well as power horizons must get due attention as they are also responsible for jute crisis. The style of management is not proper and is like a lip service to the concept of professional management.

It is high time the Central Government and concerned authorities come out with a well-defined and clear cut policy and programmes keeping in mind all the facets of jute farming and jute industry with regard to the problems of output productivity, exports, prices and supply of jute goods and raw jute. This whole process would provide a basis for sound growth development of jute industry. If these measures are not implemented, then the growers will find it difficult to grow jute on large scale. As a result, there would be a considerable decline in the area of cultivation of jute. This would lead the Indian jute to a point of no return.

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EXECUTIVE READINGS

Consultants and Consulting Styles

Sinha, Dharni P. (Ed.)

New Delhi : Vision Books Pvt. Ltd., 1979, 248 pp.

Price : Rs. 90

Reviewed by Dr. R.S. Dwivedi, Director-cum-Editor, NPC, New Delhi

Recently, consultancy has emerged as a significant device for managing change and improving effectiveness. However, there is very little published material on the role of consultants and their styles. Therefore, Sinha's effort to bring out a book of this kind is a vital contribution to behavioural science.

The book consists of 14 chapters including introduction, organisation changing through consultation and training, every manager, an OD consultant, key-groups, not T-groups, for organisational development, the utility of institution building, one consultant's trip-from technique to theory, north of the polar circle, some ethno-autobiographical notes on consulting, some perspectives on one consulting style, consultant as guru, changing roles of a consultant and consultant for organisation development. Being a collection of papers by 17 eminent consultants from India and abroad, it highlights several controversies in thoughts and strategies and attempts to provide an integration in the introductory chapter. As the editor has indicated, despite wide divergence among organisational consultants, there is one commonality among them—concern and sensitivity to self as well as client system.

The book embodies in the remaining 16 chapters the background, values, approaches and choice of interventions of different behavioural scientists. Beckhard presents laboratory training as a significant consulting device indicating relevant intervention strategies for managing change in large organisations. Blake and Mouton hold that theories of conflict must be understood properly by every consultant manager before launching an OD project. Cohen, Fink and Gadon suggest that laboratory training in an organisation is a prerequisite to effective consulting and that the consultant must train managers in accomplishing human resource and OD skills. Lynton and Thomas describe institution building framework for consulting. Burke considers OD as a process of cultural change and consultation as an effort to institutionalise social technologies. Hjelholt narrates his experience with a fishing organisation stressing the need for discussion and research rather than training. Pareek highlights the consultant's role as a catalyst rather than a change agent, respect for the client's values and focus on process. Golembiewski is of the opinion that the major role of the consultant is to prepare the client to work on managerial triad. Dayal indicates some steps and issues in consulting process. Davis identifies several aspects of OD consultancy stressing forcefield analysis, life planning and MBO. Maheshwari considers MBO as a basic theme in consulting and visualises three roles of consultants focussing on system, using flexible styles and building successful experience. Lippitt examines different consulting models and prerequisites to effective consultation. Finally,

Sinha describes process consultation as a key style and indicates several consulting issues.

The book will be of immense help for OD practitioners and teachers and students in the area of organisational behaviour.

Industrial Sickness

Bidani, S.N. and P.K. Mitra

New Delhi : Vision Books Pvt. Ltd., 1982, 189 pp.
Price Rs. 95.

Reviewed by Prof. C.D. Singh, Dean, Faculty of Commerce, Department of Post-Graduate Studies & Research in Commerce, Bhagalpur University, Bhagalpur-812007.

The book presents a very fine reading. The authors have tried their best to study the anatomy of the entire industrial body. They have given in great detail the identification of the sickness of the industrial units. Their prescription for rehabilitation are also to a very great extent realistic. Both the writers are technocrats. It would have been better, if they had very carefully analysed the human side of the industry also. Much of the problems today in industries are to human and organisational behaviour. They also play a very big role in achieving the objectives and goals of an organisation.

On the whole the book can be said to be a very big addition to the existing subject-matter on industrial organisations. The language used in the book is very fine. The suggestions for rehabilitation given by the writers should be given due attention by the industrialistics and the Government.

Problems in Personnel Management

Suri G.K. and Rama J. Joshi (Eds.)

New Delhi : Shri Ram Centre for Industrial Relations and Human Resources, 1982. 183 pp.

Reviewed by Dr. R.S. Dwivedi, Director-cum-Editor, National Productivity Council, New Delhi.

Case Method forms one of the very popular methods of teaching human relations and personnel management. Cases may be problematic or illustrative in nature. The book under review provides 24 cases both problematic and illustrative in personnel management area. These cases relate to diverse industries including engineering, electronics, electrical, pharmaceuticals, banking, marketing, manufacturing and oil. They embrace varied themes including selection, promotion, absenteeism, indiscipline, job description of managerial positions, job evaluation, performance appraisal, potential appraisal, career planning, incentive scheme, corporate wage structure, work modification, labour unrest, supervisory development, workers' participation in management and union rivalries.

The cases have been contributed by eminent personnel specialists from industry as well as academic institutes. Several of these cases have been prepared by the research team of the Shri Ram Centre as an outcome of experience accumulated in its training programmes, action research and consultancy projects. While some of these cases provide an understanding of basic concepts and principles, others stress problem solving and decision making. Many of these cases have been tried out in class-rooms. The book provides abstracts of the cases at the end, which are of utmost relevance for the users. It also embodies a comprehensive author and subject index.

It visualises that the book will be of utmost relevance for teachers and students in University departments of Commerce and Management and Management Institutes. The trainees in different company training schools may also find them highly useful. The editors deserve congratulations for bringing out this collection of cases.

Management Of Inflation And Growth

Tewari, R.N. (Ed.)

New Delhi : All India Management Association, 1982, 40 pp.

Price : Rs. 6

Reviewed by Prof. C.D. Singh, Dean, Faculty of Commerce, Department of Post-Graduate Studies and Research in Commerse, Bhagalpur University, Bhagalpur-812007.

'Management of Inflation and Growth'—A Selection of Talks at the 9th National Management Convention, New Delhi, edited by Dr. R.N. Tewari, is worth reading. The talks on the subject are thought provoking and indicative of the present crisis which has a widening

effects on the developing country like ours. The participiants have discussed the inter-related problems of inflation and inadequate economic growth from the management point of view. The remedies suggested by them are constructive and appropriate in the present economy.

The inflation goes on unchecked in our country and it is now a permanent feature of our economy. J.R.D. Tata has rightly remarked that the country is facing a state of 'Stage-flation'. No doubt, inflation and growth are co-existent and they cannot be separated from one another but to curb inflation to the tune of growth is amust especially for the balanced economic development of our country. There is a big gap in the purchasing power between have-nots and haves which demands social justice and equity. We can't control inflation at the cost of growth in order to provide jobs to the have-nots. For the achievement of this great task, financial discipline on the part of governments and business is essential.

The best antidote to inflation is to increase in productivity especially in those items consumed by the masses. The need of the hour is to harmonise inflation and growth for the betterment of the economic health of the nation. Inadequacy of domestic savings is a great hindrance in the economy. India needs to be developed at a fast rate and to achieve this objective a high rate of investment is required. If savings do not increase to maintain growth, we would have to go ahead with inflation. It is a fact that credit squeeze on money supply in recent years by the government, a widespread demand recession has set in, in industry, commerce, export and agriculture in the first three month—January-March 1982. This recession has depressed growth and the productivity year may turn into our worst year of productivity.

It would not be out of place to mention here that the current phase of inflation is due to structural deficits over a prolonged period in economic life, and solution that is likely to succeed would be both 'demand' and 'supply' management. The realities of the Indian Economy suggest measures to contain inflation without stopping growth. Necessary cuts should be made preferable on non-productive investments and not on investment as a whole.

There must be a firm determination in utilisation of our resources effectively and at the same time competition on the international as well as at the domestic levels should be maintained. Competition between public sector undertakings is a vital necessity. The public sector is going to be responsible for the commanding heights of the economy. A rational approach to the problems of inflation and economic growth is the need of the hour. The phenomenon calls for joint action by the governments and the industry, both public and private, to face the challenge posed by inflation so that growth goes on unchecked. A multi-dimensional approach is needed to fight inflation in view of the Indian conditions.

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1. BOOKS

Abdul, Aziz : *Workers Participation in Management*, New Delhi, Ashish publishing House, 1980, 150pp.

Alexander, KC : *Participative Management—the Indian Experience*, Shriram Centre, Delhi 1972, 132pp.

Anthony, WP : *Participative Management*, Addision Wesley, 1978, 214pp.

Banks, JA : *Industrial Participation—Theory and Practice—A Case Study*, Liverpool University Press, 1963, 150pp.

Blair, TL : *Land to those who work for it—Algeria's Experiment in Workers Management*, Anchor Books, Doubleday & Company, New York 1970, 312pp.

Chandra, SI : *Workers' Participation in Management, Dimensions of Industrial Relations Policy in India—Proceedings of the National Convention on Industrial Relations Policy*, ASCI, New Delhi 1978.

Das, N : *Experiments in Industrial Democracy*, Asia Publishing House, Bombay 1964, 175pp.

Employers' Federation of India, *Tri-partite Conference and Committees 1961-64—Recommendations and Conclusions*, The Federation, Bombay 1965, 208pp.

Employers' Federation of India, *Worker Participation in Management*, Bombay, E. F. I. 1971, 56pp.

Trost, CF : *Scanlon plan for organisation development—identify, participation and equity*, Michigan State University, Ann Arbor, Michigan, 1974, 197pp.

Garson, G. David ED : *Worker self-management in industry the West European experience*, New York, Praeger Publishers, 1977, 230pp.

Gordon-Brown, I : *Participation in Industry—An Introductory Guide*, Industrial Co Partnership Association, London 1972, 56pp.

Guest, D & Fatchett, D : *Worker Participation—Individual Control and Performance*, Institute of Personnel Management, London 1974, 252pp.

Hebden, JE & Shaw, GH : *Pathways to Participation*, Associated Business Programs, London 1977, 267pp.

India, Ministry of Labour and Employment, *Report on the Working of Joint Management Councils*, Controller of Publications, Delhi 1965, 179pp.

India, Ministry of Labour and Employment, *Second Seminar on Labour Management Cooperation*, March 8-9, 1960, 54pp.

India, Ministry of Labour & Employment, Lobour Bureau, *Consultative Machinery in the Labour Field*, The Bureau, Delhi 1959, 68pp.

India, National Commission on Labour, *Study Group on Worker Participation in Management*, Report Delhi, Manager of Publications, 1957.

Industrial Welfare Society, *Works Committee Members' Handbook*, London, I. W. S., 1957, 34pp.

Institute of Personnel Management, *Workers' Participation in Western Europe*, The Institute, London 1971, 103pp.

International Center for Public Enterprises in Developing Countries : *Workers' self management and participation in decision-making as a factor of social change and economic progress in developing countries*, Ljubljana, ICPEDC, 1980. V. 1 N. Report 1 Bangladesh, Malta, Peru & Yogoslavia 455p V. 2 Algeria, Guyana, India, Tanzania 304p.

International Labour Office : *Co-operation in Industry, Workers, Employers and Public Authorities*, ILO, Geneva, 1951, 238pp.

International Labour Organisation : *Participation of Workers in Decision within Undertakings*, ILO, Geneva 1969, 165pp.

Jacks ON, Dudley & Others : *Do Trade Unions Cause Inflation ? Ed. 2*, London, Cambridge University Press, 1975, 128pp.

Jenkins, D : *Job Power—Blue and White Collar Democracy*, Doubleday and Company, New York 1973, 375pp.

Johri CK & Pandey SM : *Employment Relationship in the Building Industry*, New Delhi, Shri Ram Centre, 1972, 208pp.

Kennedy, VD : *Unions, Employers and Government—Essays on Indian Labour Questions*, Manaktalas, Bombay, 1966.

McGregor, D : *Human Side of Enterprise* McGraw-Hill, New York 1960, 246pp.

Meyer, GD : *Participative Decision Making—an Analysis and Review*, University of Iowa, Iowa 1970, 52pp.

Mhetras, VG : *Labour Participation in Management an Experiment in Industrial Democracy in India*, Bombay, Manaktalas, 1966, 247pp.

Morton, FJ Burns : *Teamwork in Industry*, London, Chapman and Hall, 1948, 273pp.

National Institute of Industrial Psychology : *Joint Consultation in British Industry*, London, Staples Press, 1951.

Poole, Michael : *Workers Participation in Industry*, London, Routlege & Kegan Paul, 1975, 198pp.

Pylee, MV : *Worker Participation in Management : Myth and Reality*, New York, NV Publications, 1975, 178pp.

Renold, CG : *Joint Consultation Over Thirty Years, A Case Study*, London, George Allen & Unwin, 1950, 195pp.

Rhenman, E : *Industrial Democracy and Industrial Management*, Tavistock, London 1968, 174pp.

Richardson Reed C : *Collective Bargaining by Objectives New Jersey*, Prentice Hall, 1977, 387pp.

Roach, JM : *Worker Participation—New Voice in Management*, Conference Board 1973, 45pp.

Roberts, BC & Others : *Workers' Participation in Management in Britain, London*, Heinemann, 1972, 224pp.

Seth, RD : *Bibliography on Participative Management*, Shri Ram Centre for Industrial Relations, Delhi 1971, 73pp.

Sethi, Krishan & Others : *Self-Management and Workers Participation; Indo-Yugoslav Experience*, New Delhi, standing O of P. F., 1981, 598pp.

Seward William : *Teamwork in Industry—A Tested Program for Worker-Management Cooperation*, New York, Funk & Wagnalls Co. 1949, 206pp.

Smith Cyril : *Industrial Participation, London*, McGraw-Hill, 1977, 174pp.

Subramanian, KN : *Labour-Management Relations in India*, Bombay, Asia Pub. 1967, 658pp.

Susman, GI : *Autonomy at Work—A Socio-Technical Analysis of Participative Management*, Preger Publication, New York, 1976, 230pp.

Tabb, JY & Goldfarb, A : *Workers' Participations in Management-Expectations and Experience* Oxford, Pergamon, 1970, 336pp.

Tanic, Zivan : *Workers' Participation in Management : Ideal and Reality in India*, New Delhi, Shri Ram Centre for Industrial Relations, 1969, 132pp.

Thakur, EP & Sethi, KC : *Industrial Democracy : Some Issues and Experience*, Shri Ram Centre, Delhi, 1973.

Virmani, BR : *Workers' Participation in Management*, Macmillan Company of India, Delhi 1978, 113pp.

Vroom, VH : *Some Personality Determinants of the Effects of Participation*, Englewood Cliffs, Prentice-Hall, New Jersey, 1960.

Wall Toby D & Lischeron JA : *Workers Participation : A Critique of the Literature and Some Fresh Evidences*, London McGraw-Hill, 1977, 162pp.

Wang, K : *Worker-Participation Matrix. Unit for Industrial Democracy*, Adelaide 1974, 18pp.

Weitzman Joan : *(The) Scope of Bargaining in Public Employment*, New York, Praeger Publisher 1975, 384pp.

Wilken, F : *Liberation of Work : the Elimination of Strikes and Strife in Industry through Associative Organisation of Enterprise*, Routledge Kegan Paul, London 1969, 109pp.

Willams, E : *Participative Management—Concepts, Theory and Implication*, School of Business Administration, Atlanta 1976, 285pp.

2. ARTICLES

Alexander, KC : Participative Management in India two Case Studies, *Lok Udyog*, 5 (12), 1972, 1215-23pp.

Alexander, KC : Toward a theory of Participative Management, *Integrated Management* 54, 1970, 35-44pp.

Archbold, S : Dimensions of Participation, *Journal of General Management*, 3 (3), 1976, 52-66pp.

Arunachalam MV : Workers' Participation in Industry —Need for Proper Perspective, *Productivity*, 17 (4), 1977, 509-14pp.

Arya, P Prakash : Nature and extent of Workers' Participation in Decision Making, *Indian Journal of Industrial Relations*, 16 (1), July 1980, 45-72pp.

Atkinson, AB : Worker Management and the Modern Industrial Enterprise, *Quarterly Journal of Economics* 87 (3), 1973, 375-392pp.

Ayyar, RS : Participation in Management by Junior and Middle Level Managers, *Indian Manager*, 7 (2), 1976, 196-212pp.

Banerjee, S : The Problems of Workers' Participation in Industrial Management, *The Management Accountant*, 1974, 9 (11), 875-878pp.

Bergmann, AE : Industrial Democracy in Germany— the Battle for Power, *Journal of General Management*, 2 (4), 1975, 20-29pp.

Betancourt, RR & Clague, CK : Theory of Capital Utilisation in Labour Management Enterprises, *Quarterly Journal of Economics*, 91 (3), 1977, 453-674pp.

Bhattacharya, SK : Workers' Participation in Management Application of the Principle in the working of the Indian Railways, *Management Accountant*, 11 (9), 1976, 743-6pp.

Bhatia, OP : Indian Experiment in Joint Management Councils, *India Labour Journal*, 12 (11), 1971, 1611-20pp.

Bhatia, OP : Joint Management in the Public Sector, *Indian Management*, 12 (2), 1973, 17-21pp.

Bhatia, OP : Training for Effective Participative Management, *Industrial Journal Training Development*, 9 (2) March-April 79 : 6-11pp.

Bier, T : Participation or Profits ?, *Industrial Society*, 1973, 55, Jan. 1973, 9-10pp.

Bijlani, SK : Workers' Participation in Industry, *Eastern Economist*, 67 (9), 1976, 414-16pp.

Bijoor, SR : Workers' Participation in Management, *Karnataka Labour Journal*, 13 (10), October 1979, 3-4pp.

Bloomfield, B : Participation on the Board, *Industrial Society*, 55, Sept. 1973, 7-9pp.

Brandt, D : Industrial Democracy—What's on the Europe, *Personnel Management*, 17 (8), 1975, 22-24pp.

Brewer, R : Personnel's Role in Participation, *Personnel Management*, 10 (9), 1978, 27-30pp.

Briscoe, G : Employee Suggestion Scheme, *Management Services*, 20 (2), 1976, 4-9pp.

Brooks, E : Worker Participation—the Fundamental Issues, *Industrial & Commercial Training*, 1973, 411-18pp.

Brown, W : From Strikes to Participation—a Sociologist's Eye View, *Personnel Management*, 8 (6), 1976, 29-31pp.

Buch, AN : Participation in Productivity—Workers Point of View, *Productivity*, 14 (2), 1973, 137-9pp.

Bunch, JD : How Danish Workers Participate, *Journal of General Management*, 1 (4), 1974, 59-69pp.

Carlson, E: Participate—Yugoslavian Style, *International Management*, 28 (4), 1972, 74-82pp.

Carson, I: Preparing Workers for Participation, *International Management*, 28 (1), 1973, 44-45pp.

Caulkin, S: Light at Triplex, *Management Today*, Nov. 1972, 70-75pp.

Chadha, P : Workers' Participation calls for Change in Style of Management, *National Labour Institute Bulletin*, 2 (3), 1976, 88-93pp.

Chakravarti, PC : Joint Consultation, *Management Review*, 2 (2), 1962, 22-8pp.

Chakravarty, Nitish : Participative Management : Concept and Consensus, *Hindu*, 3rd July, 1979, 8pp.

Chakravorty, J : Some thoughts on Workers' Participation in Management, *Indian Management*, 15(2), 1976, 3-9pp.

Chandra, M : Workers' Participation—Illusions & Practicability, *Indian Management*, 12(9), 1973, 5-11pp.

Chandra, S : Consensus on the Functions of the Participative Forums, *Pregana*, 1(5), May, 1978 : 4-11pp.

Chaney, FB & Teel, KS : Participative Management—A Practical Experience, *Personnel* 49(6), 1972, 8-19pp.

Chatterjee, NR : Participative Management—A Conceptual Framework, *Management in Government*, 4(1), 1972, 22-8pp.

Chattopadhyay, GP : How to generate a sense of Participation among the Employees, *Indian Management*, 7(3), 1968, 51-7pp.

Chattopadhyay, GP : Labour Participation in Management, *Decision*, 5(3), 1978, 197-205 pp.

Chaudhuri, KK : Idea and reality of Workers' Participation in Management in India, *Economic & Political Weekly*, 14(47), 24th Nov. 1979, M-115-120pp.

Cherington, DJ & Cherrington, JO : Participation, Performance and Appraisal, *Business Horizons*, 17(6), 1974, 35-45pp.

Clay, M : It depends what you mean by participation, *Management Accounting*, 54(7), 1976, 274-6pp.

Clutterbuck, D : Bulten-Kanthal Forges New Links with its Employees, *International Management*, 30(10), 1975, 28-34pp.

Clutterbuck, D : How effective are Worker Directors?, *International Management*, 29(2), 1974, 14-16pp.

Clutterbuck, D : Rough Road to Participation, *International Management*, 30(11), 1975, 40-46pp.

Clutterbuck, D : When the the Hall Porter Becomes Managing Director, *International Management*, 28(10), 1973, 56-60pp.

Connock, M : Yugoslavia's Owner-Workers—*Management Today*, December 1975, 42-45pp.

Crane, DP : Case for Participative Management, *Business Horizons*, 19(2), 1976, 15-21pp.

Cummings, G Molloy, ES & Glen, R : A methodological Critique of 58 Selected Work Experiments, *Human Relations*, 30, 1977, 675-708pp.

Dastur, Z N : Employee-participation in the Banking Industry, *Prajnan* 1(4), 1972, 375-88pp.

Datar, BN : Workers' Participation in Industry : Concept and Reality, *Productivity*, 17(4), 1977, 461-6pp.

Datta, ED : Workers' Participation in BHEL, *Vikalpa*, 3(3), July 1978, 161-171pp.

David, G & Others : Organisation Democracy—Participation and Self-Management, *Administration & Society*, 7(1), 1975, 5-128pp.

DE, Nitish R : Industrial Democracy as an Approach to participation, *Prajnan* 1(5), May, 1978, 66-72pp.

DE, Nitish R : Employee Participation in Management —a Model, *Prajnan* 1(4), May, 1978: 27-34pp.

DE, Nitish R : Industrial Democracy in India its Prospects, *Management in Government*, 9(2), 1977, 107-21pp.

Desai, HA : Participative Management—Personnel Manager's Catalytic Role, *Industrial Relations*, 28(6), 1976, 228-35pp.

Deo, AS : Participative Management, *Mainstream*, 14(37), 1976, 31-33pp.

Devasagayam, A : Employer-employee Partnership, *Indian Journal of Social Work*, 9(4), 1949, 287-95pp.

Dhingra, OP : Participative Pre-disposition of Public Sectors Managers, *Lok Udyog*, 5(12), 1972, 1201-11pp.

Donald, JM : Theory Y is not Participative Management, *Human Resource Management*, 14(4), 1975, 25-28pp.

Dunn, J : Rights of Participation, *Business Management*, 100(5), 42-4p; 100(6), 35-9p: 100(7), 37-41p: 100(8), 32-6p: 100(9), 36-9; 1970.

Dutta, AN : Participative Management in the Indian Economy, *Mainstream*, 14(31), 1976, 11-13pp.

Emery, FE : Industrial Democracy and Regional Decentralisation, *Human Future*, 2(3), Autumn 1979, 194-201pp.

Emery, M & Beinum, I : Participative Design for Public Sector Industries, *National Labour Institute Bulletin*, 2(5), 1976, 198-201pp.

Fabricius, F : Codetermination in Germany, *Journal of General Management*, 1(4), 1974, 74-81pp.

Federalist : Prospects for Workers' Participation in Management, *Financial Express*, 21, Sept. 1975, P. 4, col. 3-8.

Fenn, DH & Yankelovich, D : Responding to the Employee Voice, *Harvard Business Review*, 50(3), 1972, 83-91pp.

Fernandes, George : Workers' Parliament, *Janata*, 34(13), May Day 1979, 6pp.

Fogarty, MP : Company and Corporation Reform and Worker-participation the State of the Debate, *British Journal of Industrial Relations*, 10(1), 1972, 1-11pp.

Fonseca, AJ : Worker Participation in Industry : a Study of European Models and Indian Experience, *Social Action*, 28(2), April-June 1978, 188-205pp.

Fox, WM : Limits to Consultative Participative Management, *California Management Review*, 20, 1977, 17-23pp.

Foy, N & Casey, D : Perils of Participation, *Management Today*, July 1977, 47-51pp.

Fomseca, AJ & DeSouza, A : Workers' Participation in Industry—a Study of European Models and Indian Experience, *Social Action*, 28(2), 1978, 188-205pp.

Frederick, BC & Kenneth, ST : Participative Management—a Pratical Experience. *Personnel*, 19(6), 1972, 8-19pp.

Furubotn, EG : Long-run Analysis of the Labour-Managed Firm : An Alternative Interpretation, *American Economic Review*, 66(4), 1976, 104-123pp.

Garbutt, D : Constraints and Possibilities of Participation and Industrial Democracy, *Accountant*, 1970, 377-9pp.

Gardell, B : Autonomy and Participation at Work, *Human Relations*, 30(6), June 1977, 515-33pp.

Garey Jones, NS : Participation in Management, *Indian Review of Public and Cooperative Econamy*, 2(3), 1973, 10-14pp.

Ghate, Prabhakar : Workers Participation Abroad, *Workers Education*, August, 1978, 37-41pp.

Ghosh, Asok : Workers' Participation in Management, *Yojana*, 21(4), 15-31, March 1977, 23-24pp.

Ghosh, B : Workers' Participation in Management, *Yojana*, 19(17), 1975, 27-29pp.

Ghosh, S : Workers' Participation in Management—its Meaning, Purpose and Form, *Indian Journal of Labour Economics*, 1(4), 1959, 409-15pp.

Ghosh, SN : Participative Management : Results of Some Experimental Studies, *Indian Labour Journal*, 17(6), 1976, 1077-1090pp.

Ghosh, Suliratesh : Technological Change Workers' Participation in Management, *Indian Journal of Industrial Relations*, 15(4), April 1980, 599-605pp.

Ghosh, PK & Vali, MT : Workers, Participation in Management Applied to India, *Management International Review*, 18(3), 1977, 55-68pp.

Gordon-Brown, I : Management Style of Participation, *Industrial Participation*, 1977, 5-9pp.

Gorupic, D : Tendencies in the Development of Workers' self Management System in Yvgoslavia, *Indian Administrative & Management Review*, 3(1), 1971, 12-21pp.

Goss, J : Participation-Norwegian Style, *Industrial Society*, 55, March 1973, 12-15pp.

Greiner, LE : What Managers Think of Participative Leadership, *Harvard Business Review*, 15(2), March-April 1973.

Gupta, AK : Participative Management in the Defence Services, *Defence Management*, 4(2), 1977, 39-42pp.

Gupta, KL : Workers Representation on Board of Directors in Public Enterprises, Pt. 1, *Industrial Worker*, 28(3), 22nd October 1979 : 4-5pp, 28(4), 29th Oct. 1979, 4-5pp.

Gupta, Rajendra Prakash : Is Gandhian Concept of Workers' Participation in Management an 'Utopia'?, *Industrial Worker*, 26(41), 10 July, 1978, 4-5pp.

Gupta, RP : Gandhiji Advice to Capital and Labour, *Industrial Worker*, 29(1), October 1980, 47-48pp.

Gurjar, MN : Unique Experiment in Workers' Participation; *Commerce*, 134(3436), 9th April, 1977, 546, 557pp.

Hann, P : Dockland Disclosure, *Industrial Society*, 57, 1975, 7-9pp.

Hartmann, H : Co-determination Today and Tomorrow, *British Journal of Industrial Relations* 13(1), 1975, 54-64pp.

Harvey, D : How Glacier Broke the Ice on Worker Participation, *Industrial Management*, Oct, 1975, 12-14pp.

Hassunani, AP : Professional Managers and Industrial Democracy, *Indian Journal of Industrial Relations*, 14(2), Oct. 1978, 301-8pp.

Heller, FA : Longitudinal Study in Participative Decision-making, *Human Relations*, 30(7), 1277, 567-87pp.

Heller, FA : Realities of Participation, *Management Today*, March 1978, 75-7pp.

Heller, FA & Yukl G : Participation, Managerial Decision and Situational Variables, *Organisational Behaviour and Human Performance*, 4 August 1969, 227-41pp.

Henderson, J : Manager's right to manage, Industrial Society, 52, 1970, 8-9pp.

Hespe, G & Well, T : Demand for Participation Among Employees, *Human Relations*, 29 (5), 1976. 411-28pp.

Hill, R : How Effective are Works Councils ?, *International Management*, 32 (10), 1977, 16-19pp.

Hill, R : Working on the Scanlon Plan, *International Management*, 29 (10), 1974, 39-43pp.

Hingorani, AV : Democratic and Secular Management, *Growth*, 5 (4), July-Oct. 1977, 15-18pp.

Holter, H : Attitudes Towards Employees' Participation in Company Decision-making Process—a Study of Non-supervisory Employees in some Norwegian Firms, *Human Relations*, 18, November 1965, 297-321pp.

Horn, CA : Participation, *Work Study and Management Services*, December 1975, 438-40pp.

Hull, Daryll : Yugoslavia : the Long Road to Self Management, *Human Future*, 2 (4), Winter 1979, 318-333pp.

Huss, C : Implementing Participative Management a Case Study in a Hospital, *Nihae Bulletin*, 4 (3) 1971, 165-80pp.

Iswar Dayal : Prerequisites of Workers' Involvement in Worker-organisation, *Manpower Journal*, 12 (2) 1976, 19-30pp.

Ivancevich, JM : Different Goal Setting Treatments and their Effects on Performance and Job Satisfaction, *Academy of Management Journal*, 20 September 1977, 406-19pp.

Jain, RK : Productive Partnership in Industries *Integrated Management*, 116, December 1976, 27-37pp.

Jena, DD : Workers' Participation in Management, *Indian Journal of Labour Economics*, 1 (4) 1959. 416-24pp.

Jochim, TC : Labour Management Relations and Employee Stock Ownership Programmes, *Personnel*, 55 (6), 1978, 53-65pp.

Johannes, S : Workers' Participation in Decisions within Undertakings, *International Labour Review*, 113 (1), Jan.-Feb. 1976, 1-6pp.

Kalra, SK : Are we Ripe for Participative Management, *ESTD Review*, 5 (3), 1975, 12-13pp.

Kamal Kishore : Progress in Partnership : A Case Study of Labour Participation in Bhilai Steel, *Lok Udyog*, 14 (6), September 1980, 47-54pp.

Kamaraju N : Industrial Democracy in India, *Mainstream*, 9 (41), 1971, 17-18pp.

Kanwaty, G : Labour Management Co-Operation in Work Organisation—Cases and Issues, *Management & Productivity*, 38, 1973, 24-9pp.

Kapur, BM : Training for Employee Participation : an O. D. Approach, *Management Review*, 1 (2), July-December 1978, 23-40pp.

Kapur, BM & Bharagava, Kashyap : Training for Workers' Participation in Industry, *Training & Development Journal*, 7 (11), January-February 1977, 54-57pp.

Karnik, B : Spotlight on Labour-Trusteeship : Here and Elsewhere, *Economic Times*, 1st December 1979 : 5p.

Karnik, VB : Workers' Participation : How to make it Work ?, *Productivity*, 17 (4), Jan.-March 1977, 489-507pp.

Kavek, B : Workers' Participation in Management of Enterprises, *Indian Left Review*, 4 (1), 1975, 28-33pp.

Kester, G : Future of Employees' Council in Sri Lanka—An Unusual Conference in Colombo, *Development & Change* 6 (3), 1975, 97-100pp.

Khan, MI : Participative Management and Twenty-point Programme, *Mainstream*, 1976, 14 (33), 4p.

Khandelwal, Anil K : Dilemma of a Training Manager, *Industrial Jr. of Training & Development*, 8 (3), May-June 1978 : 28-29pp.

Khetan, OP : Workers' Participation in Industry, *Industrial Relations*, 28 (3), May-June 1976 : 107-109pp.

Kilcourse, T : Participation—an Analytical Approach, *Industrial Training Internatianal*, 11 (7-8), 1976, 206-10pp.

Koch, JL & Fox, CL : The Industrial Relations Setting Organisational Forces, and the Forms and Content of Workers' Participation, *Academy of Management Review*, 3 (3), July 1978, 572-583pp.

Krishnan Nair, MN : Joint Consultation, *Indian Manager* 1 (3) 1970, 40-55pp.

Krishnaswamy, S : Workers' Participation in India, *Indian Management*, 18 (3), 1979, 30-2pp.

Kulkarni, VR : Workers' Participation in Management, *Industrial Relations*, 24 (3), 1972, 61-65pp.

Kulshrestha, DK : Workers Participation in the Management of Indian Railways, *Indian Labour Journal*, 20 (12), December 1979, 2235-2243pp.

Lalan Prasad & Aggarwal, Rashmi : Shopfloor Participation : An Empirical Study, *Indian Management*, 18 (5), May 1979, 29-34pp.

Lavakare, SP : Cultural Milieu and Participative Management, *Prajnana*, 1 (5), May, 1978, 59-62pp.

Lavakare, SP : Issues Involved in Workers' Participation in Industry, *Productivity* 17 (4), 1977, 563-60pp.

Lavakare SP : Workers' Participation in Management, *Economic and Political Weekly*, 12(9), 1977 M-22-M 24p.

Leary, M : How Participation Affects Line Manager, *Works Management*, September 1976, 69-71pp.

Leberman, Susan M & Leberman, Robert L : Two Case Studies on Workers' Participation in Management, *Indian Journal of Industrial Relations* Vol. 13 (4), April 1979, 467-510pp.

Lessem, R : Kibbutz & Commune—Guidelines for Industrial Democracy, *Journal of General Management*, 2 (2), 1975, 66-79pp.

Levinson, C : Industry's Democratic Revolution—An Overview, *Industry's Democratic Revolution*, (C. Levinson, Editor), George Allen and Unwin, London 1974, 15-95pp.

Lischeron, J & Wall, TD : Employee Participation—An Experimental Field Study, *Human Relations*, 28 (9), 1975, 862-884pp.

Long, J : Employee-participation and Local Govt; *Iudustrial Participation*, 560, 1977, 28-32pp.

Long, J : The Relative Effects of Share-ownership Control-Job Attitudes in an Employee owned Company, *Human Relations*, 31, September 1978, 753-63pp.

Madala, Mani K : Training for Effective Participative Management, *Indian Journal of Training & Development* 8(1), January-February 1978, 19-22pp.

Madhuri, S & Sheth, Ramesh : Trusteeship in Management, *Industrial Management*, 17(4), April 1978 : 3-5pp.

Mahesh Chandra : Workers' Participation in Management *Productivity*, vol. 18(1), April-June 1977, 91-101pp.

Mahesh Chandra : Worker Participation-Illusions & Practicality, *Indian Management*, 12(9), 1973, 5-11pp.

Malavia, Pratibha : Perception of Participation in Departmental Decision making : its Relations with Satisfaction, Job Effectiveness and Personality Structure, *Indian Journal of Industrial Relations*, 12(4), April 1977, 429-442pp.

Malcolm, W & Edelstein, JD : The Meaning and Dimensions of Democracy in Work-related Organisations, *Journal of Industrial Relations* 20 June 1978, 113-37pp.

Manchekar, Datta : Workers Participation in Employment Guarantee Scheme, *Labour Chron.* 11(4), September 1978, 6-8pp.

Mansbride, JJ : Time, Emotion and Inequality : Three Problems of Participatory Groups, *Journal of Applied Behavioural Science* 9(2-3), 1973, 351-368pp.

Mathew, MA : Workers Participation in Management—a new Perspective, *Indian Manager*, 7(2), 1976, 190-5pp.

Meena, HK : Participative Management, *Eastern Economist*, 60(9), 1973, 389-391pp.

Mehrotra, HC & Kulshrestha, DK : Impact of Workers' Participation in Management on Industrial Relations in Indian Railways, *Indian Journal of commerce*, 32(121), December 1979, 154-161pp.

Mehta, AH : Workers' Involvement in Management, *Economice Times*, June 7, 1980, 8pp.

Mehta, Prayag : Workers Participation for Increased Satisfaction and Productivity, *Productivity*, 17(4), 1977, 571-8pp.

Mehta, Prayag : Work Satisfaction and Democratic outlook—The Role of Workers Participation, *National Labour Institute Bulletin*, 2(6), 1976, 231-236pp.

Melcher, AJ : Participation-critical Review of Research Findings, *Human Resource Management*, 15(2), 1976, 12-21pp.

Menezes, Francis A : Tisco's 50 Year Record : Peace through Labour Participation, *Economic Times*, 16th January, 1980, 5p.

Mills, L : Participation in the Union, *Industrial Society*, 55, Oct. 1973, 15-16pp.

Mitchell, MR : New Forms of Work Organisation, *Work Study and Management Services*, 1975, 19(11). 402-407pp.

Mitchell, TR : Motivation and Participation-an Integration *Academy of Management Journal*, 16(4), 1974, 670-9pp.

Mohan Das, SR : Employee Directors on Boards of Enterprises, *Decision*, 7(2), April 1980, 99-107pp.

Moitra, AK : Practice of Participative Management DSP *Lok Udyog*, 11(2), May 1977, 35-39pp.

Mookherji, SC : Workers' Participation-an Approach, *Decision*, 5(2), 1978, 75-80pp.

Mortimer, JE: Participation and the German Experience, *Personnel Management*, 5(9), 1973, 28-30pp.

Morton, DJ : Theory Y is not Participative Management *Human Resource*, Management, Winter 1975, 25-28pp.

Mukherjee, DP : Encouraging Workers' Participation in Equity, *Capital*, 180(4497), 19th January, 1978, 93-95pp.

Mukherjee, Dilip Kumar : Industrial Democracy, *Industrial Relations*, 29(5), September-October, 1977, 188-189pp.

Mukhopadhyay, Asis : Participation Dilemma—Pt 1, *Industrial Times*, 20 (20), September 25—Oct. 8, 1978, 13, 15; Institutional forms : an empty formality, Pt. II. 20 (21), October 9-20, 1978, 7-8pp.

Naidu, K Munirathanam : Workers' Participation in Industry, *Industrial Worker*, 25 (35), 30th May, 1977 : 4-5pp.

Nair, KN : Training Requirements for Workers' Participation in Management *Training & Development*, 7 (1), 1977, 79-88pp.

Narayan, B : Participative Management in Public Enterprise, *Southern Economist*, 14 (8). 1975, 11-14pp.

Natarajan, AK : An Integrated Approach to Participative Working, *Industrial Relations* 28 (6), 1976, 225-7pp.

Neal L : Making Shop Floor Participation Work, *Journal of General Management*, 1974, 44-50pp.

Nick JD : Managerial Control and Participative Management, *Personnel Journal*, 51 (12), December 1972, 924-25pp.

Nilakant, V : Participation in Management—the Consensus Process, *National Labour Institute Bulletin*, 2 (1) 1976, 9-12pp

Norman, D : Norprint Package, *Industrial Society*, 1975, 57 (Sept.-Oct.) 6-7pp.

Oates, D : Argentinian Firm Introduces Self-Management, *International Management*, 29 (11), 1974, 55-58pp.

O'Neill, H : Training to Participate, *Management Today*, 1975, 66-71pp.

Ottaway, RN : Change Strategy for Worker-Participation, *Personnel Review*, Winter 1976, 13-18pp.

Padmanabhan, A: Participative Management—the Personnel Manager's Catalytic Role, *Industrial Relations*, 28 (6), 1970, 246-50pp.

Pandey, Baleshwar : Some Problems of Participative Management in India, *Labour Bulletin*, 40 (1), January 1980, 7-12pp.

Pandey, RN : Workers' Participation in Management—a New Approach to Labour Philosophy, *Indian Labour Journal*, 15 (12) 1975, 2055-64pp.

Pantulu, N : Kamaraju, Employee Equity Ownership Plans, *Industrial Workers*, 27 (47), 27th August '79, 4-6pp.

Papin, JP & Fitch, HG : Participative Management by Objectives, *Management International Review*, 17 (4), 1977, 69-75pp.

Parkyn, B: Democracy, Accountability and Participation, *Industrial & Commercial Training*, August 1978, 318-21pp.

Passi, YP : Involvement of Workers and Managers in Management, *Lok Udyog*, 6 (10), 1973, 5-7pp.

Patel, JSK : Labour Participation in Management, *Eastern Economist*, Annual Number, 26 December 1970 : 1307-1314pp.

Pathak, RD : Education for Participative Function, *Workers Educations*, September 1979, 1-8pp.

Pathak, RD : Why and How of Workers' Participation in Management, *Productivity*, 20 (2), July-September 1979, 187-203pp.

Patil, SM : Training for Participative Functions, *Workers Education*, June 1977, 40-43pp.

Pennathur, Krish : Workers' Participation—Pt. 1, *Financial Express*, 8th June, 1980.

Pennathur, Krish : Workers' Participation—Pt. 11, *Financial Express*, June 9, 1980 : 5p.

Pennathur, Krish : Workers' say in Management : a success story, *Financial Express*, October 24, 1980 : 6p.

Powell, RM & Schlacter, JL : Participative Management a Panacea ?, *Academy of Management* Journal, 14 (2), 1971, 165-73pp.

Punekar, SD : Participative Management : How to Ensure its Success ?, *Productivity*, 17 (4) 1977, 515-21pp.

Pylee, MV : Joint Councils of Management in Indian Industry—an Evaluation, *Indian Management*, 12 (10), 1973, 9-28pp.

Pylee, MV : Workers' Participation in Management—the Indian Experience, *Indian Managers*, 3 (3), 1972, 267-92pp.

Raghavan, SVS : Workers Participation in BHEL, *Vikalpa* 3(3), July 1978, 163-166pp.

Raina RK & Sekhar, A : Labour Participation Scheme, *Economic Times*, 12th May 1976, 5p.

Randeria, KN : Whither Workers' Participation, *Business Standard*, 1 Nov. 1975, 5p.

Rao, V. Bhaskara : Participative Management in Public Sector, *Workers Education*, November 1980, 13-21pp

Rastogi, JL : Labour-participation in Management—Strong and Responsible Trade Union Movement—a Pre-requisite, *Commerce*. 12(261), April 15, 1961 696-7pp.

Raymond, EM & Ritchie, JB : Participative Management, Quality vs Quantity, *California Management Review*, 13(4), Summer 1971, 48-56pp.

Reid, D : Involving the Workforce, *Management Today*, 1975, Feb. 74-77pp.

Roach, JM : Giving Top Management the Message at Jobholders Meetings, *Personnel*, 52(4), 1975, 26-32pp

Rosner, M : Worker-participation and Influence in Five Countries, *Industrial Relations*, 12(2), May 1973, 200-12pp.

Rutter, G : Participation Management and Productivity, 38, 1973, 16-23pp.

Sachar : Panel Report as Labour Looks at it, *Industrial Worker*, 27(45-46), 20 August 1979, 7-9pp.

Sarkar, D : Workers' Participation in Management of Public Sector Undertakings, *Indian Journal of Public Administration*, 19(1), 1973, 40-53pp.

Sashkin, M : Changing Toward Participative Management Approaches—a Model and Methods, *Academy of Management Review*, 3, 1976 78-86pp.

Scanlon, H : Poverty of Expectation, Journal of, *General Management*, 1(4), 1974, 15-22pp.

Schein, EH : In defence of Theory Y, *Organisational Dynamics*, 4(1), 1975, 17-30pp.

Schreegle, Johannes : Industrial Democracy in Asia: Problems and Prospects, *Asian Labour*, 18(169 & 170), January-February 1980, 36-44pp.

Schregle, J : Workers' Participation in Decision within Undertakings, *International Labour Review*, 113(1), 1976. 1-16pp.

Sethi, Krishnan C : Employers, Trade Unions and Workers Participation, *Prerana*, 1(5), May, 1978, 47-58pp.

Sethi, Krishnan C : Workers' Participation in Management: A Report and a View Point, *Indian Journal of Industrial Relations*, 9(2), 1973, 313-21pp.

Sethi, Krishnan C : Workers' Participation and Industrial Relations in India : Some Reflections, *Decision*, 5(3), July 1978 : 185-196pp.

Sharma, KN : Workers' Participation in Management, *Indian Management*, 2(4), 1963, 35-7pp.

Shephard GC : Consulting the Miners, *Journal of General Management*, 1(4) 1974, 30-33pp.

Shyama Sunder, BS : Origin of Participative Management *Integrated Management*, No. 115, 1975, 41-46pp.

Simhan, TER : Some Thoughts on Sachar Panel's Report on Workers' Participation, *Industrial Worker*, 28(2), 15th October, 1979, 4-6pp.

Simhan, TER : Workers' Participation in Management, *Company News & Notes*, 15(8), 1977, 1-9pp.

Singh, NK : Is Workers' Participation A Fad?, *Financial Express*, 29th April, 1978, 4p.

Singh, NK : Is Worker Participation a Fad, *Industrial Times*, Vol. 30(3) May-June 78, 112-116pp.

Singh NK : On the Road to Industrial Democracy ?, *Industrial Times*, 17(19) 1975, 11-12pp.

Singh, NK : Workers' Participation in India, *Growth*, 3(3), 1975, 9-11pp.

Sinha, JBP : A Case of Reversal in Participative Management, *Indian Journal of Industrial Relations*, 10(2), 1974, 179-87pp.

Sinha, JBP : Poverty Syndrome, Power Motive and Democratization of Workplace, *Integrated Management*, 12(12), December 1977, 5-8pp.

Sirotkovic, J : The Influence of Self-management on the Development of Yugoslavian Economics, *Indian Administrative & Management Review*, 3(1), 4-11pp.

Slocum, JW : Dimensions of Participation in Managerial Decision Making, *Atlanta Economic Review*, 25(3), 1975, 32-5pp.

Smith, G : Participation Through Information Disclosure *Industrial & Commercial Training*, August 1974, 350-4pp.

Smith, MP : Barriers to Organisational Democracy in Public Administration, *Administration and Society*, 8(3), 1976, 275-317pp.

Somani, NK : Workers' Participation in Managemcnt—an Overview, *Productivity*, 17(4) 1977, 523-9pp.

Srivastava, BK : Making Participation Work—Case Study of Implementation of the Government Scheme, *National Labour Institute Bulletin*, 2(11), 1976, 425-41pp.

Srivastava, BK : Participative System-design to Improve the Quality of Working Life, *National Labour Institute Bulletin*, 2(4), 1976, 132-6pp.

Srivastava, BK : Towards a Participative System-design the Case of the National Labour Institute, *National Labour Institute Bulletin*, 1975, 21-7pp.

Srivastava, P. Kumar : Industrial Democracy, *Industrial Worker*, 28(8), 26th Nov. 1979.

Srivastava, RN : Workers Involvement in the Management Performance of Public Sector Undertakings, *Prerana*, 1(5), May 1978, 19-25pp.

Steinherr, A : On the Efficiency of Profit-sharing and Labour-participation in Management, *Bell Journal of Economics* 8(2), 1977, 545-55pp.

Steinmetz, JL & Greenidge, CD : Realities that Shape Managerial Style, Participative Philosophy Won't Always Work, *Business Horizons*, 13(5), 1970, 23-32pp.

Surdas : Democratisation of Management, *Business Standard*, 24 Oct. 1975, p. 5.

Surendranath, SD : Workers' Participation in Management an Effective means to fulfil the social responsibilities of business, *Finance and Commerce*, 13(11-12) 1970, 903-8pp.

Swannack, AR : Joint Regulation of the Employment Situation, *Management in Action*, 1(36), 1974, 11-13pp.

Tata, NH : Workers' Participation in Industry—a New Start, *Productivity*, 17(4) 1977, 485-8pp.

Thakur, CP, & Sethi, KC : Participative Management in Public Enterprise, *Indian Journal of Industrial Relations*, 7(4) 1972. 615-23pp.

Thiagerajan, KM : Workers' Participation Thro' Ownership, *Financial Express*, 25th December 78: 4p.

Tiefenthal, R : Avoiding the Pitfalls of Participation, *International Management*, 30(3), 1975, 27-30pp.

Towers, B : Workers' Participation in Management : An Appraisal and some Comments (Editorial), *Industrial Relations*, 1973-74 4(4), 4-12pp.

Tripathy, G : Management by Participation, *Industrial Relations*: 28(3), May-June 1976: 105-106pp.

Tulpule, Bagaram : Approach to Workers' Participation in Management, *Prerana*, 1(5), May, 1978: 63-65pp.

Tulpule, B : Workers' Participation in Management, *Economic and Political Weekly*, 19(46) 1975, 1757-9pp.

Upadhyay, DP : To Build up Industrial Democracy Workers' Participation in Management necessary, *Yojana*, 13(26), 11 January 1970, 16-17pp.

Vaidyan, TKM : Manager Participation in Management, *Indian Manager*, 6(2) 1975, 138 46pp.

Valery, N : New Deal Beyond the Pay packet?, *New Scientist*, 2nd August, 1973, 265-267pp.

Varadan, MSS : Preparing Workers for Participation, *Hindu*, 26 August 1973, 8pp.

Varadan, MSS : Industrial Democracy in Norway, *Hindu*, 6 Dec. 1974, 6pp.

Varandani, G : Workers' Participation in Management in India—an Evaluation of JMC's, *Chartered Secretary*, 7(11), 856-8pp.

Varshney, BG : Training for Effective Participative Management, *Indian Journal of Training & Development*, 8(5), September-October 1978, 17-20pp.

Venkata Ratnam, CS : Management Participation in Trade Union, a New Idea, *Capital*, 182(45-43), 18 January 1979, 42-58pp.

Venu, S : Workers' Say in Management, *Financial Express*, 29th August, 1978: 4p.

Verma, MK : Participative Management, *Industrial Relations*, 24(3) 1972, 80-5pp.

Verma, MK : Workers' Participation in Management, *Indian Management*, 9(10) 1970, 29-36pp.

Vikram : Does Democracy Stop at the Factory Gate, *Industrial Times* 19(9), 1976, 15-16pp.

Vikramajit : Management by Multiple Boards, *Economic Times*, 6 Nov., 1975, P. 5, Col. 3-8.

Virmani, BR : Some Problems in Workers Participation, *Prerana*, 1(1), May, 1978: 73-76pp.

Viswanathan, R, & Sridharan, S : Participative Management and Management by Objectives—an Overview, *Integrated Management*, 114, Oct. 1975, 5-12pp.

Walker, KF : Workers' Participation in Management—A Comparative Study, *Management & Productivity*, No. 38, 3-15pp.

Walker, KF : Workers' Participation in Management an International Perspective, *Lok Udyog*, 5(12), 1972, 1173-87pp.

Walker, KF : Workers' Participation in Management—Problems, Practice and Prospects, *International Institute of Labour Studies Bulletin*, 12, 1962, 3-36pp.

Warner, M : Further Thoughts on Experiments in Industrial Democracy and Self-management, *Human Relations*, 29(5), 401-10pp.

Warrier, SK : Meaningful Participation in Management a New Perspective, *Indian Journal of Industrial Relation* 13(4) 1978, 445-65pp.

Warrier, SK : Participative Decision in Industry, *Integrated Management*, 114, Oct. 1975, 27-32pp.

Warrier, SK : Review of Participative Experiments in India, *Prerana*, 1(5), May, 1978, 12-18pp.

White, M : Participation by Preference, *Personnel Management*, 7(5), 1975, 24-27pp.

Yerbury, D : Participation and Apathy in Trade Unions, *Australian Journal of Public Administration*, 37(1) 1978, 33-40pp.

Zahir, MA : New Philosophy of Participation—a Case for Management Participation at Work, *Lok Udyog*, 11(8) 1977, 21-7pp.

Case Study in Participative Management, *Integrated Management*, 64, 1971, 47-58pp.

Creating Interest Through Participation, *Work Study*, 25(5), 1976, 16-18pp.

Employee-participation : Decision to be madc, *Personnel Management*, 9(2), 1977, 44pp.

How German Business Manages, *Management Today*, Apr. 1976, 23-38pp.

Joint Consultation in Public Sector Enterprises, *Industrial Relations*, 28(3), May-June, 1976, 118-122pp.

Participative Management when, where and how, *Integrated Management*, No. 114, Oct., 1975, 3-32pp.

Public Sector Management, *Economic Studies*, 16(9), 1976, 369-72pp.

Worker-directors in the Public Sector, *Economic and Political Weekly*, 6(27), 1971, 1316-17pp.

Worker Participation in Management Challenge and Opportunity, *Industrial Training International*, 8(5), 1973, 145-149pp.

Workers' Participation in Management in France, *Management & Productivity*, No. 38, 1973, 30-36pp.

Workers' Participation in Management in India, *Management & Productivity*, 1973. No. 38, 52-57pp.

Workers' Participation in Management in the Federal Republic of Germany, *Management & Productivity*, No. 38, 1973, 37-45pp.

Workers' Participation in Soviet Union, *Journal of Labour Information & Research Centre*, 1(3), 1972, 52-60pp.

Workers' Participation in Management in Yugoslavia, *Management & Productivity*, No. 38, 1973, 46-51pp.

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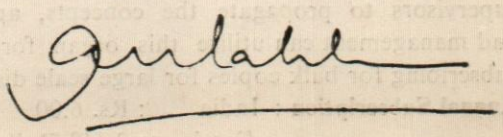
LETTER FROM EDITOR-IN-CHIEF

Corporate Strategic Planning has become an integral part of system dynamics of growth oriented organisations. The famous statement made by Clausewitz—"Most battles are won or lost-before they are engaged by men who take no part in them; by the startegists", applies well to the business organisations of today. In fact, strategy formulation has become critical in direct proportion to the increase in the risks which enterprises have to face continuously. By force of circumstances and resultant of emerging constraints, in terms of time and resources, organisations are becoming increasingly dependent upon long range and strategic planning.

The problems faced by large organisations due to fast developing technology, rising competition, changing techniques and overtaking socio-cultural values have to be perceived with greater vision and to be countenanced more effectively with Corporate Strategic Planning mechanism. Growth oriented and progressive enterprises have no option but to visualise the future and prepare themselves to face threats and at the same time utilise opportunities, monitor environmental factors and achieve the objectives set.

Since business enterprises have to be growth oriented, they have to be forward looking and must form a part of the economy. The concept of profit through control of markets or price mechanism can no longer remain the order of the day. The problems of production and growth have become inter-linked with market, distributive mechanism and protection of the rights of the consumers. Any planning at unit level which overlooks these critical factors will in the long run become counter productive.

The Industrial Policy and liberalisation in licensing system and other regulatory measures can no more be viewed as retrograde nor they should be viewed with contempt. As a nation, we must recognise the compulsions and the need to meet the aspirations of the vast masses of people who should be provided with basic human needs. No effective Corporate Strategic Planning can succeed without recognising these basic truths and impelling challenges. This special issue of 'Productivity' during the Silver Jubilee Year attempts to highlight the philosophy and methodology of Corporate Strategic Planning.



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1983, XXIV, 2, 113-117

Management of Turnaround and Recovery

DR. BERNARD TAYLOR

This paper discusses the challenges the management is facing in today's world and presents the strategies to come to grips with them. The author emphasises the need for the new style of management. It discusses the strategies for recovery of organisations and points out the need for the top management to spend a greater proportion of the time in explaining its policies to the public and to the media. It focuses on the need for rationalisation and the obstacles to rationalisation.

Dr. Bernard Taylor is a Prof. of Business Policy, Henly Management College, London.

The Present Crisis

During the 1980s management faces the unwelcome and unfamiliar task of 'Managing in Hard Times'—an era of low growth, intense competition for markets, scarce resources, cutbacks in government expenditure and fewer jobs. To quote Tony O'Reilly, President of H. J. Heinz: "The Chief Executive who pleads the case for holding on until things get back to normal has missed the point...The strategic problem of the next decade for many is going to be survival...*Today's conditions are not going to go away*".

The Challenges For Management

The challenges for management are :

—to achieve radical changes with the necessary speed and without the compensations which are available in periods of affluence and growth ;

—to reorganise the business and help rationalise the industry in order to cut out over-capacity, concentrate production and reduce unit costs ;

—to pull out of traditional businesses where the firm can no longer compete, and to build up business which make more specialised, high-quality products ;

—to reduce the firm's dependence on home markets and construct an international organisation which will enable the business to compete in the major international markets :

—to re-design products and modernise processes, in order to get into the new technologies quickly before the current generation of products is rendered obsolete (like mechanical watches, office calculators and cash registers before them);

—to reduce manning among blue collar, white collar and managerial staff in order to raise productivity and to cut overheads to the levels necessary to compete in world markets.

A New Style of Management

To manage radical changes during a recession appears to demand a style of management which is more characteristic of the individual entrepreneur than the large company administrator.

Decisiveness. The situation calls for a speed of decision and ruthlessness in decision-making: a willingness to take unpleasant decisions and to face public criticism in order to ensure the continuation and recovery of the overall business.

Direct communication. Management must rely more on personal face-to-face meetings and telephone conversations, rather than on formal committees and paperwork systems.

Personal responsibility and accountability. There must be a greater emphasis at all levels on personal responsibility and accountability for meeting the targets and deadlines which are necessary if the business is to survive.

Central control of funds. This accountability is accompanied by a tighter central control of cash and an assumption by top management of the right to reallocate cash among divisions.

Investment and Disinvestment. Thers is a need to rethink the future prospects for each product and market segment—in terms of the growth and profit potential and how to stay competitive in price, quality and service often on a lower level of business, and take radical decisions to invest or disinvest.

Expansion internationally. As growth slows down in traditional markets, it is necessary to expand internationally, sometimes into politically risky areas.

Personal negotiation. The re-structuring and rationalisation which is taking place demands political skills of a high order and the ability to negotiate with employee representatives, with pressure groups, and government bodies at home and abroad.

Innovation and risk-taking. There is a recognition that firms must adopt and develop the new technologies, or go under—introducing new products and processes and pioneering new business.

Strategies for Turnaround and Recovery

In the successful management of turnaround and recovery, a central problem is to manage the contraction of traditional activities and the expansions of new activities within the same organisation. These two processes co-exist in most businesses but in a turnaround situation the shift of emphasis must take place quickly, often in conditions of crisis. Management has to work with limited resources and in the face of continual pressures from the work-force, the media and public authorities.

Typically, the strategies for turnaround and recovery involve :—

☐ *Mergers and Co-operative Supply Agreements*

These are necessary to reduce the number of firms, concentrate production capacity and to build a business or businesses of an appropriate scale to compete for world markets.

☐ *Scale of Assets and Reduction of Overheads*

In the business which needs rationalising and restructuring, there is often a cash crisis, and a need to reduce the level of debt. Paradoxically, management is forced to sell off valuable land and buildings and profitable businesses to re-establish profitability and to raise the cash needed for re-investment in new products and modern equipment.

☐ *Cutback in Central Administration*

Central staff departments are cut back and the personnel re-deployed in line management. Head offices

are closed or moved to less expensive sites. The number of management levels is reduced to produce a "flatter", "leaner" organisation. Operationally, the company is divided into separate businesses, for each of which a Chief Executive is appointed and held accountable.

☐ *A Business Strategy and Tight Budgetary Control*

Five-year planning is frequently eliminated. Funds for investment and working capital are allocated centrally, according to the cash needs of the total company and the prospects for each particular product/market. Operating management usually work on a tight monthly budget.

☐ *Pruning the Product Line and Introducing New Cost-Effective Products*

Traditional product lines are heavily pruned: marginal businesses are closed, and distribution is rationalised to focus on a few, big outlets. This enables marketing expenditure to be concentrated on a smaller number of established "pillar brands", and on the introduction of new products and services which have high profit potential in a period of recession, e.g., because they offer new features, value for money, energy-efficiency etc.

☐ *Achieving Dramatic Improvements in Productivity*

To achieve marked improvements in productivity usually involves major structural changes :

—closing obsolete factories and concentrating activities in fewer specialised plants,

—automating processes at home and moving labour-intensive operations overseas,

—involving the work force in improving quality and productivity.

☐ *Developing a Highly Productive and Well-Paid Work Force*

This normally involves :

—a reduction in staff numbers,

—the introduction of new technology,

—a dramatic increase in levels of productivity and quality—to match standards achieved by international competitors,

—retraining, up-grading and increased pay for the smaller number of employees who remain.

☐ *New Structures for Employee Participation and Communication*

Dramatic changes such as these require the involvement and willing co-operation of employees and trade union officials. This implies that management consult and communicate widely but they reserve the right to make the final decision.

☐ *A Strong Public Affairs Operation*

In a turnaround situation the top management team has to spend a larger proportion of its time explaining its policies to the public via the media and to local and national politicians and officials. This is necessary to minimise the social and political problems resulting from closures and de-manning, and to obtain government funding and collaboration in setting up new businesses at home and abroad.

The Control of Public Spending

Managemement in central and local government, in the public services, in nationalised industries and public corporations are faced with particularly difficult problems in attempting to contain the growth in public expenditure.

☐Total government expenditure appears to grow inexorably as the public demands more services and as Parliament continues to enact new laws.

☐The present crisis has brought extra commitments: support for an increasing number of unemployed, subsidies for ailing industries, higher interest charges, rising costs for energy etc.

☐As we have seen recently with the miners, public sector unions often wield monopoly power over essential public services and union leaders know that, whatever their demands, they are unlikely to force their employers into bankruptcy.

☐Politicians and pressure groups, too, acting through the media and through democratic institutions are frequently able to stop the cut-back of public services in a particular industry or region.

In a word, the process of "cut-back" in the public sector responds less to movements of supply and demand and more to political pressures. As a consequence, the public sector administrator is less in control of his costs than the manager of an independent business. In particular, there is likely to be more inertia and a longer reaction time before staff numbers and expenditure levels are reduced.

Management Strategies

Among the strategies which public administrators are adopting to control and reduce public spending are the following :—

☐ *Privatisation*

This involves 'hiving off' whole businesses or parts of businesses, such as British Petroleum, British Airways, or the National Freight Corporation, into the private sector.

☐ *Sub-contracting Services*

This involves public organisations in buying services from private businesses. These services might include, e.g., office cleaning, catering, building, refuse disposal, security services and fire brigade services.

☐ *Selling Services Abroad*

Many nationalised industries and public corporations, such as the National Coal board, the Electricity Industry and the B.B.C., add to their income by selling services, particularly to Third world countries.

☐ *Selling Services to Industry*

Many public bodies have assets—land and buildings, computers and other equipment, laboratories etc.—which are under-utilised. In many cases the use of these assets could be sold at a fee. National Research Laboratories, for example, cover a third of their budget through contract research for industry.

☐ *Selling Services to the Public*

Another means of raising income is to open up facilities to the public. Schools, universities and college, for example, can make their buildings and playing fields available for use by the public, or by sports clubs and other voluntary organisations, for a fee.

☐ *Office Automation*

The introduction of electronic office equipment opens up the possibility of reducing managerial and clerical staff, provided union agreement can be secured.

☐ *Transfer of Resources*

In many situations what is required is a transfer of resources from a declining area (e.g., maternity services) to an area of increasing demand (e.g., geriatric services).

☐ *Rationalisation*

Economics are also possible by cooperation between public organisations (e.g., in purchasing) and by amalgamating several smaller organisations into fewer larger units.

☐ *Simplification of Paperwork Systems*

A common way of saving costs is to eliminate or radically simplify bureaucratic systems.

☐ *Reduction in the Number of Levels*

Further reductions may be achieved by eliminating one or more levels in an organisation (e.g., the Area level of the N. H. S.). This could have the additional advantage of reducing delays and speeding up communication.

Obstacles to Rationalisation

In addition to the political opposition he may meet, the public official has also to work within a system of accountability which puts numerous barriers in the way of rationalisation :—

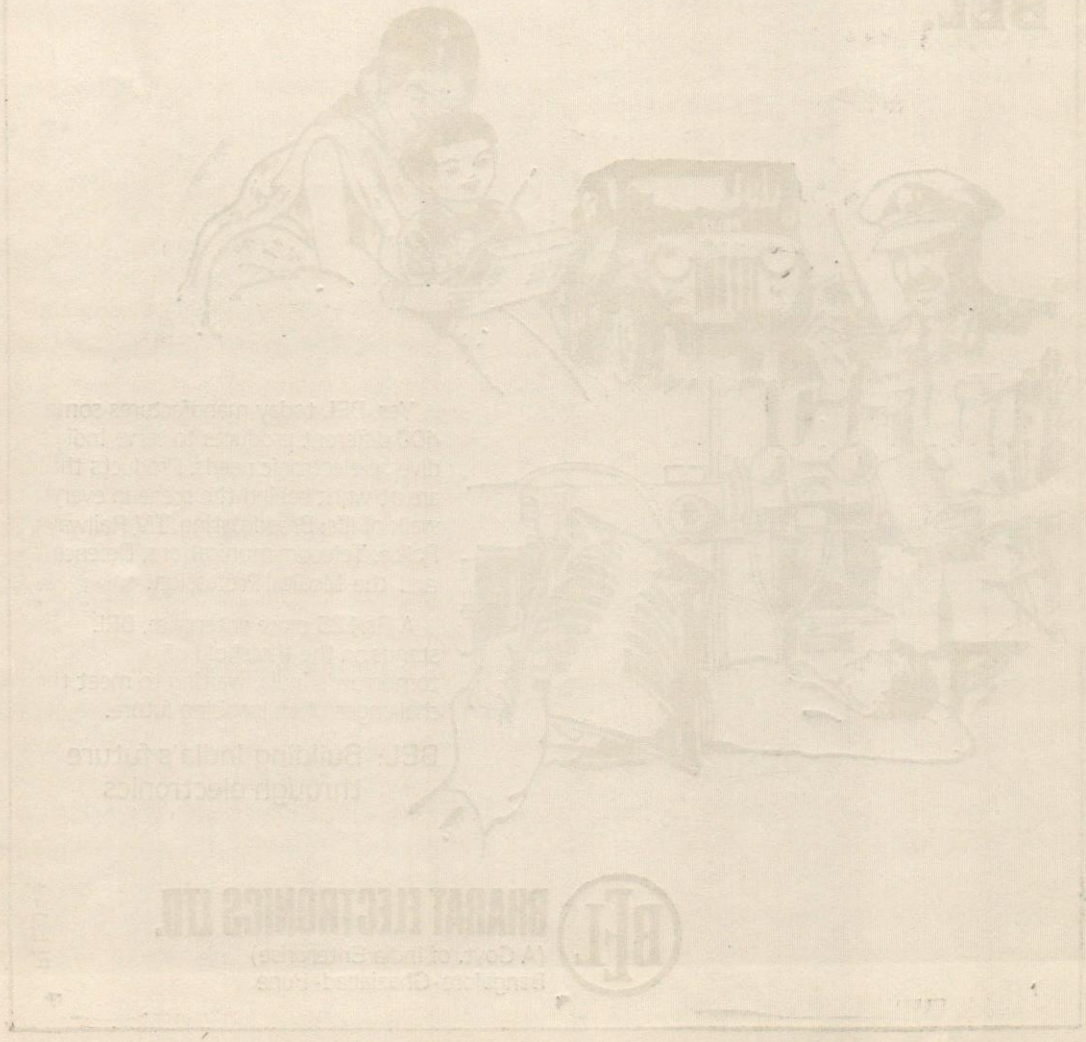
☐The scope of his activity is frequently limited by statute.

☐It is often impossible to transfer funds from one activity to another because they have different budgets.

☐A public authority is not organised like a business. To sell its services to industry or to the public usually involves a radical change in staff attitudes,

considerable reorganisation and a programme of training and development.

- ☐Strong vested interests abound and any attempt at cut-back in staff and budgets involves a bitter political struggle inside and outside the organisation.
- ☐These vested interests are protected by powerful professional associations and strong trade unions, and buttressed (e.g., in the case of the armed forces) by long-established traditions.
- ☐In many cases civil servants and professional groups, such as doctors, teachers and university lecturers, are protected from dismissal and may only be investigated by their peers.
- ☐The system of public accountability frequently encourages caution and discourages initiative.



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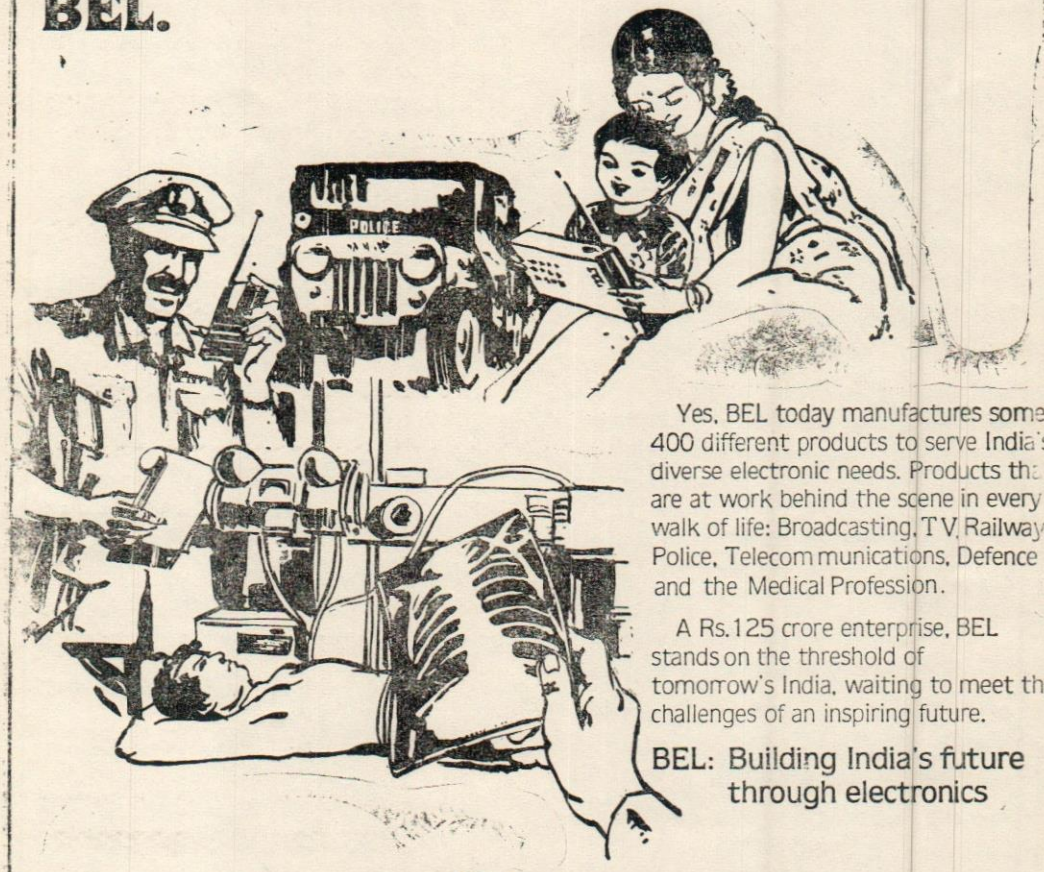

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Productivity
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Is Strategic Planning Necessary ?

DR. RAVI K. ZUTSHI

The ever dynamic socio-political and technological environment make it imperative that people exercise the Corporate Managerial foresight and have Strategic Planning. The paper briefly peruses the state-of-art of Corporate Planning and focuses on the issues central to Corporate Planning.

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Introduction

The increased perturbations in the socio-political and and technological environment and the accompanying distortions in the product-market relationships have had its effects on the managerial thinking. It is becoming increasingly clear that in the shrunken time-space, the indirect and tertiary impacts of decisions are no longer insignificant or too far off in future that they can be reacted to at the appropriate time. The environment of heightened awareness, where the stakeholders and competitors alike are tuned to the changing trends and are ready to react to them, calls for greater managerial foresight and hence the need for strategic thinking.

These concerns have led the management scientists to pay greater attention to developing innovative methods and techniques for reduction of uncertainty. Consequently, the decision-makers and the decision processes have started relying more on rationalisation, formalization and sophisticated predictive models. Operationally, this has translated into what we observe and claim to be the growing "planning culture". Even the empirical research, overwhelmingly supports the contention that more and more companies are going in for long-range planning. Brown et al.[1] reports that the study of 165 manufacturing companies cooperating in the National Industrial Conference Board Survey of Business opinion and Experience revealed that 90 percent of the companies carried out long-range planning (as distinguished from annual budgeting). Rue[2] surveyed U.S. industry by questionnaire to deter-

mine which industries actually practiced long-range planning. Out of the approximately 250 responses, about 50% of the firms in each industry (52% in total) reported pro-forma IRP (moderate level of LRP), while a small percentage reported Primary IRP (little LRP). Approximately 25% of the respondents claimed to perform Progressive-Predictive IRP (high-level of IRP), which supports his hypothesis that Long-Range Planning has grown dramatically in the recent years. Seventy-five per cent of the responding companies averaged over $ 75 million in annual sales.

A number of surveys conducted among the British corporations also show similar patterns. Denning and Lehr[3] attest that a small percentage of British companies had introduced long-range planning by summer of 1967. Hewkins and Kempner[4], who also conducted a survey of British industries, report increases in the number of British companies performing long-range planning. Similarly, Taylor and Irving[5] report an increase in the long-range planning activities among the British firms. Strigel[6] (45) made a survey of the industrial firms in West Germany and concluded that, while the majority of the industrial forms in West Germany do not use overall coordinated planning, 69% of the 1600 firms that participated in the survey believed that industrial planning can partially replace intuition and 10% even believed that industrial planning was necessary. Recently, Ang and Chua[7] who surveyed 113 U.S. corporations, report that "from the result of the survey, it is obvious that long-range planning activity has become an integral part of the firm's decision process". Their research also reveals that planning is getting increasing support from top management.

Not only is corporate planning becoming a prominent part of the corporate life, corporations are also making increased use of corporate modelling to assist in the planning function. Gershefski[8] conducted a survey of 1900 corporations in 1969, to determine the extent to which corporate planning models were being used by the companies. Of the 323 respondents, he identified 63 corporations (20%) who claimed to be using or developing a corporate planning model. In September 1974, Naylor and Schanland[9] followed this with a similar survey of corporations in the U.S., Europe and Canada. This survey revealed that 73% of the respondents (numbering 346) were either using or developing a corporate planning model. Another 15% were planning to develop such models. This increase in the corporate modelling activity during the seven year period, between the two surveys, also points to the increased adoption of long-range planning. Recently, Mclean[10] conducted a short mail survey among chief executive officers of 1240 industrial, financial and other organisations to find out the extent of their use of computer based planning models. Responses were received from 410 firms, and he found the most CEO's were in favour of computer-based planning models.

Of course, there are others who claim that planning has not attained such acceptance. According to Ringbakk,[11] based on his sample of 350 companies that he surveyed, planning is practiced only to a limited extent. It might be said that things have changed in the past decade but Martin,[12] based on his consulting experience, argues that the "gap between corporate theory and practice is alarming and growing."

However, from the interest that strategic planning has generated in the academic and among the corporate practitioners, as exemplified in the literature and research results, it is evident that strategic planning has matured.

Whatever status "strategic planning" might have attained in the corporate world, it has to be realized that relying on the concept of rationality in policy formulation can lead to misleading results. Allison[13] claims that there are three alternative conceptual models. He contrasts the rational policy model with other models, and concludes that it is difficult to doubt the descriptive validity of the latter two models in the policy formulation process. All three of his models, are partial paradigms and to make good decisions, it is necessary to take all three models into consideration. Mintzberg, Raisinghan and Theoret[14] also challenge the reality of the view that decision makers at the strategic level approach the decision process in a calm, considered manner and go through the steps that are implied in a rational approach.

Assessing the impacts of planning on the resolution of public policy issues, Lindblom[15] rejects planning on

the contention that it does not validate the two assumptions implicit in most literature on policy making. The first is that public policy problems can best be solved by attempting to understand them; the second is that there exists sufficient agreement to provide adequate criteria for choosing among possible alternative policies. It would suggest that at the policy level the decision makers ability to negotiate and arrive at compromised solutions is more important than planning.

Another limitation of planning that merits thought is Hirshman's[16] argument that the utility of planning is extremely limited by the fact that mobilizing the potentially available resources and decision making activity itself is extremely difficult and, in fact, irrational. Further more, the inadequacy of incentives for problem solving belies the contention that, given the information and means of deciding, people will make choices which are effectively directed toward the specific problem situation.

The reason for raising these issues is to demonstrate that strategic planning has to be viewed from a broader perspective. To respond to the needs of the decisions makers, setting up of corporate planning departments and incorporating planning as a formalized organization function, is not necessarily enough. The need for this awareness is more pressing, in the Indian context, where inspite of the fact or may be due to the fact that we operate in a planned economy, the so called irrationalities are multiplied at the policy level, and this holds true for both the private and the public sector.

The Issues: The reason for raising these issues is to demonstrate that strategic planning has to be viewed from a broader perspective. To respond to the needs of the decisions makers, setting up of a corporate planning departments and incorporating planning as a formalized organisation function is not necessarily enough. The need for understanding this is more pressing, in the Indian context, where inspite of the fact or may be due to the fact that we operate in a planned economy, the so called irrationalities are multiplied at the policy level. This holds true both for the private as well as the public sector of Indian economy.

Implementation of Strategic Planning: The Issues

For those who view planning not as an end but as a means of improving the managerial decision making, and are interested in strategic planning for the purpose of enhancing the quality of the policy decisions, it is imperative to understand the implications of strategic planning in an organisational context. The question that any organization has to respond to is not whether to plan or not to plan but how to plan. It involves making hard decisions regarding—

(a) The level of financial resources to be invested.

(b) The level of sophistication of planning technology and the consequent investments in information gathering, modelling, etc.

(c) The formalization of the planning process which may necessitate structural rearrangements.

(d) The nature of the planning process to be adopted i.e., centralized-decentralized, bottom-up, top-down, etc. which calls for the involvement of various individuals.

It is at this practical, operational level that the evaluation of the benefits that the organisation may obtain from strategic planning attains importance. For strategic planning to be accepted the planners and the practitioners have to come up with systems that are technically as well as financially sound. The crucial test in operationalizing strategic corporate planning is designing a strategic planning system (SPS) that fits the needs of the organization. This paper, therefore, attempts to highlight the variables that need to be considered in the design of an effective SPS.

Evaluation of Strategic Planning: Evaluation and design are inextricably linked. A good design should meet the specifications, and this has naturally led to identification of specifications or the elements of evaluation. Most research on evaluation of strategic planning (long-range planning in many cases), has focused on two aspects:

Classification of the Planning Systems: The efforts, in this case, have invariably been directed toward establishing what a good strategic planning system should be. The preponderant consideration, in this scheme of things, was to establish criteria for distinguishing between the formal and informal strategic planners.

Determining the utility of planning: This, of course, carried the first exercise to its logical conclusion, i.e., attempts have been made to find out if investing in formalized planning paid. A number of research studies using different research designs have been carried out to determine whether the firms that invested in planning performed better as compared to those that did not plan. But as expected the results have been inconclusive.[17]

One of the implied assumptions that pervaded the planning literature in the past, was that planning, irrespective of the contingencies, was either utilitarian or not-utilitarian. This view, of course, has not survived and the planning literature has been enriched by the experiential and empirical findings. What emerges is that a strategic planning system has to evolve from within and has to be tailored to the needs of the organization.

From a detailed study of the strategic planning processes and the survey of the planning literature it has been possible to identify some of the critical dimensions which need to be taken into consideration in the design of a strategic planning system appropriate for the organisation.[18] These are :

(a) Strategic Fit

(b) Organizational Commitment

(c) Structural Dissonance

Strategic Fit : This refers to how the SPS is matched with the characteristics of the firm. The literature identifies four organizational and environmental variables which greatly influence strategy formulation, strategy implementation and strategy evaluation. These are :

(1) behavioral factors;

(2) structural factors;

(3) task/technology variables;

(4) external environmental variables;

A detailed review of the literature reveals that :

1. *The Structural and behavioral* factors do not seem to guide us in determining the optimum level of formalization of SP that is necessary to develop an effective system. In fact, one can provide reasoning in either direction. For example, it is suggested that—

(a) As the complexity of the organization increases formalizing strategic planning will become more difficult and expensive. Hence, managerial (process oriented) rather than positional (structurally oriented) view of the decision making may be preferable for such fiirms.

(b) With increased complexity, the need for integration as well as adaptation will increase. Hence, the need for formalized, strategic planning will increase, particularly, in a decentralized firm.

2. *The Technology/Task* factors are important determinants for the selection of the SPS. It has been found that in industries characterised by high rate of technological innovations and new product innovations, the formal planners performed better than non-planners.

3. *The environmental* factors, it is seen, are most important in the design of the SPS. It is inferred that :

(a) It is not clear how the static characteristics, i.e., (i) the size of the enterprise, (ii) type of industry and (iii) organizational diversity, alter the need for formalization of planning. The indications, however, are that larger the size, greater the need for formalization. But the relationship is not well established.

(b) The dynamic characteristics, i.e., (i) changes in competitive environment, (ii) changes in technology, (iii) industry growth rate and (iv) changes in overall product, market and resource environments; have more direct bearing on the formalization of the SPS.

From the analysis of the organizational and the environmental characteristics, it appears that the need for formalized strategic planning is more acute in the case of firms operating under conditions of environmental variability and complexity. Lindsey and Rue,[19] have developed, a detailed questionnaire to measure complexity and variability of the firm's environment.

Organisational Commitment : An important element of the planning process is the extent to which the SPS

has been accepted by the organization. It is possible to develop a comprehensive and sophisticated SPS but if those who make strategic decisions don't use it, it serves no purposes.[20] The major determinants of the organizational Commitment are :[21]

(a) Chief Executive Officer's involvement and actual participation.

(b) planner's; openness to suggestion, technical skills, demonstrated leadership, involvement with line personnel, influence on decision makers.

(c) SPS's compatibility with other organizational systems.

(d) Organization's Structure.

(e) Top management's commitment to SP.

(f) Organization's faith in SP.

(g) Objectives, goals and directions for growth.

(h) Resource allocation decision's rationality.

(i) The firm's preparedness for contingent events.

(j) Among line and staff : transfer and promotion, communication.

Structural Dissonance. The Strategic planning system consists of a number of interrelated activities.[22] It is possible that some of the activities may receive greater attention than the others. It would appear that for SPS to be effective, it is not only imperative that the firm invest in SPS but also, that the distribution of resources among the various activities, such as, environmental analysis, issue analysis, etc. be balanced.

Inferences

Based on the literature review, this conceptualized characterization and the research study that was conducted, it emerged that :

1. Firms that have initiated balanced strategic planning process have more effective SPS than those that have not.
2. CEO's support of SPS will result in increasing the effectiveness of SPS.
3. Higher investment in strategic planning (greater sophistication) does not necessarily lead to increased effectiveness of SPS in all firms.
4. Formalization of the strategic planning process does not, necessarily, lead to increased effectiveness of SPS in all firms.

These findings lend support to the thesis that a SPS has to be developed in the organizational setting and should fit in with the needs of the organization.

Conclusion

The characteristics of our corporate entities are preculiarly Indian, we are constrained not only by law but also by our management as well as socio-political culture which limits our strategic choices. In the case of our Public Enterprises, since the tenure of the Chief Executives is limited the *involvement* and *participation* in strategic planning is hard to expect. Of those who may be *committed*, many are so insecure and the external pressures too strong, with the result that hard decisions are often not made. One Chief executive, for example, mentioned that in his short tenure he received more than three hundred calls from the speaker of the Lok Sabha alone, trying to influence decisions. Some of the strategic options are out of bound for most chief executives in public enterprises; mergers; acquisitions, and, particularly, liquidations are difficult to conceive of. For many even the strategy of contraction and consolidation is difficult to accept, primarily because of its personal and political fall outs.

The private sector in India has its own limitations. In most parts the impetus is on growth and those who dominate it at the policy level are those with an entrepreneurial spirit. Superimposing strategic planning on top management that relies heavily on entrepreneurial mode of decision-making and has not developed a planning culture is disfunctional even if attempted in good faith.

These limits on the arena of options, real or imaginary have debilitating effects on strategic planners, the process of planning, and thereby limit the utility of strategic planning. Also, it appears that adopting formalized strategic planning systems, particularly, the techniques, without understanding either the texture of the planning process or the fabric of the corporate environment, may not yield results. I am reminded of

a corporation in India which years back started their corporate planning by buying the whole set of manuals for strategic planning from SR I. It is, therefore, felt that for strategic planning to become meaningful in India a managerial philosophy which is supportive of the planning culture has to take roots.

REFERENCE

1. Brown, J.K., S.S. Sands, and G.C. Thomson, "Long Range Planning in U.S.A.—NI CB Survey," *Long Range Planning*, Vol. I, No. 3 (1969), pp. 4-51.
2. Rue, L.W., "How and Who of Long-Range Planning", *Business Horizons*, Vol. 16, No. 6 (1973), pp. 22-30.
3. Denning, B.W. and H.E. Lehr. "The Extent and Nature of Long Range Planning in U.K.," *Journal of Management Studies*, Vol. 8, No. 2.
4. Hewkins, J.W.M. and T. Kempner, "Is Corporate Planning Necessary?" BIM Information Summary, December 1968.
5. Taylor, B. and P. Irving, "Organized Planning in Major U.K. Companies," *Long Range Planning*, Vol. 3, No. 4 (1971).
6. Strigel, W.H., "Planning in West German Industry" *Long-Range Planning*, Vol. 3, No.1 (1970) pp. 9-15.
7. Ang. J.S., and J.H. Chua, "Long Range Planning in Large U.S. Corporations-A survey", *Long Range Planning*, Vol. 12, April 1979, pp. 99-102.
8. Gershefski, G.W., "Corporate Models—The State of Art." *Management Science*, Vol. 16, No. 6 (1970), pp. 303-323.
9. Naylor, T.H. and H. Schauland, "A survey of Users of Corporate Planning Models," *Management Science*, Vol. 22 No. 9 (1976), pp. 927-937.
10. McLean, E.R., "A Chief Excutive Perspective on Computer-Based Plaanning," Paper submitted at ORSA/TIMS Joint National Meeting, Los Angeles, Calif., Nov. 13-15, 1978.
11. Ringbakk, K.A., "Organizational Planning in Major U.S. Companies," *Long Range Planning*. Vol. 2, No. 2 (1969), pp. 46-57.
12. Martin, J., "Business Planning: The Gap Between Theory and Practice," *Long Range Planning*, Vol. 12, Dec. 1979, pp. 2-10.
13. Allison, G.T., "Conceptual Models and Cuban Missile Crisis". *American Political Sciences Review*, Vol. 63, No. 3, Sept. 1969.
14. Mintzberg, H.D. Raisinghani and A. Theoret, "The structure of unstructured Decision Process". *Administrative Science* Quaterly, Vol. 21, No. June 1976.
15. Lindblom, C.E., "The Science of Muddling Through" *Public Adminstration Review*, Vol. 19 (1959), pp. 79-88.
16. Hirskhman, A.O., *The Strategy of Economic Development*, Yale University Press, Conn (1958).
17. See, Zutshi, R.K. "Strategic Planning System Evaluation Methodology: A systems Approach". Ph. D. dissertation, Graduate School of Business, University of Pittsburgh, Chapter II.
18. For detailed discussion; See, Zutshi, R.K. Ibid., Chapter V and VI.
19. Lindsay, W.M. and L.W. Rue, "Impact of the Organization Environment on the long-range planning process: A Contingency View", *Academy of Management Journal*, Vol. 23, No. 3, Sept. 1980.
20. For example, based on their research results, Taylor and Irving (1971) conclude that "to develop planning against an adverse company climate may be wasting time".
21. For the questionnaire developed to measure it see, Zutshi R.K., ibid.
22. A process model of SPS which identifies six process elements of the SPP has developed. See Ztushi, R.K. ibid. Chapter IV.

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The Underlying Rationale for the Test of Validity of System Dynamics Models

DR. KHALID SAEED

This paper attempts to explain the rationale for the tests of validity of analysis used in the system dynamics method. The mechanics of these tests are radically different for those of the contemporary methods of problem solving, although they seem to conform closely to the scientific method. The tests of validity of system dynamics models also appear to relate well with the objectives of this method which are to study organisational change so as to be able to design policies which can intervene in the social system (organizations) under study.

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Introduction

The system dynamics method for the study of a change in social systems has now been in use for almost three decades since it was introduced by Professor Forrester in the 1950s. While the range of the problems addressed by the method has considerably increased, the validity of many of the analyses produced continues to be questioned on many grounds. Interestingly, the analyses that observe certain ritualistic, but often irrelevant, validation procedures pass without being questioned, even though their validity may be seriously in doubt. On the other hand, many insightful analyses, that have conformed to the scientific method but have dispensed with the irrelevant validity procedures, have aroused much criticism.[1]

The criticisms directed at the analyses of systems dynamics do not appear surprising if they are viewed in the light of the substantial differences in methodological thinking between system dynamics and the traditional methods of problem solving. Although the methodological position of system dynamics is poorly documented[2] and many people associate it either with DYNAMO[3] or with doomsday modelling[4] this method incorporates practices and attitudes that differ radically from the traditional methods. Thus, when the correctness of the practices of the traditional methods are accepted a priori, the practices of the system dynamics method will indeed appear incorrect.[5]

This paper attempts to present the rationale for the validation procedures adopted in system dynamics.

These procedures appear to be logical and to conform to the scientific method when examined without an a priori notion of legitimacy. However, it should be added that the purpose of this paper is not to criticize the validation procedures of the contemporary problem solving methods, nor to refuse system dynamics. Its purpose is to state clearly for the practitioners of the method its requirements and to help them identify appropriate testing procedures that satisfy these requirements. The validation procedures for system dynamics are discussed in detail by Forrester and Senge[6], and by Richardson and Pugh.[7]

Validity and Validation Procedures

All scientific methods of problem solving involve the use of some kind of a model. The model is an abstraction from the real world that can take the form of a physical or a mathematical analogue of the system it represents or can remain a concept in the mind of a problem solver.[8] Although the mechanics of testing the validity of a model vary depending on the method used, in theory, two requirements of validity are recognized by all: the model should represent the real world as closely as possible, and the behavior of the model should be fully explained in terms of its logic.[9] In practice, however, validity may often be interpreted as nothing more than the observance of a set of ritualized procedures, irrespective of whether these procedures meet the theoretical requirements of validity or not.[10]

Thus, the criterion that there should be correspondence between the model and the real world may result either in the comparison of a mathematical model with metaphorical theories held sacred in a discipline[11] or in the testing of the significance of correlations between time series of data.[12] Likewise, the criteria for solving a a model may demand that the solution be expressed in a symbolic framework irrespective of whether it conveys to the parties concerned the understanding of the model or not.[13] Such ritualized, and, irrrelevant procedures of validity have become very much a part of most widely-practiced methodologies currently used for analysing social systems. Although a detailed examination of these procedures is outside the scope of this paper, a few example of the anomalous applications of these methodologies are given here to elucidate the point being made.

Mathematical models of social behavior proliferate, particularly in the field of economics, but most of these models are based on the normative theories of social behavior, rather than on the actual behavior of the social system being analysed. For example, a mathematical model in neo-classical economics may accurately translate the postulates of the descriptive theories of neo-classical economics, although, these theories may correspond very little to reality. A model using mathematical programming may be used to obtain an optimal solution of a resources allocation or a scheduling problem, but this solution really depends on how the objective function is formulated and how the utilities and costs of meeting the objective are measured. Yet, such models are freely applied in areas of public policy in which the complex objectives of the parties involved can rarely be translated into a function which is amenable to the computational capabilities of the method. Even if it is possible to formulate an appropriate objective function, the measurements of the pertinent utilities and costs are often practically impossible and, therefore, the measurements used may be highly questionable. A statistical model may be applied to a problem of change in a social organization, although, statistical methods disregard the organizational arrangements underlying the changing phenomenon being studied, and postulate relationships between variables purely on the basis of the correlations between the components of the phenomenon. Since organizational arrangements are capable of generating a variety of phenomena, a statistical postulate, although emanating a high level of confidence about its validity, is based on a phenomenon appearing over a specific time period and in special circumstances. Such a postulate may bear no resemblance to the relatively durable organizational relationships underlying the phenomenon on which it is based.[14] However, statistical correlates are freely substituted for organizational arrangements in the context of change.[15]

Apparently, the validity of an analysis is judged not on the basis of its expository value or its conformance to the requirements of the scientific method, but on the basis of the validity procedures legitimized in a methodology, irrespective of whether these procedures are

relevant to the analysis or not. Consequently, many views of a problem can be legitimized, thus creating controversies which may not have a common basis.[16]

Forrester, while discussing the issue of validity of models of social behavior, divides the various views of validity into two categories: the observer's view and the operator's view. The observer's view, as presented by Forrester, appears to subsume the analyses that create theoretical debate rather than provide useful information for policy intervention. Such analyses apparently derive validity from observing legitimized procedures. The operator's view is presented as a pragmatic one for providing pertinent information for a decision. Forrester advocates the operator's view for evaluating the validity of analyses that may have policy implications and proposes that this view be adopted by the users of the system dynamics method for building confidence in their models.[17]

To some, Forrester's categorization of the views on validity might seem a bit jaundiced, but it clearly brings out the difference between the system dynamics method and the traditional methods of analysis used in social sciences. The theoretically-based study of social systems has become encumbered with ritualized procedures which have served to legitimize controversial, and, metaphorical models. Although these metaphorical models have generated much debate, they have contributed little to the design of effective policies.[18]

The pragmatic view of validity advocated in system dynamics seems to have evolved as a reaction against the prevailing methodological practices. Thus, an undiscerning comparison of the procedures of system dynamics with those of the traditional methods only confuses the issue. Such confusion often appears in many critiques of the method, some of which criticize the pragmatic outlook adopted by it, which, ironically, is the very basis for its existence. In a not very complimentary critique of the method, Schwartz and Foin point out.[19]

> "Forrester's major contention is that we had better get on with the job of training model-builders in the art of "social dynamics," the forthcoming intellectual revolution of the final third of the twentieth century. Such a program will insure that there are enough individuals to make use of the best computer techniques for eliminating the ills of mankind. Otherwise we shall be faced with the spectre of bumbling decision-makers (and their academic advisors) muddling through with their totally inadequate models of reality."

This view of system dynamics is unfortunate, although one might get such an impression from the somewhat euphoric epilogue of Forrester's World Dynamics.[20] In fact, in the preceding chapter of the same book, Forrester takes a far more modest view of his analysis :

> "As a next step we can hope the dynamics of growth and equilibrium will be investigated by more people and the propositions presented here will be confirmed or altered until a consensus begins to form..."

A theory of social behavior emerges after repeated rethinking and reformulation, but this theory, again, should never be accepted as an absolute truth. An accepted theory might be rendered invalid if new aspects of behavior are discovered which the theory fails to explain.[21] However, a new theory advanced to replace the old one must go through repeated rethinking and reformulation. Indeed, the Schwartz and Foin critique makes this point well:

> "...For social systems models to be of value, much more hard work at describing their complexity will be needed. What is needed at least as much is an attitude of humility on the part of the model builders, which enable them to appreciate and admit their shortcomings and the uncertainty of their task. Perhaps then models could be used to inform people of possibilities, probabilities, and choices, not to promote technocratic solutions based on a sense of certainty that is entirely unjustified."

The Schwartz and Foin critique suffers from one grave inadequacy: It is almost entirely based on a limited number of early works of system dynamics, which may not be free from the euphoria of a new discovery. The System Dynamics method introduced the idea of experimentation into the designing of social policy. The introduction of similar ideas into the physical sciences forced the supporters of the previously held belief about the physical behaviour to produce experimental proof. This shattered many old theories,

and brought about a revolution in these sciences. That such experimentation became possible in the social sciences was indeed a methodological breakthrough, which may have been expected to be accompanied by the euphoria reflected in the early writings of system dynamics.

The early euphoria that related to the use of the system dynamics method was, nevertheless, a temporary phenomenon. The later applications of the method have strongly emphasised that the bounds of the analysis be clearly stated and that the analysis conform to the scientific method. The scientific method requires that the deviation between the conceptual abstractions and the real world be minimized through repeated comparisons of the empirical data with the deductions drawn from the abstracted models based on those data.[22] This is quite in line with what the contemporary methods of social science also advocate. In practice, however, these methods largely require that the formal procedures designated for validation be followed, irrespective of whether these procedures lead to scientifically valid and practically useful results or not. On the contrary, system dynamics dispenses with many formal procedures, although it places a great emphasis on the scientific validity and practical utility of its results.

Thus, validity in system dynamics is far from being a dichotomous matter depending on the performance of a set of rituals. Instead, it is interpreted as the level of confidence which can be placed in an analysis by a decision maker whose concern is to carry out policy intervention in social system. This confidence is acquired through painstaking, though non-formalized, tests which are integrated with the purpose of the analysis. This purpose is usually to identify pertinent pressure points for policy intervention.[23] However, the model is used not for merely obtaining procedures of policy directly from it but for clarifying the mental model, which leads to a deeper understanding of the problem. In a lecture on public policy implications of system dynamics Forrester points out[24]:

> "Computer models should be judged by the way they relate to, support, and clarify mental models. By the criteria of compatibility with traditional political processes, most computer models of today fall short of that goal. Too many computer models are presented without an adequate tie to the relevant mental models. Too often, the computer models are manipulated to get results that will support the prior opinions of those who employ the models to justify their own opinions."

The non-formalized testing in system dynamics, however, is not random. It strives to meet very specific requirements of validity which combine attempts to discern the organization of the system being analysed and to understand its behavior as well as possible. The considerations underlying the testing conducted in the following section.

Considerations Underlying Tests of Validity

The system dynamics method aims at studying change in the social organizations. At the outset, the method requires that the phenomenon of change be distinguished from the organizational arrangements from which that phenomenon arises. The method also involves the formulation of often complex formal models of social organizations. The behavior of these models is studied by using computer simulation. In fact the low cost of computer simulation has been a key factor in making the method feasible and a relatively simple computer code, DYNAMO, has made the programming for simulation accessible to a wide range of users. Because of its close involvement with computer simulation, the method is often confused with a mere use of DYNAMO,[25] although such applications of it are closer to conventional methods than to system dynamics.[26] In order to use this method to deal effectively with the problem of organizational change, the following requirements must be met:—

Distinction between structure and behavior:

The first and the foremost requirement in formulating a system dynamics model is description of the phenomenon of change under study. This is followed by the organizational arrangements underlying that phenomenon. These organizational arrangements represent the structure of the system under study. The structural relations, however, cannot be based on correlational factors as these factors, by definition, correspond to phenomenon itself, not to the organizational arrange-

ments which cause it. This is a very important distinction which is widely neglected in the study of social systems. Some examples from economics are the postulated relationships between labor productivity and wage rate, between saving and investment rates, between income and consumption.

There is no formal procedure for describing the phenomenon under study. Information which can be quantitatively or qualitatively observed over time constitutes system behaviour. A succint description of the whole fabric of behavior is necessary for establishing a basis for further analyses. This description also serves as a reference for comparing the behaviour of its model which is subsequently developed.[27]

The formulation of a model of the organizational arrangements is, at the outset, guided by the cybernetic principles of section and structuring of information.[28] These arrangements must be based on a deep understanding of the microstructure of the organization under study. The suggested sources for obtaining this understanding include participant observation, expert opinion, and literature. Numerical data are often not useful for delineating the organizational arrangements.[29] For example, the organizational mechanism for wage determination is bargaining;[30] investment depends on the backlog of demand, on money balances held by the investors, and on the availability of capital goods; consumption is determined by the money balances of the households and by the inventory of consumption goods[31] none of which may be reflected in the time series of data on investment, consumption and income.

A greater confidence can be placed in a model if its organizational structure is verifiable while its behaviour is consistent with what is empirically observed. However, there is no simple way to achieve this. Efforts to achieve consistency between behavior, structure, and empirical observation usually form a substantial part of a modelling effort using the system dynamics method. Figure-1 illustrates the sequence of the tasks performed in a typical system dynamics analysis. A model is formulated on the basis of observations about how various elements in the system interest. The structure of the formulated model, however must be reconciled with the alternative theories on the subject. Identification of the points of agreement and disagreement with the alternative theories help to reveal ambiguities in the model and to allow initial formulations to be revised and refined.

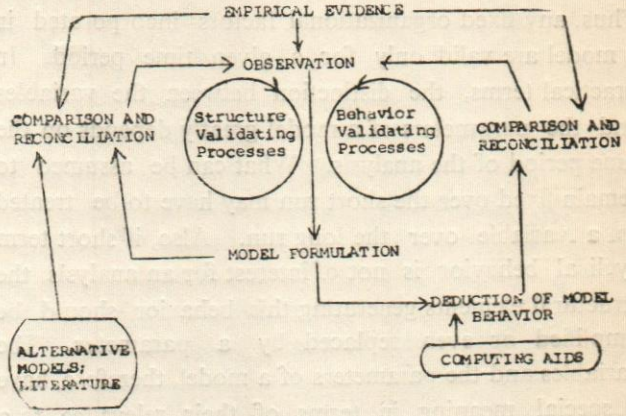

Fig.-1 : Sequence of Tasks in the System Dynamics Method

Once a satisfactory correspondence between the empirical evidence, the alternative theories and the model has been achieved, the model is subjected to behavior tests. Computer simulations are used for deducing the behavior of the model from its structural components. The behavior of the model is compared, and reconciled, with the empirical evidence of the system behavior. If a discrepancy is observed between the model's behavior and the observed behavior of the system, the model structure is re-examined and modified if found lacking in suitable detail.

Only when a close correspondence is simultaneously achieved between structure of the model and the theoretical and experiential knowledge of the system, and also between the behavior of the model and the empirical evidence about the behavior of the system, can a model be accepted as a valid representation of the system.[32] This requirement of validity considerably limits a modeller's freedom to modify the model structure at will. The modifications made in the structure, in order to obtain behavior similar to that of the system, must not violate known facts about the organizational arrangements. For example, if the behavior of falling objects is being modelled, the organizational arrangements of the model must not violate the laws of motion. This procedure discourages application of unnatural "fixes" to a misbehaving model.

Time Period of Interest : The organizational arrangements forming the structure of a system cannot be

considered as lasting for an infinite period of time. The experience of a certain behavior may create incentive to modify the structure that underlies this behavior.[33] Thus, any fixed organizational factors incorporated in a model are valid only for a given time period. In practical terms, the distinction between the variables and the parameters of a model greatly depends on the time period of the analysis. What can be assumed to remain fixed over the short run may have to be treated as a variable over the long run. Also, if short-term cyclical behavior is not of interest for an analysis, the structural elements generating this behavior should be simplified or even replaced by a parameter. The variables and the parameters of a model, therefore, have a special meaning in terms of their relevance to a specific time period. According to Forrester[34] :

> "No sharp distinction is possible between the structure and parameters. In many ways they are one and the same thing. Generally speaking, parameters stand for variables whose variation is thought to be unimportant (over the time period of interest)..."

Both parameters and variables have an explicit meaning corresponding to the organizational arrangements in the real system to which they apply. Thus, parameters pertinent for an analysis can be constructed from direct measurement of the characteristics of the real system which remain unchanged over the time horizon of the analysis.[35] The tests for selecting the variables for a model require the model to be constructed in steps. Each step entails incorporating into the model an additional variable and studying its behavior. This process continues until a behavioral correspondence between the system under study and its model over the period of interest is obtained and including additional variables does not change the basic reference mode generated. This may, however, identify additional aspects of the system behavior which are outside the scope of the analysis.[36]

The concern of the system dynamics method for developing a model pertinent to the time period of analysis is a refreshing departure from the prevailing practices in social systems, particularly in the area of economics where long run equilibrium models are often used to tackle short term problems, and vice versa[37].

Solution or Understanding of Model Behavior :

Even though it might be possible to obtain the time paths showing the behavior of a model, the model is of little value unless this behavior is adequately understood. One way of acquiring understanding of the behavior of an organizational model is to obtain its general solution using formal mathematics. But this method also requires that the solution be obtained through a set of logical deductions carried out in a formal symbolic framework. Unfortunately, formal mathematical procedures can be applied only to relatively simple organizatinal models. Because real world organizations are complex, the models that are formulated and solved using formal mathematics are often normative and quite removed from the systems they represent.[38]

The solution technique adopted by system dynamics represents a bold departure from the formal procedures of mathematics. Due to the emphasis on relating the model to the real world, a certain level of complexity has to be incorporated into the model. At the outset, this rules out the use of a formal mathematical framework for attempting its solution. However, a solution implies an understanding of the behavior of the model which can also be acquired intuitively if the solution does not have to be expressed in terms of formal symbols. This can be illustrated with the help of a simple model.

Consider a first order goal-seeking inventory system as shown in Figure 2. Inventory I is adjusted towards desired inventory DI and the production rate P is a function of the discrepancy between DI and I, and the inventory adjustment time IAT. Shipment rate S is a function of I and the inventory coverage T.

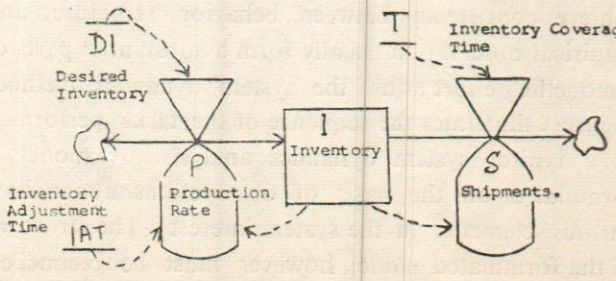

Fig.-2 : Example of a Simple first Order System with 2 Negative Feedbacks.

The solution of this model must incorporate the following information.

1. The equilibrium level of I
2. The transient behavior of I
3. How changes in the parameters DI, IAT, and T, and initial value of I affect the equilibrium value and the transient behavior,

This is a relatively simple system. Hence its solution can be obtained by inspection. First of all, since the equilibrium will occur when P-S, for this equilibrium,

$$(DI-I)/IAT = I/T$$
$$\text{or, } I\,(1/T+1/IAT) = DI/IAT$$
$$\text{or, } I = (DI*T)/(IAT+T)$$

which is independent of the initial value of I. The next issue is how this goal will be reached. Will there be an overshoot or an oscillation during the transient period? It can be easily established intuitively for this system that when P approaches S and becomes equal to it, further changes in the level of inventory cease. Thus, one may not expect an overshoot or oscillatory behavior. Since the net change in I, which is given by $(DI/IAT-I*(IAT+T)/(IAT*T)$, progressively its equilibrium value, the transient behavior will be as shown in Figure-3 for the various initial values of I. Finally, the greater the value of DI, the higher the equilibrium value of I, the higher the value of T, the smaller the inventory depletion, which means that there will be a greater accumulation in the level when equilibrium is reached. Similarly, the longer the inventory adjustment time IAT, the smaller the rate of production P, which for a given value of T, will decrease the rate of net accumulation in the level over the transient period and thus limit the equilibrium value of I. Furthermore, the equilibrium value of I will always be less than DI as there must be a positive inventory discrepancy when the production and shipment rates become equal. Only when shipments are reduced to zero, i.e., T is made infinitely high, will the equilibrium value of I approach DI.

This model may be analytically solved as follows:

$$d(I)/dt = (DI-I)/IAT-I/T$$
$$+DI/IAT-1\,(1/IAT+1/T)$$
$$\text{or, } d(I)/(DI/IAT,-I\,(1/IAT+1/T)=dt$$
$$\text{or,}-(1/IAT+1/T)/(DI/IAT-I\,(1/IAT+1/T))\,d(I) = -(1/IAT+1/T)\,dt$$

Integrating this expression,

$$Ln\,(DI/IAT-(I\,(1/IAT+1/T)= -(1/IAT+1/T)\,t+A$$
$$-(1/IAT=1/T)\,t$$
$$\text{or, } DI/IAT-I\,(1/IAT=1/T) = B*e$$

Let I=I. at t=0

Therefore, $B+DI/IAT-(1/IAT+1/T)\,I.$

and,

$$It=(DI+T)/(IAT+T)-(DI+T)/$$
$$(IAT)\text{-}I,.T_e^{-(1/IAT+i/T)t.}$$

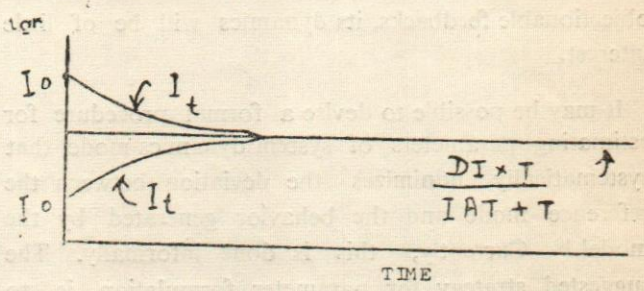

Fig. : 3 : Time Paths and Equilibrium Value of Inventory I

Both intuitive and formal solutions of the model described above contain the same amount of information, although the two solutions are obtained differently and are expressed in different forms.

When dealing with complex models, the system dynamist designs a set of simulation experiments for understanding the model's behavior. The objective of these experiments is to obtain as much information about the behavior of the model as might be contained in a formal solution. Without such experiments, simulations giving time paths of the model behavior are of not much value, even if the parameters of the model have been estimated with great rigor.

Parameter Estimation :

There appears to be a conspicuous difference between the contemporary methods of problem solving and system dynamics in their attitudes towards the selection of the numerical values of the parameters of their models. While most other methods favor rigorous statistical procedures for determining the parameters, system dynamics is often criticized for using subjective parameters.

A system dynamist spends a great deal of time and effort in assuring that the parameters he uses are either directly measurable or insensitive. Statistical procedures are not recommended for estimating parameters of the models of system dynamics.[39] These models have a feedback structure which incorporates strong interdependencies among variables, and violates the major assumption of independence between variables, which is necessary for applying the statistical methods. When these methods are used for estimating parameters of feedback models, little confidence can be placed in the estimates even when they appear to be significant. On the other hand, if the model does not contain the objectionable feedbacks, its dynamics will be of little interest.

It may be possible to devise a formal procedure for estimating parameters of system dynamics model that systematically minimizes the deviation between the reference mode and the behavior generated by the model.[40] Currently, this is done informally. The suggested strategy for parameter formulation is to estimate as many parameters as possible from real world measurements, then to obtain final values for those parameters which are difficult to measure by comparing model behavior with the reference mode and fine tuning these parameters to minimize the deviation between the two.[41]

Feedback models also have the fortunate property of being parameter insensitive because of the tendency of the negative feedbacks present in them to act against change. Parameter insensitivity is also a property of the real world systems in which the arrangement of the organizational elements rather than the parameteric differences between the behavioral relationships distinguish one system from another.[42] Thus, the parameter insensitivity of a model in itself is a source of confidence in it. In a good model, there will be very few sensitive parameters. The sensitive parameters will also often have policy implications. If not, much empirical research will be required to determine the values of these parameters.[43]

Communication :

The system dynamics method does not seek debate among the theoreticians from its analyses but aims at affecting the design of policy. This requires that a clear and logical picture of the implications of the analysis be communicated to the policy makers.[44] Thus, according to this method, it is desirable that the logic of the model and the understanding of its behavior be clearly and simply described in order to clarify and refine the mental models of the policy makers. The confidence of the policy makers in the analysis will depend greatly on how effectively that analysis is communicated. To facilitate communication, the method discourages the use of specialized symbols and jargon which are not universally understood.

Conclusion

The tests of validity advocated by the system dynamics method seem radically different from those used in the contemporary methods of problem solving. However, these tests strive to satisfy the requirements of the scientific method rather than to engage in mere rituals. The system dynamics method is meant for studying change. The procedures adopted by the method for developing a formal model of a system and building confidence in it seem to be very relevant to the subject of change in organizations. Furthermore, because this method has the practical aim of affecting the design of policy, communication is considered an important aspect of it.

The system dynamics method cannot adopt the mechanics of validation of the contemporary methods as these are not relevant to its framework of analysis and its purpose. The contemporary methods of social sciences seem to have adopted a view of validity which precludes questioning the legitimized but metaphorical theories of social behavior, as well as the ritualistic and sometimes irrelevant validation procedures. The system dynamics method provides a framework for experimentation with the models of social systems in order to develop theories of their behavior and, therefore, its analyses may question many theories which are generally accepted. But, such experimentation is in line with the requirements of the scientific method. Thus, the rationale for the validation procedures of the system dynamics method, which differ from those of the contemporary methods, lies in the radically new methodological outlook adopted in system dynamics.

The validation procedures of system dynamics appear quite appropriate if seen in the light of this methodological outlook.

REFERENCES

1. See for example, Nordhaus, William D., "World Dynamics : Measurement Without Data", *Economic Journal*, December 1973, Boyd, Robert, "World Dynamics : A Note", in *Science*, August 1972. Also see Forrester, Jay W., *Response to Comments by Arnold Zellner on "Information Sources for Modelling National Economy"*, D-3129, SDG, MIT.
2. See, Bell, James A., and Bell, James F., "System Dynamics and Scientific Method", in Randers, Jorgan (ed.), *Elements of the System Dynamics Method*, MIT Press, 1980.
3. DYNAMO is a simulation code widely used in System Dynamics. For details of DYNAMO, see Pugh, Alexander L. *DYNAMO III Users Manual*, MIT Press, Second Printing, 1977.
4. This image is possibly due to the pessimistic outlook of the most widely read system dynamics work published : Meadows et. al. : *Limits to Growth*, Universe Books, N.Y., 1972.
5. See, Meadows, Donella H. , "The Unavoidable A Priori'," in Randers (ed.), 1980, *op. cit.*
6. Forrester, Jay W., & Senge, Peter M., *Tests for Building* Confidence in *System Dynamics Models*, D-2926-5, SDG, MIT, June, 1979.
7. Richardson, George P., and Pugh, Alexander L., *Introduction to System Dynamics Modelling with DYNAMO*, Chapters 5 & 6 MIT Press, 1981.
8. Forrester, Jay W., *Confidence in Models of Social Behavior, With Emphasis on System Dynamics Models*, D-1967, SDG, MIT, December, 1973, p-5.
9. Abstracted from the description of the scientific method given by Kemeny, John G., & Snell, J. Laurie, *Mathematical Models in Social Sciences*, MIT Press, 1972.
10. Berger, Peter L., Luckman, Thomas, *The Social Construction of Reality*, Allen Lane, 1966.
11. For example, a mathematical price adjustment model in economics may conform to the cobweb theorem, not to the actual mechanics of price adjustment in the market being studied.
12. For example, wage rate, which may be highly correlated with the productivity of labour, may be linked with the latter in a model, although wage rate may actually be determined through mechanics of bargaining which do not depend on labour productivity.
13. This is evident in the numerous public policy related papers appearing in the various journals which are practically incomprehensible to the decision makers.
14. This relates to the principle of equifinality defined by Ludwig Von Bertalanffy, *General System Theory*, George Braziller, NY, 1968.
15. Some examples of this appear in Saeed, K., "Economic Development: Phenomenological Models and Irrelevant Controversies", *AACC Record*, Forthcoming.
16. Ibid.
17. Forrester, Jay W., *Two Views on Validation of System Dynamics Models*, D-2690, SDG, MIT, 1977.
18. Brown. E. H. Phelp, "The Underdevelopment of Economics", *The Economic Journal*, March 1972.
19. Schwartz, S. I. & Foin, T.C., "A Critical View of the Social Systems Models of Jay Forrester", *Human Ecology*, Vol. 1, No. 2, 1972.
20. Forrester, Jay W., *World Dynamics*, Wright-Allen Press, 1971.
21. Kuhn, Thomas S., *The Structure of Scientific Revolutions*, University of Chicago Press, 1970.
22. Kemeny, 1972, *op. cit.*
23. Forrester, Jay W., Confidence in Models of Social Behavior ....1973, *op. cit.*
24. Forrester Jay W., *Computer Models and Public Policy*, part of a lecture for the commission on Production and Exchange, French National Assembly, Paris, France, D-3267, SDG, MIT, November 1980.
25. Forrester, Jay W., "System Dynamics—Future Opportunities", in Legasto and Forrester (eds.), *System Dynamics*, TIMS studies in Management Sciences, Vol. 14, North Holland, 1980.
26. Meadows, Donella, 1980, *op. cit.*
27. Randers, Jorgan, "Guidelines for Model Conceptualization", in Randers (ed.), 1980, *op. cit.*
28. Forrester, Jay W., *Information Sources for Modelling the National Economy*, D-3114-1, SDG, MIT, 1979.
29. Forrester : Confidence....*1973*, *op. cit.*
30. Saeed, K., "Public Policy and Poverty : A System Dynamics Analysis of a Social Change Effort in Pakistan", *Technological Forecasting & Social Change*, Forthcoming.
31. Mass, N. J., Stock and Flow Variables and the Dynamics of Supply & Demand, in Randers, 1980, *op. cit.*
32. Saeed, K., "Mechanics of the System Dynamics Method, *Proceedings of the International Conference on Systems Theory and Applications, Ludhiana*, India, December 1981.
33. Katz, Daniel, & Kahn, Robert, "Open System Theory", in Maurer, John G., *Readings in Organization Theory : Open System Approaches*, Random House, NY, 1971.
34. Forrester, "Confidence in...". 1973, *op. cit.*
35. Graham, Alan, "Parameter Estimation in System Dynamics Modelling", in Randers, 1980, *op. cit.*
36. Mass, N.J., & Senge, Peter, *Alternative Tests for the Solution of Model Variables*, D-2636, SDG, MIT, 1977.
37. Worwick, G.D.W., "Is Progress in Economic Science Possible ? *The Economic Journal*, March, 1972.
38. Leontief, Wasily, "Theoretical Assumptions and Nonobservable Facts". *The American Economic Review*, March, 1971.
39. Senge, Peter, *Testing Estimation Techniques for Social Models*, D-2199-4, SDG, MIT, 1975.

40. Britting, K. R., *Engineering Approach to Estimation*, D-2302, SDG, MIT, 1976.
41. Graham, 1980, *op. cit.*
42. Forrester, Jay W., "Systems Analysis for Urban Planning", in Mass, N.J., (ed.) Readings in Urban Dynamics, Wright-Allen-Press, 1974.
43. Graham, 1980, *op. cit.*
44. Forrester, Confidence...1973, *op. cit.*

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Evaluating Strategic Planning System

WILLIAM R. KING

A direct methodology for the evaluation of strategic planning systems is illustrated and contrasted with the indirect evaluation methodologies that have previously been used. The direct methodology involves twelve distinct varieties of assessment of the goals, inputs, feedback mechanisms and impacts of the planning system that are made in terms of the system's goals as well as various bodies of external standards.

Mr. William R. King is a professor of Business Administration, Graduate School of Business, University of pittsburgh.

Introduction

The strategic planning function in any business firm is one of its least evaluated and probably least accountable, activities. Planners are generally held responsible for their plans and their consequences only to a modest degree, if at all, and the planning function is not evaluated as routinely as are most other organizational functions.

Some of the reasons for this are clear and understandable. The staff planner is most often not the implementer of the plan, so one can argue that he should not be held accountable for its consequences. On the other hand, the planning function should be responsible for designing an implementation plan for the strategic plan and for business plans (King & Cleland, 1978). Therefore, the function's accountability must extend beyond the mere promulgation of a planning document.

This paper describes a direct operational approach to the evaluation of planning that provides the basis for the achievement of planning accountability and for the improved management of planning. The various elements of the approach have been developed and applied in real world contexts, although the entire framework has not been applied in any single firm. Although it was not primarily designed to do so, the approach has also proved to be a valuable tool for the diagnosis of problems in the organisation and in the way in which it conducts its planning, as well as a tool for motivating better strategic thinking.

Planning Accountability and Management

General James M. Gavin (1978) provides an interesting insight into planning accountability in his book recounting his World War II experiences by saying that "Nothing chastens a planner more than the knowledge that he will have to carry out the plan."

In business firms that operate sophisticated planning systems, it is common to hear line managers refer to the "lack of realism" in plans, recommendations, and analyses coming from the planning department. According to Gavin, realism would be promoted if planners were made to carry out the plan. Barring that, planners—both line managers and staff planners—should be held accountable for it.

While such formal assessment of planning accountability may not be widely practiced, the need for it is implicit in modern planning thought. The notion that line managers, and not staff planners, must ultimately "do" the planning is widely accepted—partly because they can bring realism to it and, in part because they can more readily be held indirectly accountable for the plan through the performance exhibited by their unit. So too does the notion of "Planning implementation," (King, 1980; King & Cleland, 1978; Lorange, 1977) recognize the need for planners to be more involved in the implementation phase of the planning cycle—thus placing them closer to the consequences and to potential accountability. However, just as some firms have failed to apply "hard-nosed management" to their computer information systems function and perhaps to some other staff functions (King, 1982), so too have many failed to stringently apply such "gut-level" management to the planning function.

The consequences of this lack of strict management and accountability of planning is probably detrimental to the firm, to the planning function and to the profession of planning. Lack of accountability may be perceived as leading to greater costs, lesser effort and poorer planning performance than could otherwise be obtained. If this view is held, the planning department may come to be viewed as "organizational slack" whose resources can readily be cut back during times of austerity (Cyert & March, 1963). The overall view of the planning profession that may arise from this is also quite negative. The natural view of non-planners is that those who are not accountable and who are the first to be cut back must not be of real importance. If this is true of the staff people that are responsible for planning, its extension to the planning function itself is not too great a step.

Thus, despite the many valid reasons for failing to hold planners totally responsible for plans and their consequences, greater planning function accountability is undoubtedly desirable. Perhaps the most significant reason for the absence of greater accountability in planning is that there is no comprehensive and agreed-on basis for evaluating planning. Some other organization functions and entities have clear measures of performance—e.g., the cost of profit generated by the unit. Others have less clear, but nonetheless formal and accepted, performance standards which facilitate accountability—e.g., sales quotas, efficiency and productivity measures, etc. However, there are not such measures that may readily be applied to the plan, the planning function or the planning system. Thus, there is no standard that can provide a ready basis for planning evaluation and for the greater accountability and better management of planning that such evaluation permits.

"Indirect" Versus "Direct" Evaluation of Planning

This paper develops a framework for the direct evaluation of planning. Most previous work in the evaluation of planning has been of an "indirect" variety that is not well suited to providing information that might enhance a firm's ability to better manage its planning activities. Nonetheless, the indirect approach to the evaluation of planning offers both an interesting perspective and the basis for the development of a more useful approach.

The Indirect Approach to Planning Evaluation

The indirect approach to evaluating planning emanates from the claims of planning enthusiasts that planning will lead to improved business performance. As shown in Figure 1, planning "evaluators" using this approach have taken this assertion and set out to

assess its validity by attempting to measure the relationship between a firm's strategic planning system (SPS) and its business performance. (The format of Figure 1 does not make it clear why this approach is termed the "indirect" one. This will subsequently be clarified.)

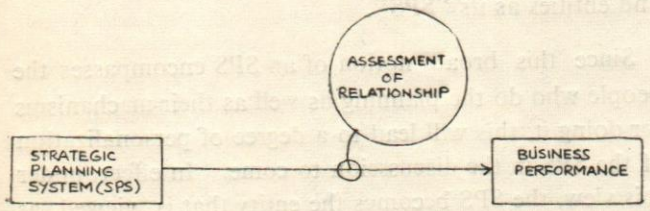

Fig. 1 : Process Description of the Indirect Evalution of Planning

Studies that have used this indirect approach evaluate the influence of planning by comparing various firms—each operating different levels or varieties of SPS—on the basis of their performance as measured by profitability, growth, etc. Proponents of this approach argue that these are the ultimate objectives to which planning is addressed (e.g., increased business profitability or growth), that these are the claims that are implicitly made for planning by planning enthusiasts and therefore that these are the standards by which planning should be gauged.

For instance, Thune & House (1970) used the indirect approach when they compared formal and informal planning firms in six industries and found that "formal planners" outperformed, informal planning firms in terms of ROI, ROE, and EPS while equalling them in sales growth. Herold (1972) used pre-tax profit as a performance standard and assessed some of the same firms over four additional years with similar results.

Ansoff et. al., (1970) studied firms using twenty-one measures of business performance. They distinguished between "planners" and "non - planners" using questionnaire responses as to the existence of eight characteristics of formal planning. Again, planners significantly outperformed non-planners. Malik and Karger (1975) used the same measures of business performance, but classified firms as "planners" on the basis of the existence of a written plan.

Rue (1973), Grinyer and Norburn (1974), Sheehan (1975) and Kudla (1980) have used a similar indirect approach and their results bring into question whether planning does indeed lead to better business performance.

Wood and LaForge (1979) studied 41 large banks and found no consistent relationship between business (financial) performance and the degree of comprehensiveness of the planning system that they used. They concluded that " . . . it is time . . . to abandon the smorgasbord use of financial measures . . . and try to match up the appropriate performance criteria with the primary objective of the organization being studied."

The indirect approach does not provide results that are operationally useful to management, even if the results were consistent. In effect, the indirect approach treats the products of planning—the plan, the strategy which it entails, etc.—as a "black box" that should be assessed solely in terms of the ultimate performance of the business. *Without* making direct assessment of the nature or quality of the plans and other elements of strategic choice, (except insofar as is necessary to ascertain the existence or level of planning in a firm), the indirect approach seeks to assess whether the existence of planning (or its level of sophistication) can be associated with business performance.

The logical basis on which the indirect approach is based has merit. However, the indirect approach has clear limitations and deficiencies:

(1) Because of the simple bases used to describe and measure the existence of level of planning, it provides little useful guidance concerning the improved management of planning.

(2) It does not consider either the quality or quantity of the direct outputs of planning. Rather, it views these merely as intervening elements in the process of producing business performance.

(3) It does not take cognizance of the many other intervening elements which also contribute to business performance.

(4) It is not possible to use the indirect approach to demonstrate a causal relationship between planning and business performance; rather it can merely

indicate the existence of, or degree of, association between the two elements.

(5) It does not consider "process values," such as the development of an improved understanding of the business, which frequently are claimed as important benefits of planning (King & Cleland, 1978).

(6) It does not consider the business performance levels that might have been achieved if other planning situations existed in the firm.

(7) It does not permit the use of any external standards; rather, only relative comparisons of various levels of planning and business performance are possible.

The Direct Approach to Planning Evaluation

In contrast to the indirect approach, the direct approach to planning evaluation that is presented here seeks to assess the SPS on a detailed and comprehensive basis. In effect, it seeks to redress, insofar as is possible, the limitations and deficiencies of the indirect approach.

The basic premise of the direct approach is that planning cannot adequately be evaluated if it is done on a "black box" basis. A wide variety of benefits are claimed for planning by virtually all of its proponents (e.g., Steiner, 1969). To fairly assess planning, the evaluator must assess the degree to which these diverse benefits are, in fact, achieved.

Moreover, each firm's SPS has specific goals that it is designed to seek. Illustrative of such goals are "ensuring that all relevant alternative strategies are given due consideration" and "improving the level of rigor with which strategies are assessed." Such goals may not be directly reflected either in business performance or in any generic evaluation scheme that is applied uniformly across many firms.

Figure 2 shows an expanded version of the process model of Figure 1 in which additional elements have been incorporated. The most important of these elements are represented by the block labeled "External Standards" "Resource Inputs," "Goals of the SPS," and "Outputs of the SPS"*.

The Strategic Planning System (SPS)—The "SPS" is the complete set of processes and entities through which a firm does planning. King and Cleland (1978) have defined an SPS in terms of subsystems such as a planning process, an information subsystem, a decision subsystem, and an organiational subsystem. At whatever level of sophistication and complexity a firm's planning operates, we shall here refer to these process and entities as its "SPS".

Since this broad notion of an SPS encompasses the people who do the planning as well as their machanisms for doing it, this will lead to a degree of personalization of the SPS in the discusssion to come. In effect, under this view, the SPS becomes the entity that is viewed as performing the planning.

Inputs to the SPS—The leftmost block in Figure-2 characterizes two varieties of inputs to the SPS—resource inputs and goals. The "Resource Inputs" are the people, funds, computer time, etc. that are consumed in the planning function. As well, it includes the time and emotional energy of the people that perform planning. The "Goals of the SPS" represent the specific purposes for which it was developed (and against which its efficacy should therefore, in part, be assessed).

Outputs of the SPS—An SPS produces documents—"plans"—as its primary visible output. However, the *content* of those plans represent the substantive outputs. King (1980) describes the firm's *strategic choice elements* to be its mission, objectives, strategies, goals, resource allocations and strategic programs. Each of these represent strategic choices that are outputs of the SPS. Similarly, many of those strategic choice elements that have been considered in the planning process, but which may not be a part of the plan—such as strategies that were proposed and considered, but not accepted—may also be considered to be an element of the SPS's output.

Business Performance—The rightmost element in Figure-2 represents the collection of indices that are used to assess business performance: profit, ROI, ROA, market share, etc. While most indirect evaluation studies have used a prescribed set of such measures that are applied to all firms such an approach is probably inadequate in that it does not reflect industry norms or the unique goals of the firm.

*The circled letter in Figure 2 will be explained subsequently.

External Standards—The "External Standards" block at the top of Figure 2 reflects the body of standards that may be appropriately applied to each of the other process elements. Any approach to measurement requires standards, and one of the difficulties that is inherent in the indirect approach to planning evaluation is the lack of such stanards.

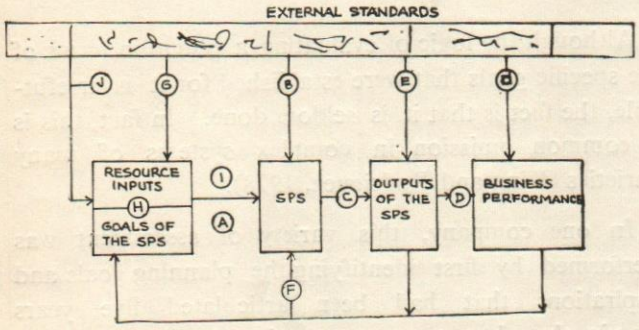

Fig. 2 : Expanded Model of SPS Evaluation Process: Direct Evaluation

A Methodology for the Direct Evaluation of Planning

A comprehensive methodogy for the direct assessment of planning may be described in terms of the system elements in Figure 2. The methodology involves the execution of a number of assessments at various points in the process that is described there. These assessments are made in a fashion that is derived from a number of fundamental precepts.

Underlying Precepts of the Direct Assessment Methodology

Among the fundamental precepts on which the direct methodology is based are those that ameliorate some of the deficiencies in the indirect approach. In addition, several other fundamental premises have been used to guide the development of the methodology.

Multi-Dimensional Assessment—The notion of assessing something in terms of a number of criteria and then reducing the multiple assessments to a single overall "utility" measure has great appeal, unfortunately, there are significant problems involved in doing so (Zutshi, 1981). Thus, the approach taken here is one in which multiple assessments are made, but there is no attempt made to synthesize the various measures into a single one. The overall evaluation must be made in terms of an array, or profile, of dimensions. This means that judgement is still required to make the overall assessments of the SPS. However, that judgement is not merely impressionistic. Rather, it is guided by a series of prescribed measurement points and prescribed assessments, which, while the details may vary from firm to firm, are generic in future.

Use of Both Internal and External Standards—Despite the fact that any complex system should be evaluated in terms of the specific goals for which it was designed there are also bodies of external standards that can form a part of any comprehensive system assessment Such standards may complement the internal standards that are used in making an assessment of a system relative to its unique objectives.

Analysis of Multiple System Stakeholders—Since anything that is as comprehensive and complex as an SPS must serve a variety of interest groups within (and possibly, outside) the organization; it must be assessed in terms of the interests of a variety of "stakeholder" groups. Clearly, a system may be serving the parochial interests of one group, such as staff planners, while not serving others. If this is so, this must be "captured" in the assessment process.

"Stakeholder analysis" has been primarily applied at the business and corporate levels (Emshoff and Freeman 1931). However, it has also been applied to information systems (King, 1978). It involves the identification of stakeholder groups and the development of criteria and measures that can be applied to the interests, "claims," and objectives of each group. In one evaluation of a SPS, the SPS stakeholders were identified as:

(a) corporate top management
(b) corporate planning staff
(c) other corporate staff groups
(d) business unit top mangement
(e) business unit planning staff
(f) other business unit staff
(g) other business unit line management

Each of these stakeholder goups was perceived to have a specific interest in the SPS that was reasonably

homogeneous within the group but different from group to group. As such, the SPS had to be evaluated in terms of the degree to which it met the needs of each group.

Use of Judgmental and Objective Assessments—A wide variety of assessments are required to collectively form the comprehensive SPS assessment that is ultimately desired. These assessments will invariably involve both the collection of objective data and the making of subjective.

The operating precept is that both can be made and used so long as the judgment are obtained in a structured fashion (e.g., using structured interviews or a predetermined questionnaire) that facilitates aggregation and comparison.

King and Rodriguez (1978) have described a variety of such assessments in the MIS context. Dutta and King (1830) applied them to a strategic decision support system. Here, the general approach is extended to the assessments made of SPS.

Elements of the Assessment Framework

The various elements of the direct assessment framework are represented with circled letter designations in Figure 2. The various assessment are of the:

A. Effectiveness of Planning
B. Relative Worth of the SPS
C. Role and Impact of the SPS
D. Performance of Plans
E. Relative Worth of Strategy
F. Adaptive Value of the SPS
G. Relative Efficiency
H. Adequacy of Resources
I. Allocation of Planning Resources
J. Appropriateness of Planning Goals

Each of these elements of the direct assessment framework are discussed and illustrated below. After each has been discussed, the making of overall assessments of the planning system will be treated.

Effectiveness of Planning (A)

The evaluative dimension that is termed "planning effectiveness" represents a set of measurements that can be made to address the issue of how well the SPS has met *its* goals. Every firm begins to do strategic planning, changes to a new SPS, or to a new approach to planning with some *planning goals* in mind. Often, these are communicated in the form of a proposal for a new system or for the hiring of a consultant.

Although the logic of evaluating a system in terms of the specific goals that were established for it is irrefutable, the fact is that it is seldom done. In fact, this is a common omission in complex systems of many varieties (King and Rodriguez, 1978).

In one company, this variety of assessment was performed by first identifying the planning goals and aspirations that had been articulated five years previously when a more extensive planning effort had been undertaken. This was accomplished by retrieving and analyzing a number of memos that had been sent by and to top management as well as a task force report that had been prepred and on which the decision to undertake a higher level of planning had been based.

These tentatively-stated goals for the SPS were then reviewed with several individuals who had a long history of association with the planning system. In several cases, the statements were modified to account for changes that had occurred since the original goals had been stated. In one case, a change was confirmed directly by a document. In several other instances, the changes were confirmed through independent discussions with several relevant people.

Members of each of the stakeholder groups were identified and asked to complete a survey instrument in which they evaluated the SPS in terms of the degree to which they preceived it to have attained the goals that had been prescribed for it.

This was initially done using scales in which individual indicated his or her degree of agreement or disagreement with such statements as—"The SPS has served to identify many new business opportunities that might otherwise have been overlooked" and "The SPS has led to the better evaluation of strategic programs."

Subsequently, personal interviews were conducted

with these individuals to validate their responses as well as to obtain, where possible, judgmental assessments of the magnitude of the benefit accruing from the extent to which each goal had been achieved. In those sessions, the interviewer asked questions such as, "what was the profit impact of the acquisitions that have been made as a consequence of the SPS?"

Relative Worth of the SPS (B)

This element of the assessment relates the features and characteristics of the SPS to external standards for good planning. Such standards can be based on those developed by Steiner (1969) for instance.

This assessment may be made in a fashion similar to that just described for the effectiveness of planning except that "standards of the field of planning" are used instead of the unique planning goals of the firm. Holloway and King (1979) have presented a way of doing this that is based on "issues" and the development of profiles. Among the criteria that may be sued involve the degree to which the SPS facilitates or necessitates:

(1) precise identification of business *strengths and weaknesses.*

(2) the specification of existing and potential *comparative advantages* for the business.

(3) the assessment of the *risk* involved in strategic alternatives.

(4) the explicit evaluation of the *internal consistency* of strategic elements.

Closely related to these planning criteria are general external criteria related to the notion of system implementation (Churchman & Schainblatt, 1965). The issue of systems implementation deals with the degree to which a system, in this case the SPS, is actually used. Such issues might well be thought of as being an appropriate element of the SPS goal statement. In most cases, they are not so spelled out, presumably because it was not considered necessary to explicitly state a goal related to system use.

However, since the degree to which complex management systems are truly effectively used has come into question and study in the past decade, such implementation issues are probably best dealt with as external standard. Various instruments have been developed to assess the degree to which complex systems are effectively implemented and to identify impediments to implementation (Schultz & Slevin, 1975).

Role and Impact of the SPS (C)

This assessment addresses a set of issues that may be summarized as addressing the question:

Is the plan really used to guide the strategic direction of the firm ?

This question has to do with the degree to which the "strategic choices", which are the outputs of the SPS, truly guide the firm. In some firms, a spohisticated planning process is carried on, but many of the firm's strategic moves—such as acquisitions—are, in fact, opportunistically arrived at through the actions of a chief executive or other high officials. In such cases, planners often believe that the SPS, however good it may intrinsically be, is devalued, because it is not truly guiding the most important choices of the firm. In one company this was assessed using a survey instrument such as that discussed in A. The perceptions of top managers and those of middle managers and planners were found to be quite different. Top managers believed that the SPS was, in fact, guiding the firm's strategy and its strategic actions, whereas middle managers, (to some degree), and staff planners, (to a large degree), felt that it was not.

A set of interviews with those that had responded most negatively revealed that there was little feedback provided on recommendations that were not accepted and implemented. The lower-level managers and staff were largely left to infer the reasons that plans were not incorporated into the overall strategy of the firm. This resulted in the identification of a need for feedback from top management to those who were intimately involved at lower organizational levels in the process of formulating alternative strategies and making recommendations based on them.

Performance of Plans (D)

The ultimate test of the strategic choices made by a firm is business performance. However, unlike the

"black box" relationship that is postulated in the indirect evaluation approach, the direct approach inlvoves a more detailed and specific view of the strategy-performance relationship. In particular, it:

(1) focuses on the specifiic impact of *each* strategic choice element, not merely an aggregate business performance;

(2) requires performance to be assessed relative to what may be a number of different measures of peformance reflecting diverse business goals and objectives, rather than merely in terms of an aggregate measure.

In making such assessments, such things as the specific goals and targets for strategic programs need to be established and used as a standard for comparison. A company that has a system such as that of Texas Instruments, in which various levels of strategy are delineated and managed (Texas Instruments, Inc., 1975) has a clear basis for doing this. It is more difficult to do at the "higher" levels of strategy, but it is feasible at the strategic program level (King, 1980).

The methodologies that have proved useful in this regard involve the comparison of strategic program goals and expectations with actual performance. Just as it can be enlightening to look back on the aggregate-level sales, profit and other forecasts contained in historical plans, the quantitative comparison of actual strategic program results with projected returns on investment can be of great value. There is a tendency for people in organizations to "forget" their past optimism——or at least to forget its degree of intensity, if not its existence. Such a formal program-by-program comparison provides insights into the worth of past decisions that are direct, objective and useful in profiling the overall worth of planning.

However, such aggregate measures as "earnings per share" and the "value of the business," as are emphasized in the indirect approach to planning evaluation, are indeed also relevant. For this reason, the lower-case letter "d" is shown in Figure-2 to indicate that the direct measurement of the performance of each strategic choice element relative to its goals (D) may be complemented by the assessment of business performance relative to external industry and market standards (d). This merely means that one also may compare business performance with that of comparable firms using traditional financial and earnings measures. The PIMS data base (Grant & King, 1982) develops "PAR" reports which make this sort of comparison.

Relative Worth of Strategy (E)

In addition to the performance basis for assessing strategy, there are some external standards that may be applied to strategy. For instance, "internal consistency" is an important general standard that is widely applied (Grant & King, 1982). Rumelt (1979) has proposed a wide variety of such criteria that may readily be sued.

The contingency theory of strategy that has developed in recent years reflects an emerging body of broad external standards that may also be applied in this regard. For instance, Hofer (1975) summarizes a variety of studies in this area that deal with the specification of appropriate strategies for various contingencies. The contingencies reflect such things as the stage of the market life cycle, and the business status as reflected by its existing market share, experience, and the environment that it faces.

Such standards can be used as a check list against which a preliminary assessment of the strategies can be made. This can by done by identifying the business situation and then judging the appropriateness of the strategy to the situation. In one business in which this was done, outside consultants were initially asked to make an ressessment of the appropriateness of existing strategies by making explicit use of such formal prescriptive standards. Then, executives were allowed to review these outside evaluations to explain special circumstances and to critique the logic and application of the standards. These reviews were fed back to the consultants, who were asked to revise their evaluations appropriately.

One other important "external standard" that is not directly captured by any traditional assessment of business performance is that which has to do with *strategic opportunities.* In one company, such an assessment was made on the basis of the question:

What opportunities have been available or considerd that have been foregone and not enacted into strategy?"

The varieties of such opportunities are relevant:

(1) those good opportunities that were either not identified or not recognized to be good;

(2) those bad opportunities that were foregone after having been identified and assessed.

The former are clearly "missed opportunities" which serve to devalue the performance of the SPS. The latter represent an important output of formal planning that is seldom discussed or identified——those bad ideas that the SPS led the firm *not* to pursue.

In the company in question, the assessment in this area was done by the author as a consultant because it was believed that outside objectivity was necessary. The assessment was necessarily incomplete, because some records were not available and because the former category involves the identification of opportunities that were not previously identified. However, through a process of interviews, of searching through the files of some parties who had retained documents regarding program and strategy proposals, and by assessing the innovative strategies of competitors during the relevant time period, this assessment was made possible.

Adaptive Value of the SPS (1)

One important dimension of a SPS is its adaptability to changing circumstances as well as its ability to be improved as it is being operated and evaluated. while this may be considered to be one of the external standards for B, it is so important that it is specifically identified on the "feedback loop" portion of Figure-2.

That feedback loop represents the SPS's ability to adjust its own goals, characteristics or inputs to its outputs and the business performance that they produce. For instance, if a SPS has produced high-risk strategies as outputs, and if those strategies do not produce the desired business performance, can the system be adapted so that it does not continue to do so ? Moreover, has this in fact been done?

In one situation in which this was the case, it was determined that a group decision making process was producing risky recommendations that, when enacted by the firm, did not frequently produce the anticipated results. When this was discovered through an audit of the process that had led to these strategies, it was determined that the group process should be changed. In another case, the SPS was found to have made inadequate use of available information. This led to the development of a new computerized competitor data base. The evaluation of the adaptive value of the SPS was rated positively in both of these cases since the system itself had identified the problem and acted to correct it through improvements in the system.

Some systems have not been evaluated positively in this regard, for instance, one in which the rewards provided to managers did not motivate them to follow the prescribed business strategy. When this was recognized, no changes were made in either the reward structure of the strategy, presumably because of the perception that both elements were so fundamentally entrenched in the company's culture that changes would create additional difficulties.

Such anecdotal evidence of adaptive value can lead to the identification of characteristics that contribute to this element of value. For instance, a system that is sufficiently well documented to provide an "audit trail" that can be used to diagnose the cause of deficiencies in system outputs would be relatively highly-valued, if the audit trail were, in fact, used.

In effect, these more general characteristics represent a kind of external standard that is applicable to the feedback element of the SPS. It is not shown as such on Figure-2 because such standards are not well developed for the SPS context.

Relative Efficiency (G)

Little attention is often paid in planning circes to the resources that are consumed by planning. Questions of the efficiency with which resources are employed are often shunted aside. One planner was recently heard by the author to remark that to apply such a criterion to an activity that deals with such important issues is "nit picking." Yet, at the same time, the resources of planning departments are often cut substantially during periods of business downturn.

External standards for the relative efficiency of planning can be readily developed by a firm. For example, how many man-years are put into preparing the plan for each million dollars of sales? It is rather easy to estimate "industry standards" as well as standards for "well managed" firms to which a firm might wish to be compared. Indeed, in one such case, in which the author participated, direct requests to other firms resulted in the provision of a wealth of data concerning their planning expenses.

Adequacy of Resources (H)

A related measure is that of the adequacy of resources relative to the goals for planning. Sometimes, unrealistic expectations are implicitly established for planning in terms of both the quantity of SPS outputs. For instance, if staff planners are frequently assigned to perform "special projects" as they are in many firms, the planning resource base may be so diluted that planning goals cannot be met.

In one case, the mere quantity of proforma financial statements that were required in the planning document was so great as to tax the capabilities of the planning department's clerical and secretarial staff. When this was formally demonstrated through such an assessment, a commercial computerized financial planning language was purchased to serve (initially, at least) merely as a "high speed printer" making it possible to efficiently produce those documents which were to be included in the plans and thereby freeing resources for more significant tasks.

Allocation of Planning Resources (I)

A third variety of planning resource assessment has to do with the *allocation* of the resources to the various funtions and activities of planning. One way of assessing this is to develop a description of the various planning activities and to survey both planners and managers in terms of the time and resources spent on each activity. (Zutshi, 1981). In one case, this was done in terms of "actual" versus perception of "desirable" proportions of total planning effort with results that implied that much greater effort was being devoted to the "description of the current state of affairs" aspect of planning than to the creation and evaluation of alternative strategies. The perceptions of virtually everyone led to the conclusion that this was a misallocation of effort, and actions were initiated to reallocate resources appropriately.

Appropriateness of Planning Goals (J)

The evaluation approach of Figure-2 ends where it began—with planning goals. The appropriateness of these goals, in the context of the firm's environment and position, should be subjected to scrutiny using external standards.

While specific and precise standards of this kind may not be readily available, a good deal of research has been conducted in terms of the level of uncertainty in the firm's environment as well as in delineating "realistic expectations" for planning (Warren, 1965). These can provide the basis for a judgemental assessment, probably best conducted by someone external to the firm, of the reality and appropriateness of its planning goals.

Overall Assessment of the Planning System

There is a great deal of theoretical appeal to the idea of making multi-dimensional assessments and then of aggregating them into an overall measure of utility (Bell Keeney and Raiffa, 1977). However, there are significant practical problems involved in doing so (Zutshi, 1981), and the usefulness of the result is questionable because the practical use of a planning system evaluation is *not* the comparison of its overall worth with that of others. The practical use is more in terms of the various elements of the assessment (A through J).

For instance, the various assessment, A through J, identify areas of weakness in the planning system. They are, therefore, of great diagnostic value. Even the accountability issues are best dealt with in this way, since accountability is probably best with respect to specifics rather than to a single abstract index.

However, composite assessments are indeed necessary since it is not at all clear that certain values of some of the assessments are necessarily bad or good, except in the context of the other assessments. For instance, if the planning function is assessed to use greater resources than would be prescribed by an external standrad, its "relative efficiency" (G), would be low.

However, if most of the other assessments were quite high, this might merely reflect a greater investment in planning than is fully justified by better output.

Thus, in addition to being viewed individually, the twelve assessments (A-J) should be arrayed to form a *planning system effectiveness profile*. Such a profile permits the visual protrayal of these inter-relationships and provides a sound basis for the judgements that must necessarily be involved in an overall assessment.

Summary and Conclusions

Most of the evaluations that have been made of planning systems are either totally impressionistic or make use of an "indirect" approach to empirical assessment that is neither very satisfying nor useful.

A "direct" aproach to the evaluation of planning systems is presented here in terms of methodological framework. The framework involves twelve distinct assessments of planning system inputs, outputs, feedback mechanisms, and impacts that are made in terms of the planning system's goals and a number of bodies of external standards. Each of the dozen separate assessments that make up the methodology have been applied in business firms, although the overall methodology has not been applied in a single firm.

The methodology employs both the collection of objective data and the making of subjective judgements. One of its underlying precepts is that both can be made and used so long as the judgements are obtained in a structured fashion (e.g.,using structured interviews or a questionnaire) that facilitates aggregation and comparison. The other precepts on which the methodology is based are also discussed.

The evaluation approach ultimately requires that judgements be made of *overall* planning effectiveness. This is done in terms of a planning system effectiveness profile that permits judgements to be made concerning the interactions of the various individual assessments.

The approach is particularly valuable as a diagnostic tool, since it permits the direct identification of potential planning weaknessess as well as the identification of elements of the planning system that are unique or particularly productive.

For the field of planning to progress and to achieve its much-heralded potential will require that a formal evaluation methodology be developed and implemented. While further application experience is clearly necessary, the approach presented here appears to have the potential for providing such methodology.

REFERENCES

Ansoff, H.I., et. al., "Does Planning Pay ? The Effect of Planning on Success of Acquisitions in American Firms," *Long Range Planning*, Vol. 3, No. 2, 1970, pp. 2-8.

Bell, D.E., R.L. Keeney and H. Raiffa (eds.), *Conflicting Objectives and Decisions*, John Wiley, New York, 1977.

Churchman, C.W. and A.H., Schainblatt, "The Researcher and the Manager : A, Dialectic of Implementation," *Management Science*, Vol. 11, No. 4, February 1965, pp B69-B87.

Cleland, D.I. and W.R. King, *Systems Analysis and Project Management*, 2nd Edition, Mc Graw-Hill, New York, 1975.

Cyert, R.M. and J.E. March, *A Behavioral Theory of the Firm*, Englewood Cliffs, NJ, 1963.

Dutta, B.K. and W.R. King, "A Competitive Scenario Modelling System," *Management Science*, March 1980, pp. 261-273.

———, "Metagame Analysis of Competitive Strategy," *Strategic Management Journal*, October-December, 1978, pp. 357-370.

Emshoff, J.R., and R.E. Freeman, "Stakeholder Management : A Case Study of the US Brewers Association and the Container Issue," *Applications of Management Science*, Vol 1, JAI Press, 1981.

Gavin, James M., *On to Berlin*, Viking Press, New York, NY, 1978.

Grant, J.H. and W.R. King, "The Logic of Strategic Planning", Little Brown Company, Boston, MA, 1982.

Zutshi, R.K., "Strategic Planning Systems Evaluation : A Systems Approach", unpublished Ph. D. Dissertation, Graduate School of Business, University of Pittsburgh, 1981.



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Organisational Climate and Strategic Management

ARIE P. NAGEL

Organisational Climate is one of the dominant factors which determine the effectiveness of strategic management. To improve the positive Organisational Climate and to make the Strategic Management effective the quality of managers should be improved. The paper also emphasises the importance of formal procedures in the Organisation.

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Introduction

The effectiveness of strategic management is determined by several factors. In Figure-1 we suggest a tentative conceptual framework which relate these factors. It is compiled from the works of Galweiler[1], Faure[2], Rhenman[3], Tregoe[4] and Thompson[5].

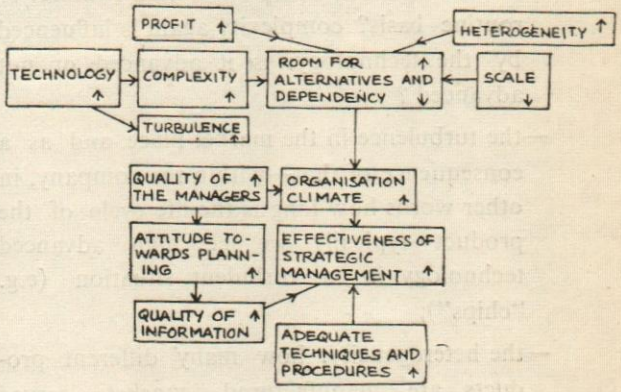

Fig. 1 : A conceptual framework for determining the effectiveness of strategic management.

In our opinion the organisation climate is one of the most important factors that determines the effectiveness of strategic management. In this paper we will not regard the organisation climate as such—as a sociological entity—but we will dwell on the factors that determine this climate. These are :

a. the quality of managers :

—their know-how of strategic management is crucial; therefore, a great deal of this paper will

be dedicated to common problems, misbeliefs and failures in introducing and executing strategic management;

—the more managers move upon the managerial grid of Blake and Mouton,[6] the more they will tend to be "strategically capable" (as indicated above), and also more social oriented and cooperative with people inside as well as outside the company. In this paper we will explain the extreme importance of cooperation with outside experts on strategic management.

(b) Room for alternatives—this is another key factor which determines the organisation climate which is quite reverse to the notion dependancy—to this we will refer several times in this paper :

* this margin itself is determined by several factors such as :

—the profit;

—the complexity; this refers to the organisational complexity; are the products and production methods unique or standard? i.e., are the decisions made on a non-routine or routine basis? complexity again is influenced by the technology: is it advanced or not advanced ?

—the turbulence in the market place and as a consequence of that—within the company, in other words how long is the life cycle of the product—typically we see high advanced technology in a turbulent situation (e.g. "chips");

—the heterogeneity: how many different products are manufactured, markets served (needs fulfilled) and is the production process versatile;

—the scale; once invested (capital goods—economies of scales!—or know how) it is difficult to change;

—the quality of managers; the better the manager the more room he will see—it is not only a matter of facts, but also of perception.

Completing the picture of Figure-1 we state that the quality of the managers influences the positive attitude towards planning. More quality results in better communication, more adequate information[8], a higher analytical level and a longer time-horizon of the managers. In short, more feeling for (strategic) planning.

Better planning results in better information and more adequate techniques and procedures. By adequate we mean-better adapted to the situation and certainly not necessarily more advanced, like computer corporate models.

Eventually, the effectiveness of strategic management is determined by the organisation climate, the quality of information and the adaptation of the techniques and procedures used.

Some Beliefs, Misbeliefs about Planning

The process of *strategic management* is directed to the reduction of uncertainty and eventually to take strategic decisions. This can be done either on a cyclic (yearly) basis or on an acyclic (project) basis. However, each company should be involved in strategic management. because there are always opportunities to evaluate and threats to cope with. In this process of strategic management the company will heavily bank on its strengths. Figure-2 gives the components of strategic management.

strategy formulation	*allocation*
* analysing	* of resources and translation into financial terms
* prognoses	* eventually resulting in financial and manpower budgets
* alternative plans with its consequences	* action plans
reduction of uncertainty and preparing decisions	taking decisions

strategic management

Fig. 2: Components of Strategic Management

*The aim is to reduce uncertainty. Of course this is possible to a certain extent. In a few cases the future will be completely uncertain or equally worse we know it perfectly but the "response-time" is too long. In these cases more information is useless and strategic management ineffective.

The first condition for the process, indicated above, to be carried out successfully, is that there is *room for alternatives*. If the margin for taking strategic decision is next to zero, the whole process would be a waste of time and money. More specific there should be a margin in financing, in time, in know-how (in the broadest sense) and last but certainly not least in willingness. An example: a cleaning company which just has invested in an automatic washing street, is tied to this decision for several years. The financial resources have been put into this expensive washing street. After having taken this decision it has little use to evaluate alternative actions in the *production* area for several years. This is by the way, one of the reasons why strategic management in smaller firms should be done on a project basis.[7]

Furthermore, *strategic planning* (see Figure-2) is a systematic procedure to sustain the process of strategic management. A *strategic plan* is the result of this and should address itself to:

- ☐ what is our scope or what kind of business(es) are we in: products, markets, technology, which customer-groups do we serve, which needs do we fullfil, . . .
- ☐ in which direction will we extend, diminish our scope
- ☐ what objectives do we have in doing this (objectives can either be an input or a result of the strategic process)
- ☐ how these objectives should be met: in what time with which person financial and material means (action plans).

Objectives should give the desired state in:

- ☐ financial and economic,
- ☐ social,
- ☐ commercial,
- ☐ technological situations,
- ☐ the field of management development and organisation structure,
- ☐ the productivity.

Objectives can be stated explicitily on paper, but can be implicitly as well and will be actual in case of concrete alternatives at hand. Smaller firms will tend to have implicit objectives, where larger firms will make their objectives explicit. This is simply because the more people are involved in the process of strategic management, the more necessary it is to communicate the views in a formal way.

Objectives should be realistic. They might be challenging, but should never be castles in the air. Nor should they be set too low, as people do in the communist countries, so they can meet the plan easily with an excess of ten or more percent. In setting realistic objectives, one takes the planning process serious. But even with realistic plans, objectives will be met only by accident. This does not mean that the process of preparing plans is a waste of time. Giving some room for alternatives, which are available most of the time (e.g., closing the business is almost always a possibility), one must choose. And to choose properly one should discuss the consequences of several alternatives with the information at that moment. Later-on, after the decision, it will show that things happened (slightly) different. Connected with the misunderstanding that objectives should be met and that otherwise planning is a waste of time, is also a belief that one should tell apart prognoses and plans. You need prognoses to make plans, but they are certainly not the same. Figure-3 gives the relationship between prognoses and plans within the whole process of strategic management. Figure-4 gives a very simple example to explain the difference between prognoses and plans. Even if the prognosis (weather-forecast) is rain, you can decide (i.e., plan) not to bring your raincoat with you. Maybe you don't mind a little rain, or you take the risk that it does rain at that very

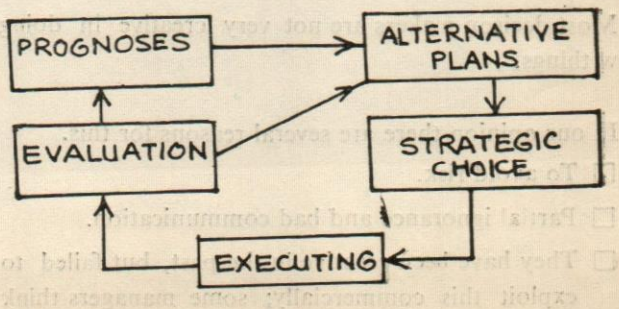

Fig. 3 : Relationship between Prognoses and Plans.

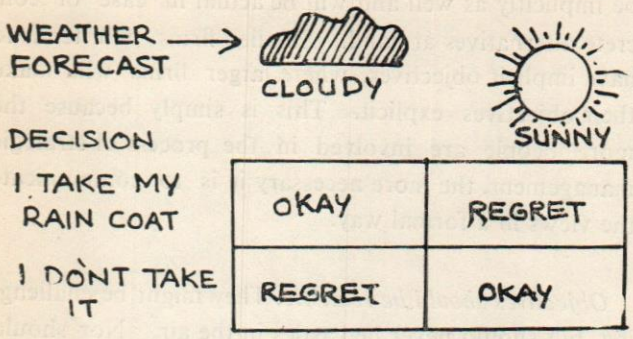

Fig. 4 : Differences between Prognoses and Plans

moment you are out, or you don't trust the weather forecast.

Strategic Decisions have Severe and Long-range Consequences

At the same time they are non-routine decisions, because one has to cope with new situations. So you are faced with a dilemma: on the one hand they are of vital importance, whereas on the other hand they are unique decisions. But even if it is very difficult to prepare such vital decisions, one has to do this in a proper way. Problems such as partial ignorance and time-pressure weigh heavily.

Later-on it is often so that the wrong decision had been taken. This does not mean however that you should not plan. At that time the decision was made with that information. Under that circumstances and with that knowledge it was a good decision; there has been a lot of thinking about it. And this is most of the times better than doing "nothing" or an impulse reaction. Evaluation of the decision and the actual situation is always useful. In doing this one could learn a lot.

Most decison makers are not very creative in doing new things.

In our opinion there are several reasons for this.

- ☐ To avoid risk.
- ☐ Partial ignorance and bad communication.
- ☐ They have been creative in the past, but failed to exploit this commercially; some managers think that new should be real new, a total different product, market or technology and in that small companies will fail most of the times.
- ☐ The room for alternatives is too little, especially in smaller firms.
- ☐ They think merely in terms of "solutions", more than in terms of "alternatives", decision making is done implicitly and intuitively and not in an analytical way.

In doing so one comes to obvious solutions or even worse jumps to conclusions.

A common belief is that strategic management has little to do with today; it mainly effects things in the far future. It is a vague philosophical process which deals with the long term. On the contrary strategic management deals with today, with today's decisions. Even if the decision is postponed, we have a decision NOW; the decision that the decision is postponed. And that decision can have dramatic consequences: Think of delaying a decision to merge. Later-on one could be glad that this decision was postponed until better information was at hand. Or that a feeling of regret arises because of the missed change.

Of all the possible mistakes in strategic management, there are *two serious mistakes made in practice* (see Figure-2).

(a) The allocation is started, while the strategy formulation has not been carried out :

- ☐ allocation degenerates to a longterm book-keeping, carried out by middle management and is not supported by top management
- ☐ so it has no "vision" in it and it will not lead to new ideas
- ☐ even worse there will exist or grow a hostile climate against strategy formulation—people will look at this as unnecessary and useless, certainly if things go different from the usual way
- ☐ the allocation has been done as a financial extrapolation; e.g., a 4, year plan.

(b) The strategy formulation has been done and the allocation is expected to be carried out spontaneously:

- ☐ top management has spread its ideas and leaves it to middle management to translate the ideas into action
- ☐ it is very difficult for middle management to do this if they don't know why; in rare cases they might even sabotage the ideas
- ☐ strategy formulation is quite useless if at the same time the ideas are not translated into action plans (who does what and in which time) and projects
- ☐ It is preferable if not essential that middle management is involved in the ideas from an early stage.

The Organisation of the Strategic Management Process

This brings us to the following question. Who should join the process of strategy formulation and allocation ?

- ☐ First of all the responsible top management; they have to take strategic decisions which determine the direction of the company (objectives—WHAT —and strategies—HOW—) and furthermore they should create conditions in such a way that the directions also can be followed; i.e., conditions in the field of contracting (or dismissing) personal, proper allocation of tasks and conditions for communications to middle-management, because they have to execute the plans; e.g., the sales director, the production director, one could also consider a representative of the labour-force
- ☐ One or more outsideres such as:
  - —a new (top) manager
  - —consultant
  - —someone from a bank
  - —an accountant
  - —a competitor, e.g., when there exists a regional separation between the markets served.

We like to go further into detail concerning the *outsider*. What are the criteria for choosing one and why should we involve an outsider ? First some criteria.

- ☐ the outsider should have the confidence of top management and all the others who are involved in the process of strategic management
- ☐ must have experience with this process
- ☐ must have the "art" of putting appropriate questions to the managers, who on their turn should be prepared to discuss things frankly, e.g., to come forward with their doubts.

Before giving more criteria, we like to answer the second question, why an outsider ?

Experience teaches us that most managers can only get a 'breakthrough' in strategic thinking if an outsider is involved. The reasons for this are rather obvious:

- ☐ an outsider brings in new ideas and approaches
- ☐ most managers have good ideas, but have a—in their lonely reflections—great need for someone, which brings some ordering in his/her throughts; in other words, a 'sounding board' is needed.

This is connected with the fact, earlier mentioned, that a manager merely thinks in terms of "solutions" than in terms of "alternatives". If so, it is very useful sombiosis to join the manager with an outsider.

In addition, this outsider should:

- ☐ have the task to schedule the strategic procedure i.e., strategic planning; without "phasing" it often deteriorates
- ☐ be aware not to push his ideas; this is quite useless, because it is the manager who decides and he will—at the end—only decide that in which he believes.

Strategic management also shows that the results count and not the brillant ideas.

- ☐ keep in mind what the organisation can bear; strategic planning surely is a tedious and long-range job:

How to organise it ? Here, great differences between smaller and larger firms arise. *In larger firms* strategic planning is done on a yearly basis; e.g., from the consolidation point of view. Sometimes it is completed

by some sort of issue management. At the top level there are generated ideas, whereas at the middle level there are generated facts which are complied then to form proposals for plans. These plans are tested against

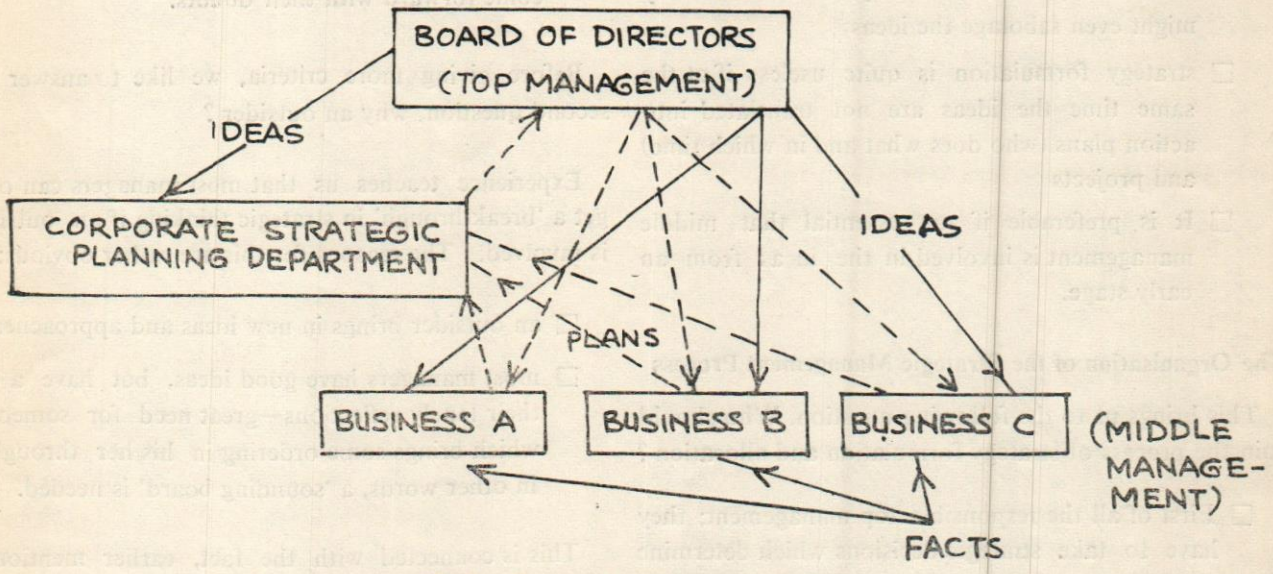

Fig. 5 : Strategic Planning in a Large Firm

the ideas and norms by a corporate planning department. Finally the plans are confirmed by top management and are implemented.

The tasks are divided as follows :

- ☐ top management should provide for ideas and the conditions mentioned earlier and confirm the business plans
- ☐ middle management should gather facts and prepare the business plans and execute them
- ☐ the corporate planning department should develop procedures, consult top managements and the businesses, develop planning norms, carry out board environmental surveys, compare the business plans with the norms, carry out special projects, e.g., product innovation, manpower planning and the like.

The members of this department should have a thorough knowledge of the firm and a substantial part of the department should consist of people, which are bred in the company and have seen the company from different angles.

In smaller firms the organisational set-up is easier. As there is a narrow margin left for alternative action, strategic decisions are not as frequent as in larger firms. If a firm has up to 500 members, strategic decision making on a project basis will be quite sufficient. The project-team should consist of 3 to 8 members. The chairman should be the director of the firm, because he makes the decisions. Working groups, committees or experts can be attached to the project-team on an agenda basis. The chairman of these groups should be a member of the project-team.

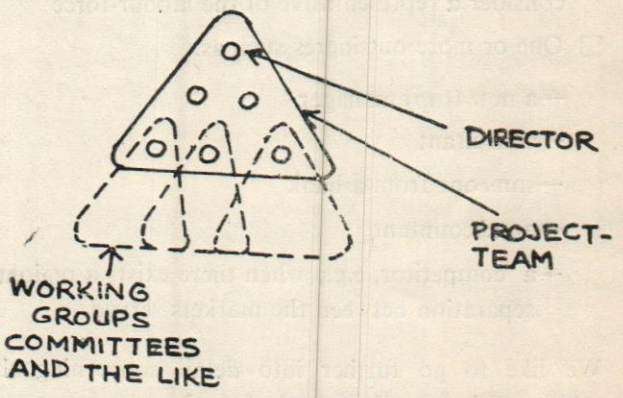

Fig. 6 : The Linking pin idea applied to Organising Strategic Management in Medium Sized Firms

It is important to agree on a limited time for the project-team. Say one or two years. Moreover, it is

very important to do everything together in the team. For the following reasons:

- ☐ it motivates people to execute the plan later-on
- ☐ they will have a better idea what it is all about and so they will make better plans and execute the plans in a better way
- ☐ it improves the communication among the members
- ☐ it shows quickly the difference in ideas such that the decision can be more to the point and will hopefully lead to consensus which is not the same as compromise
- ☐ the decisions will delay the decision making in the beginning, but time will be gained later-on, because the execution will take place without confusion or discussion.

A drawback could be that the project-team is regarded by the rest of the organisation as an elite and this can result in misunderstandings between the project-team and the rest. Therefore, a proper introduction of the project-team is a must, and adequate information from the project-team to the organisation should be provided.

How should we start with strategic management? To a certain extent one can do strategic management intuitively, but as the situation grows more complex (i.e., more products, more regional areas and the like), it is almost a necessity to make use of a procedure. This means that it is desirable to consider subjects and/or aspects of the organisation step by step. Although it is true that everything coheres with everything one cannot possibly consider everything at the same time; knowing this one deals with the problem in parts so that it will be more tractable. This dealing with the problem parts is a must when strategic management is being carried out by—say—more than three persons.

Putting strategic management into a procedure—a planning schedule—it will be clear for each member of the project-team what the subject for discussion is at that very moment. Doing so it works much the same way as an agenda does for a meeting. Furthermore this procedure will put time-pressure on the members and hasten the process.

So we see that strategic management is a pre-eminent means to policy making and communication in the company:

- ☐ as we have seen before it is a way to get consensus
- ☐ and it motivates people.

Moreover:

- ☐ it is a way of learning for the individuals as well as for the company as a whole
- ☐ it is a way of preparing and executing strategic decisions
- ☐ it helps to make the policy clear to the members in the organisation
- ☐ members can then give more adequate information to management on their turn
- ☐ and they can show one face (image) to the outside world; e.g., with Public Relations.

If there are areas which have no strategic problems (e.g., purchasing or production), there is no need for strategic management in these areas.

It is desirable to emphasize only one or two areas per year. Of course it should be those areas that call for strategic decisions, i.e., where there are problems. Actually, it is wise to stress one area per year; for example:

1982 : purchasing
1983 : the international division
(with a wink to George Orwell)
1984 : manpower planning and personal development
1985 : product-market combination number 12 (whatever that may be)
1986 : production technology
etc.

So now we created a continuum between project planning and cyclic planning.

See Figure 7.

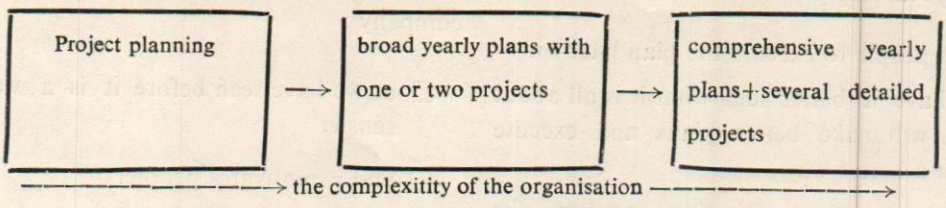

Fig. 7 : A Continuum at Strategic Management Approaches

Concluding Remarks

Do we really need formal planning ? Research shows that companies which have formal planning procedures perform better than those who don't have it. Moreover, if the informal planning is substituted by formal planning, the performance raises.

The quality of the planning results according to Galweiler[1] out of three factors:

- ☐ the quality of the people involved in planning
- ☐ the quality of the information and
- ☐ the quality of the methods and procedures used.

In our opinion the quality of the procedure is not the most important factor; it is only the factor which can be influenced easiest. As we stated already: start simple, start with a simple procedure—it is the agenda for the meeting, no more no less...

Any procedure which is simple and agreeable for the members of the project planning team will do for a start.

For convenience one can find the fundamental pattern of all procedures in Appendix-1.

APPENDIX 1

Ground pattern for strategic planning procedures.

1. WHAT IS OUR POSITION ?
   Strengths, weaknesses relative to the competitor.
2. WHAT ARE THE POSSIBILITIES FOR THE FUTURE ?
   Opportunities, threats and risks in the market place and within the company.
3. WHAT IS THE CURRENT FORECAST ?
   Where would we be, if we don't change our strategy.
4. WHAT DO WE WANT TO DO, WHERE DO WE WANT TO GO ?
   'leitmotiv' and goals and objectives.
5. WHAT ARE THE ALTERNATIVES ?
   Which are the alternative possibilities for our company ?
6. WHAT DO WE CHOOSE ?
   And what alternatives do we have to fall back on?
7. WHAT IS OUR ACTION PLANNING ?
   Who does what and when and with what financial, material and personal resources ?
8. EVALUATION AND CONTROL
   During and after the planning process.

REFERENCES

1. Galweiler, A., *Unternehmungsplanning, Grundlagen and Paraxis*, Herder & Herder, 1974.
2. Faure, R., et al., L'ombre des grands, perspectives pour les PMI, *Revue Francaise de Gestion*, 22 (1979), 108-115.
3. Rhenman, E., *Organization Theory for Long Range Planning* John Wiley and Sons, 1973.
4. Tregoe, B. B. and Zimmerman, J. W., Strategic Thinking, Key to Corporate Survival, *Management Review*, febr. 1979, 8-14.
5. Thompson, J. D., *Organizations in Action*, New York, McGraw-Hill, 1967.
6. Blake, R. R. and Mouton, J. S., *The Manager Grid*, Houston 1963.
7. Nagel, A. P., *Strategy Formulation for the Smaller Firm*, LRP, 4, no. 4 (1981), 115-120.
8. Ansoff, H. I., *Strategic Management*, McMillan, England, 1979.
9. Hofer Ch. W. and Schendel, D., *Strategy Formulation, Analytical Concepts*, West Publishing Company 1978, 7-11.

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Developing, Monitoring and Evaluating A Corporate Strategic Plan—BHEL's Experience

K. R. PARMESHWAR

This paper in a brief manner describes the history of Strategic Planning in BHEL, a pioneer Public Sector Undertaking in India. BHEL case proves beyond any doubt, organisations must be prepared to reorganise and adapt themselves to the changing environmental conditions, for long time survival and growth.

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Over the years, BHEL in India has emerged as a diversified and divisionalised company operating in high technology areas. Today, it comprises of eleven major manufacturing and service divisions and is active in the fields of energy, industry, transportation and electronics. It's turnover exceeds one billion dollars and the employees are over 70,000. (BHEL's organisation chart is enclosed in Annex. 1). This development has been the result of systematic planning. Since there is a very dynamic relationship between strategy and structure, at different phases of the company's growth, the organisation's structure, content and concern for planning have undergone considerable change.

BHEL's history has certain features common to all public enterprises in India. As would be apparent, these enterprises were set up as part of a national perspective plan for industrial development. In many cases, self-reliance and import substitution in the vital sectors of economy were the major goals.

In the area of high technology, the public sector companies were the only enterprises of the kind in the country. At the stage of their conception, their goals were specific and certain. It is only when the environment changed with varying market needs and technological obsolescence that the enterprises felt the need for a second look at their technology base, product profiles and the organisation structure.

The history of planning in BHEL spans over four phases. These are depicted in Fig. 1. In the formative

phase of BHEL, major importance was given to the planning, review and monitoring of projects. The Chairman's Office consisted of a Secretary to the Board of Directors, Chief Planning & Development (CPD) and Deputy Financial Adviser and Chief Accounts Officer. CPD was assisted by two Chief Project Co-ordinators who dealt with the work on new projects being set up with Soviet and Czech assistance. Consequently, planning activity was limited to monitoring and review of projects, providing coordination among divisions and linkage with Government agencies.

It is in the later years of Phase II that systematic planning started emerging in BHEL. To most of us, it is this phase that would be of interest. The year 1974 is important in the history of BHEL, as in this year the formal marger of HEIL with BHEL took place. Also a comperhensive outline for future course of action for the corporation was prepared in this year keeping in view the needs for continued survival and growth of the company.

The key elements of the Corporate Strategic plan of 1974 were :

* Product Rationalisation
* Engineering reorganization
* Corporate R & D Group
* Indigenisation
* Ancilliary development
* Export Drive
* Non conventional energy systems group
* Nuclear engineering group
* New Service Divisions

—New manufacturing centres

* New location for existing products
* Vertical integration
* New Products

Management Development

Steps for implementation and monitoring :

To implement and monitor the Corporate Plan goals, several steps were taken. Some of them were :

* Organisation restructuring
  —functional differentiation
  —engineering reorganisation
  —product grouping
* Venture management for oil rigs and export.
* Introduction of product planning as basic unit for corporate planning, thus linking strategic plans with operational plans.
* Integrating capital and revenue budget.

Among the very first steps taken for providing an integrated view in all matters, was the setting up of a Corporate Office at New Delhi to assist the Chairman in generating and evaluating alternatives and integrating the programmes of the Divisions. Corporate R & D Division was set up to strengthen the capability in the field of research. A Services & Spares Division was set up to provide adequate after-sales service. Adequate attention was given to finance, systems and management reporting by appointing a full time Finance Director. Personnel function was also given the highest attention with the appointment of Director (Personnel). An independent Division for Corporate Planning & Development was created.

Corporate Executive Committee was formed in 1976 to assist the Board of Directors in formulating long term directives, policies and strategies and for promoting optimum utilisation of resources. As the number of Divisions and spectrum of activities increased, Corpo-

Fig. 1 : Four Phases of Planning in BHEL

1	Project Implementation and Initial Production Phase Upto 1969	Project implementation. Annual Budget. Annual Programme
II	Preparation for developing Corporate Plan 1969-74	Stretching the time horizon. Broad Objectives. Preparation for Planning
III	Implementing the first Corporate Plan 1974-80	Diversification. Organisation Planning for Development. Streamlining Planning process. Development of Strategic planning capability.
IV	Corporate Refounding for the 80s	Strategic Management. Technology upgradation. Entry into high technology areas. Decentralised participative planning.

rate Office became full-fledged with functional Directors and nearly 100 executives to support planning, review and implementation of various programmes of the Company. The Corporate Finance Department had separate groups for development, installation and auditing systems. Personnel Department was responsible for manpower planning and career planning, designing and guiding training programmes and recruitment programmes in addition to assisting in the preparation of policies and systems. Marketing group assisted Chairman in framing marketing policies for the company and in installing total marketing system of BHEL. The need for structured integrating devices was fulfilled by setting up a number of forums such as Corporate Functional Committee, Corporate Product Committee, Project Review meetings etc, cutting across divisions, products and functions of the Company. The functions of such integrating devices was to monitor various short term and long term plans arising out of Corporate Plan.

A major element of reorganization has been the assignment of long term planning in specific product or functional areas to each Executive Director. As the product range of BHEL was expanding, it was felt that strategic planning should not be left alone for Corporate P & D set up. So attempts were made to use the experience and expertise of senior executives who had a wide-based knowledge of many functional/product areas by involving them in planning for products/systems at Unit level. The idea behind creating some of the organization devices was that gray areas which were too important to be neglected would be looked after until stable organization evolved for such function.

Organisation of Planning & Development Division

By the middle of Phase III, a full-fledged Corporate Planning & Development Division was established. This group had counterpart supportive groups at Divisions viz. Bhopal, Trichy, Hardwar, Hyderabad and Power Projects and Services Divisions. The organization of P & D Division was broadly structured around following groups :

—Investment and Facilities Planning
—Operation Planning
—Long Range Planning
—Optimisation & Modelling

Investment and Facilities Planning : This group is responsible for coordinating the companywide investment programmes. The activities include preparation of five year plans, annual capital budgets, modernisation and rationalisation schemes, township schemes, scrutiny of investment proposals and linkage with concerned Government agencies. Work done by this group includes maintenance and updating of data availability and utilisation of various facilities and machine tools. It has undertaken studies in productivity at various Divisions and formulation of policies for replacement and fresh investments.

Operation Planning : This group is associated with formulation of broad objectives and analysis of performance budgets. The group is organized around multi-functional groups for each major division. These desk activities include monitoring of unit performance, assistance to Units, top management reporting etc. The operations planning group along with Corporate Finance Coordinates, Operational review meetings of various Divisions.

Long Range Planning : This function reviews the planning system in the company, updating and formulation of Corporate, Sectoral and Product plans. This group has undertaken studies in organisation development and has also been assisting the company's in-house Management Development Institute in seminars on strategic planning. This group also reviews licensing and collaboration.

Optimisation and Modelling : Considering the increasing use of quantitative methods, a separate group named 'Optimisation and Modelling Group' was created at Corporate Office in 1978. This group has undertaken development of various models using quantitative techniques. The group has completed studies relating to optimal utilization and scheduling of machining facilities, investment appraisal techniques, portfolio analysis and energy modelling.

The organisation of planning set-up at Corporate Office and Divisions is given in Fig. 2 and 3 respectively. The changing complexion of planning activity is depicted by Table 1.

Fig. 2 : Organisation of Planning and Development Division in Corporate Office

Head Planning and Development

Investment Planning	Operations Planning	Long Range Planning	Acquisitions Technology, etc.	Engineering Coordination
— Project formulation and appraisal. — Coordination of project Review committees. — Project monitoring. — Annual capital budgeting.	— Reviewing of MIRs — Analysis of performance budgets. — Coordination of operations monitoring committees. — Material management. — Production coordination. — Project management studies for Industrial projects.	— Review and appraisal of long term plans. — Technology transfer. — Collaboration — Sub-licensing — Organisation planning. — Training. — Review of integrating devices. — Environment Analysis.	— Acquire units divisions. — Facilities planning. — Productivity services. — Technical Development. — Modernisation & Rationalisation,	— Product Engg. & Development programmes. — Research Facilities — Engineering Organisation. — Quality Assurance. — Documentation. — Technical Publications. — NCST Interaction.

Fig. 3 : Organisation of Planning Division at BHEL Units

Unit	Main Tasks	Other Groups Associated with Planning
1. Bhopal Complex	1. Long Range Planning 2. Product Planning 3. Collaborations 4. New Projects Planning 5, M I S; System and Procedures.	— Central Planning. — Project implementation Group. — Product Planning. — Jhansi Planning Group.
2. Hardwar Complex	1. Long Range Planning 2. M I S 3. Systems & Methods 4. Quantitative Methods 5. Computer Systems 6. USSR Coordination 7. Manpower planning	— KWU Cell. — CFFP Planning Group.
3. Hyderabad	1. Long Range Planning 2. Collaboration Coordination 3. Investment Planning & Capital Budget 4. Operations Monitoring, M I S.	— Management Services. — EDC (IT & C), EDC (SWG)
4. Tiruchi Complex	1. Long Range 2. Collaboration 3. Investment Planning 4. Organisation Planning	— Systems & EDP — Data Base Group — Indigenous Development Group — W R I — BAP Planning Group.
5. PP & SD	1. Project Planning 2. Systems	— KWU Coordination Cell. — Regional Planning Groups — Site Monitoring Groups
6. Bangalore Complex — C E D	1. MIS 2. General Coordination 3. Broad Objectives	— Projects Group.

Fig. 3 (*Contd.*)

Unit	Main Tasks	Other Groups Associated with Planning
— I S G	1. Drawing up functional plans from Budget. 2. Analysis of data for Internal Management Reports. 3. Monitoring progress in new business areas.	— Business Development Group — Systems Development Group
— E P D	1. Collaborations 2. Investment Planning 3. MIS.	—

EDC—Engg. Devp. Com. WRI—Welding Research Instt.
BAP—Boiler Accessory Plant.

Table 1 : Function and Planning Division in BHEL Over Phases

PHASE—I (1964—69)

Functions :

— Monitoring and review of new projects.
— Maintenance of Liaison with Govt. agencies, collaborators, site organisations.
— Planning for Projects.
— Sales Coordination.
— Strategies for pricing

PHASE—II (1969—74)

Functions :

— Assist Chairman in generating and evaluating alternatives.
— Integrating programmes of divisions.
— Organisation Development.
— Improving communication and coordination.
— Preparatory work for first Corporate Plan.
— Establish data base for planning and developing the planning systems.

PHASE—III (1974—79)

Functions :

— Structuring planning function and defining responsibility matrix.
— Assist in development of strategies.
— Studies for fulfilling the planning programmes.
— Environment analysis.
— Monitor implementation of long term and short term programmes.
— Stimulate formal planning in divisions.
— Bring out formal planning documents.
— Monitor transfer of know-how and overseeing.
— Organisation design.
— Assist various functional/product committees in drawing programmes.
— Secretariat for executive committee.
— Dove-tailing operational planning with strategic planning.
— Liaison with Government agencies.

PHASE—IV (1980—90)

Functions :

— Plan for modernisation and expansion of manufacturing base.
— Develop technology management capability in view of the rapid rate of technological obsolescence.
— Assist in the development, review and evaluation of product plans.
— Synthesising divisional plans and product plans into the sectoral plans and weaving them together as Corporate plan.
— Introduce contingency planning in all areas of business operation.
— Raising planning capability at divisions by conducting workshops on strategic plng, planning managers' mtgs., etc.
— Assist in preparation of functional plans, viz. Engg. plan, Technology plan. etc.
— Study reorganisation needs.
— Strategic management development.
— Monitoring performance at divisions.
— Enhance information processing capability.
— Environment analysis,

The Current Scene

The fourth phase from 1980 to 1990 is the period in which BHEL is trying to cope with a turbulent environment. The threats and opportunities faced in this phase are :

* Severe resource constraints particularly during VII plan period.
* Trend towards external financing of projects, particularly through inter-government loans.
* Export earnings would be required to balance foreign exchange gap.
* Increasing difficulty to retain specialists and highly qualified personnel under current economic environment.
* Widening of technology gaps due to high cost of development and acquisition.
* Need for innovative approach to Industrial Relations management.
* Increased emphasis on internal resource generation, improvements in productivity, over all efficiency and better cash management.
* Continued emphasis on infrastructure development.
* High growth envisaged in industrial production and technological upgradation.

To cope up with such an environment, key elements of planning should be :

* Modernisation and expansion of manufacturing base, technology upgradation.
* Marketing thrust
* Development of strategic management capability
* Information processing capability
* Flexibility – Resilience
* Contingency planning.

That is, the organisation in 80s must be flexible, adaptive and proactive. A major step in this direction has been the decentralisation of planning activity. Though Corporate P&D group continues to direct & coordinate planning activity in the organisation, basic inputs are generated by unit planning set-ups. In this bottom-up approach, divisions are to prepare unit perspective plan; keeping their microenvironment in view.

Divisions have also the responsibility for developing product plans for products within their purview. The linkage between product plan and other plans in the company is given in Fig. 4. A major ingredient of product plan is the technology plant This details out know-how and know-why gaps and inputs required for bridging these gaps. Based on all these technology plans, a Corporate technology plan is prepared which gives directions for corporate R&D programme. These plans and programmes are reviewed and evaluated in product committees and technical committees. A list of product committees and technical committees as existing today is given in Annexure 2.

A major change in phase IV has been the orientation of planning towards sectors and systems. Product plans and divisional plans are integrated into sectoral plans. The concept of organising a company's business in the form of Strategic Business Units (SBUs) and

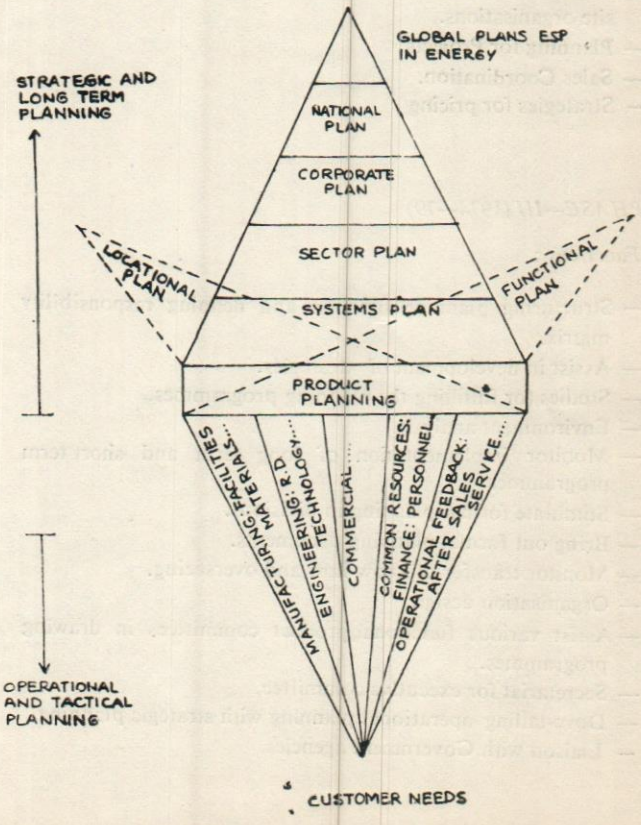


Fig. 4 : Product Planning in BHEL—A Link between Strategic and Operational Planning

grouping SBUs into sectors of business for their integrated and effective management was first developed and adopted by General Electric, USA. In BHEL, even while product plans were being developed, it had become clear that considering from the market point of view, BHEL's business lay in distinct sectors and many of the products served more than one sector. As an industrial product does not usually satisfy a customer's need in isolation, but only as part of a larger integrated system of manufacture, process or end service, systems approach became necessary. Moreover, this will be in line with BHEL's Corporate outlook of 'More than Products, A Total Service".

The above requirements have led to various measures like task forces, committees, special linkages etc. In short, a strong and widely dispersed need has been felt for taking a look at technological, market and organisational needs for serving a segment larger than a product and some times even a system. This segment has been termed as Business Sector and at present there are three major sectors existing in BHEL, viz. Energy, Industry and Transportation Sectors. Fig. 5 gives the constituent products and systems of major business sectors.

When properly implemented, these sectors take over many of the responsibilities of corporate level for review

Fig. 5 : Business Sectors—Constituent Systems & Products

I. Energy Sector	*Thermal/Nuclear*	*Hydel System*	*Transmission/ Distribution System*	*Non-Conventional Energy Systems*
	* TG sets and auxiliaries * Boilers * Boiler House auxiliaries * Pumps * Motors * Heat Exchange * Equipment * Valves * Pipes and Fittings * Control Equpt. * Controlgear	* Hydro sets & auxiliaries * Pump turbines * Micro Hydel * Bulb turbines	* Transformers Switchgear * Capacitors * Insulator * Control Equpt. * Controlgear * Meters @	* Solar Heating system * Solar Power General System
			(@ Predominantly loose sales)	
II. Industry Sector	*Thermo-Mechanical System*		*Electric Drives & Control System*	
	* Industrial TG sets and auxiliaries * Compressors and drives * Industrial boilers and BHA * Valves * Pumps * Motors * Control equipment * Controlgear		* AC machines * DC machines * Control Equipment * Controlgear	
III. Transportation Sector	* Traction equipment * Control equipment * Controlgear			

and approval of product plans. Sectoral plans are based on the constituent product/system plans. Sector planning includes sector strategy development, product strategy review and operating plan development/review within a cycle consistent with the company planning cycle.

To make sectoral strategy identification more meaningful, different segmen ts of market having varied attributes e.g., in the thermal sector, two segments that could be considered are 200/2I0 MW sets of 500 MW and above are being identified. Thus, an attempt is being made to draw broad segmentation to facilitate strategy identification depending upon the specific segment of the business. Following are typical business segments identified.

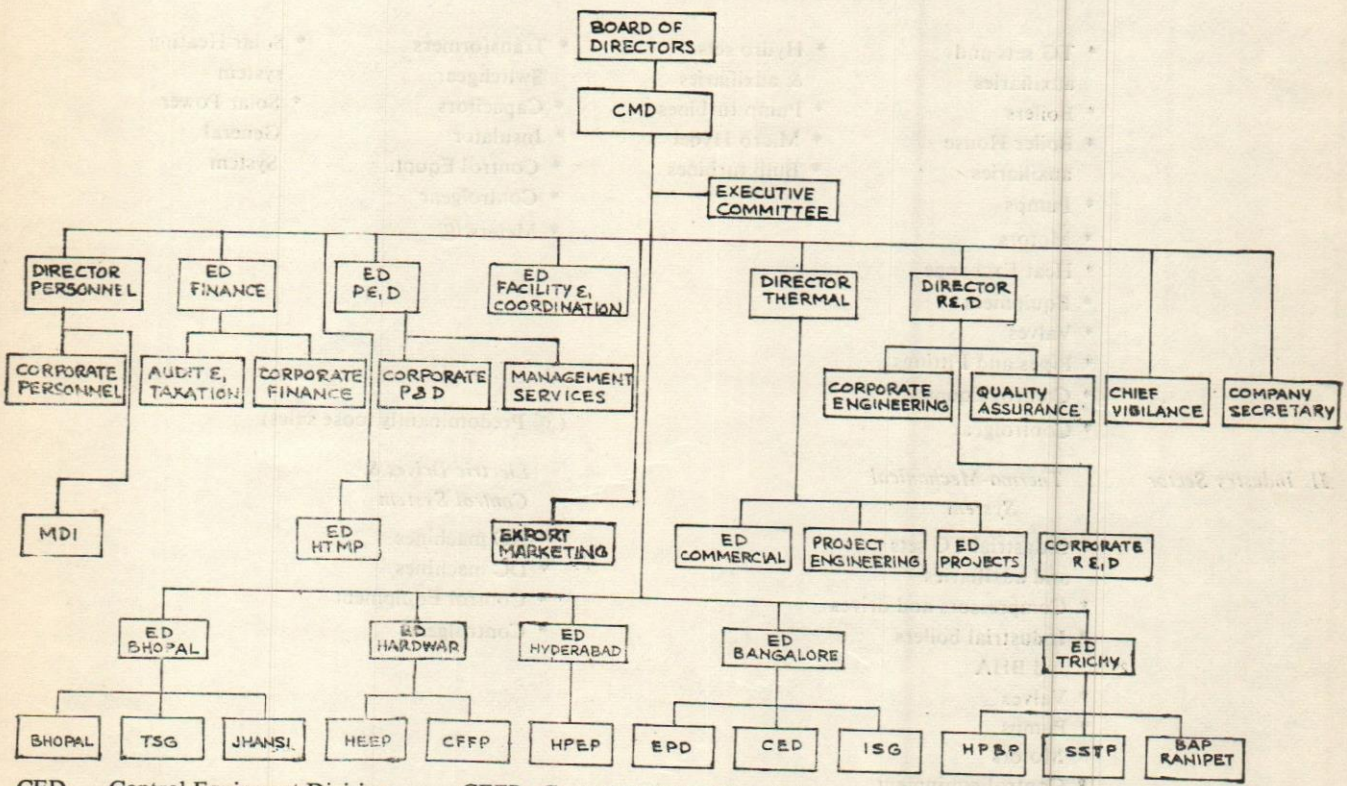
1. Existing products/systems/services which will be strengthened/may be discontinued.
2. Related products and systems which would be taken up.
3. New business areas in the sector which will be taken up.
4. Futuristic business applications in which preliminary work would be started by 1990.

As organisation development is a continuous process, BHEL can not rest content with the organisational devices and mechanisms created so far. Despite these devices, there are bound to be problems in achieving transparency among all these forums.

Every change has brought in its wake new issues and challenges to be faced. But to avoid change and opt for status quo is detrimental to the long term interests of an organisation.

For long term survival and growth, organisations

ANNEXURE-1



CED	Control Equipment Division	CFFP	Central Foundry Forge Plant	CMD	Chairman & Managing Director
ED	Executive Director	HEEP	Heavy Electrical Equipment Plant	HPBP	High Pressure Boiler Plant
HPEP	Heavy Power Equipment Plant	ISG	Industrial Systems Group	MDI	Management Development Institute
EPD	Electro Porcelains Division	BAP	Boiler Auxiliaries Plant	SSTP	Seamless Steel Tube Plant
P & D	Planning & Development	HTMP	Hydro Transmission & Motor Products	R&D	Corporate Research Development
TSG	Transportation Systems Group				

Annexure 2 : List of Product Committees and Technical Committees

Product Committee	Technical Committee
1. Steam Turbines	1. Rotating Electrical Machines
2. Turbo Generators	2. Mechanical Rotating Machines—Thermal Plant.
3. Boilers	3. Static Electrical Equipment
4. Boiler House Auxiliaries	4. Boiler, Boiler Auxiliaries and Coal Programmes
5. Valves	5. Non-conventional Energy Sources, Specialised Engineering Areas and Futuristic Projects.
6. Piping	6. Mechanical Auxiliary Equipment/Thermal Plants.
7. Hydro Turbines	7. Power Controls and Systems
8. Hydro Generators	8. Hydro Turbines and Hydro Systems Engineering
9. Capacitors	9. System Engineering.
10. Traction Equipment	
11. Transformers	
12. Compressors	
13. Industrial Turbines	
14. Pumps	
15. Heat Exchangers	
16. Oil Field Equipment	
17, Control Equipment	
18. Controlgear	
19. Ceramics	
20. Meters	
21. Switchgear	
22. Motors	
23. Spares & Services.	

must be prepared to reorganise and adapt themselves to changing environmental priorities and constraints. It is in this spirit that so many changes were introduced in BHEL over the years. Organisations are composed of people which makes organisational development process complex yet exciting to tackle. This creative element has been in the forefront in BHEL in keeping the corporate strategic planning alive and vibrant. we, in BHEL hope the same will help us tide over the uncertain future with creditable performance.

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Productivity
1983, XXIV, 2, 165-173

Strategic Planning in a Small Firm

K. KITTAPPA

The performance of an organisation, this paper emphasises, depends on the 'Strategic Thrust' that the organisation can exercise to counteract the environmental dynamics. Strategic budget is a factor of importance to Strategic Thrust and is a product of managerial capabilities and the managerial perception of the environment and the managerial aspirations. In this paper is described the performance of a Small Industry and development of a Strategy Plan for its growth and development.

Mr. K. Kittappa is a Director, National Productivity Council.

Strategies, Objectives & Small Firms

The economic results of an organisation depend on the 'Strategic Thrust' the organisation can exercise to counter the environmental turbulances. The magnitude of strategic thrust is decided by the strategic budget developed and the quantum of resources that could be committed. The economic result is then the result of the matching between the strategic thrust and the forces of environmental turbulances.

The strategic budget level in turn is a product of the organiation's perception of the environment, aspirations, the individual and group leadership, the organisational culture and more of the managerial and logistic capabilities. These factors are not totally exclusive and the factors like individual or group leadership and capabilities influence the aspirations which in turn affect the acquisition of capabilities.[1] The leadership more often than other factors affects the 'strategic behaviour' of the organisation. The management changes are not unusual. When the power shifts at the top, the strategic behaviour as well shifts; it may be as small change as change in budgetary behaviour, adaptation in strategies or a total shift or strategies. When Mr R.C. Geigueta took over as Chief Executive of Coca-Cola (U.S.) (1981) which was loosing its market leadership to Pepsy in U.S., and was hitherto increasing the thrust to improve the market share and saw a shift in strategy. The change was to search and stabilize in new markets rather than spending the resources on recapturing the market share!

The strategies are not merely for achieving profit.

The main objectives for which the long range planning and strategic planning are developed are 'Growth and Stability' of the organization.[2] The enterprises cannot afford to stay stagnant at the same level of business operations. They have to grow not only due to internal stresses like better dividends and frustration among employees (stagnation in posts and grades etc.) but also due to life cycles of product, technological changes in process and product, changing policies of the control factions like Government and Financing Agencies. Above all 'growth' becomes the main objective in organisations whose leadership have high aspirations, ambitions and innovative capabilities.

There can be no business without risk; especially growth plans encounter more risks, than normal operation. But a business plan cannot be developed to take blind risks; the enterprises take calculated risks in selecting their venture programmes. Many maintain a part of the existing—even though only moderately paying—business till they stabilise in new ventures. They also develop strategies to stay at the grown level of operation. All these are done to ensure 'stability'. Hence in most organisations the objectives are 'growth and stability'. Problems of small firms: These arguments on strategies and objectives suit larger firms more aptly. But the picture is very different in smaller firms. The problems of smaller firms are very different than the larger ones. The smaller firms are also constrained on the options available. A brief discussion on constraints experienced by small firms in respect of long range planning may be useful at this stage to understand their behaviour.

The work load on the owner/partner is usually heavy. He has to do almost all functions of management. Since he cannot afford to have many tiers of management, he is bogged down with day-to-day operations and trouble shooting and he finds very little time for any conceptual exercise on long range planning.

The turn-over of skilled technicians is very high especially in the trades of salesmen, designers and supervisors. In one company which produces industrial equipment this problem was very acute. In this company diploma holders and degree holders used to join the company in design cell/sales cell and after a year or two of experience they used to leave the company to join medium or large industries. This affected the progress of the company to a great extent. The reason for the turnover is not only the low remuneration compared to bigger industries but also less independence and therefore less job satisfaction due to top management's interference. Such frequent changes resulted in inadequate involvement of lower level management in the strategic management of the firm and also consume the time of top executives in selection for training etc. This also results in top management resorting to secrecy about designs, customers, financing etc. Retaining secrecy, excess interference, less job satisfaction and turnover then become a vicious circle. These factors form a positive feedback loop in which the values only increase with time.

The small firm operates with low capital. Very often managing cash flow for the normal operation itself is a big task. It is very difficult to commit resources/money for longer durations on venture strategies. Hence the strategies have to be for shorter durations and are limited by the quantum of resources available. The low level of operation does not allow experiments with risk capitals.

The market share of an individual small firm is very low. Only a few exceptional companies like the one referred in this paper have a good market share in one or two 'Product Market Combination (pmc)'. This results in heavy competition in the pmcs. Management of majority of smaller firms have reconciled to the fact that the low strategic budget—the resources and money they can afford to commit for development, promotional activities etc. will have very little influence on the turmoils of the market generated by changing market conditions/competition.

The other handicaps are information and perception. Very little information is generated and collected inside the firm. When information structures like even budgeting and costing are totally absent in these firms, we cannot speak of 'strategic information base' and 'competitive information system'. The managements are not exposed to such new ideas and suffer from perceptual limitations of not being able to see beyond the budgetary period of one year.

So it is the Operational Plan which has the higher priority than the corporate Strategic Plan in such firms.

Going in for Strategic Planning

Inspite or all the handicaps the small firms have, some are very successful, A few of them even have well drawn-out plans for a longer duration than the budget horizon. Why do they go in for long range plans ? The management which is ambitious, who have bigger dreams cannot be satisfied with limited results they have been achieving. They would like to widen their vista of operation and improve the performance of the firm.

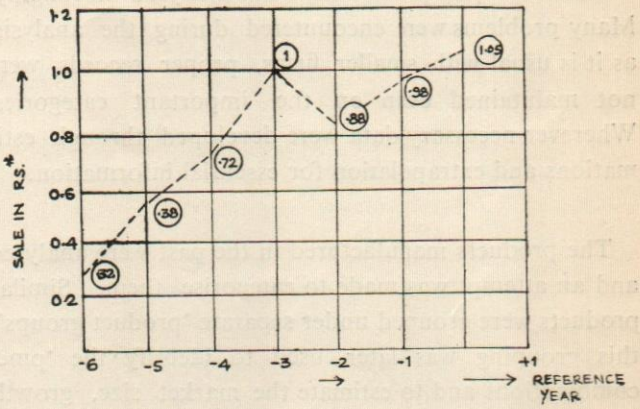
The management who think they are capable of performing better, have higher capabilities than what the firm demands to-day and better knowledge and skill cannot allow their skill to rot. They thrive for better performance and this leadership creates a 'strategic shift' in the firms behaviour.

Some others are motivated by the success others have achieved as compared to their own stagnation. Usually they resort to long range planning when major crisis strikes the firms.

The Firm

The firm whose case is discussed in this paper is registered as a small industry. The factory was originally a cycle parts manufacturing unit. The present owners, with capital raised through friends and relatives, floated a partnership company and bought the factory in 1971.

The cycle Manufactures and retail outlets were the customers for the products at the time of taking over. The Cycle Manufacturers in the region were patronising their own ancillary units and as such large orders from them were only ad hoc. The competition in the retail market was high. Further the retail market being very widely scattered (topographically) it needed a huge sales force. One of the four brothers who took over this company, an engineer, also had some experience in the design of material handling equipments. Hence the new owners decided to diversify into fabrication and material handling equipments business and discontinue the old products. So the reliable handling equipment company was born. We will refer to this company in short as RHE henceforth.



Sales figures are expressed as decimals of sales year under reference.

Exhibit 1—Actual sales in the past

In the past years the firm tried many businesses and there were many additions and deletions to the product line. Many of these changes were not planned but purely accidental. In spite of such variations in product lines the company registered a continuous growth. The management was always trying for higher sales because they knew that higher sales mean higher profit. So the management was not worried about stablising in any product or market or channelising the operation. But in the three years, prior to the year under reference, the steady growth pattern in sales was not maintained (Refer Exhibit-1). All figures in this exhibit and others are express in terms of sales in the reference year. There was a growing concern about the dip in sales value especially in the past two years. This prompted the management to seek outside assistance in analysing the situation.

The main idea behind seeking external experts help is to analyse the reasons for the failures of past and to develop sound policy for growth. The outside consultants, analysed the situation and agreed to provide consultancy. It was decided that the consultant will provide only the process and steps of planning and all the data collection, analysis etc. will be carried out by

the company personnel only. It was thus a 'process consultancy'.

Product Growing

The firm's past performance was analysed thoroughly. Many problems were encountered during the analysis, as it is usual with smaller firms, proper records were not maintained even on the important categories. Wherever necessary data were developed through estimations and extrapolation for essential information.

The products manufactured in the past were analysed and an attempt was made to categorise them. Similar products were grouped under separate 'product groups'; this grouping was later used to identify the 'pmc' combinations and to estimate the market size, growth rate, special characteristics of market etc. This exercise led to the identification of nine distinct product groups. The group wise sales for the past years are shown in Exhibit-2.

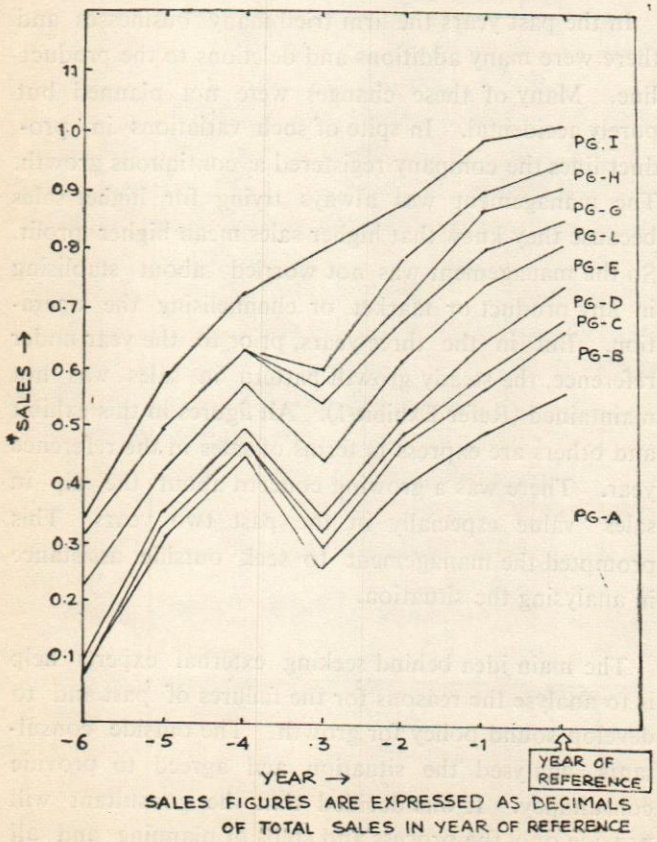


Exhibit-2—Productwise Sales

Present Scene : Product, Market, Management Approach

Product Group-A

Product : This is an equipment used for cleaning of underground sewer lines. It consists of two structures with drive motors which are placed above two adjacent manholes of the sewer line. Buckets attached to wire rope are pulled by the motors to clean the sewer line.

Market : The management has identified about 80 municipalities and corporations as the users.

Management Approach : RHC is the pioneer in this products. It was a monopoly product of the company for many years. Only in the last two years or three, other firms tried to market the product and only one of them succeeded in selling two units each year taking a market share of 10 per cent. The total number of machines sold is steadily increasing. In the previous year RHC and its competitor totally sold 18 equipments. But this is no indication of the market potential. Later on it was accepted that only a small portion of the market has been exploited so far. The management is too happy that they are the market leader and decided to stay at that position.

Product Groups-B & C :

Product : PG-B is an equipment with motor used for cleaning any blockage in the sewer line. This can be hanged from the shoulder of a man and with required length of chromoflex rods (PG-3) and special attachments at the other end of rod, the blockages can be cleared. PG-3 is rods used for this equipment and also sold as accessory and replacement.

Market : Same as Product Group A

Management Approach : Same as PG A

Product Group-B .

Product : This group is small wheel barrows supplied in large quantities usually above 50 nos.

Market : Large industries and civic bodies.

Management Approach : The internal work load is much less and the profit margin is also good. Management does not try hard to get the orders but never refused any enquiry received.

Product Group-D :

Product : This group is winches of different sizes. No standardisation has been attempted. Each time the product is designed and manufactured as per order specification.

Market : There are two markets for this product. One is railways where the winches are used to haul wagons for shunting. The other is shipping where it is used for handling shipways and ladders. There is recession in this market.

Management Approach : Comparatively the volume of sales is low but would like to continue.

Product Group-F :

Product : This group is cranes. The company tried many types of cranes and faced technical design problems. Finally they settled down for overhead travelling cranes only. Recently there developed a stiff competition for this product.

Market : The customers for this type of cranes are the medium and small industries. Since the product is simple to manufacture tiny industries started under 'unemployed graduates scheme' have entered this market. With their low overheads they are able to quote low and bank most of the orders. RHC has realised the slipping of the market and has been quoting low to establish itself back in the market. RHC is successful in winning a few tenders.

Product Groups-G & H :

Product : Recently the firm had a few orders for the manufacture of Screw Conveyors and Bucket Elevators for handling powdery material from sugar and other sectors.

Market : Sugar and chemical factories.

Product Group-I

Product : This group includes all miscellaneous orders handled by the company like fabrication of air conditioning ducts, water tanks, etc.

Market : Miscellaneous and difficult to specify as the jobs are accepted from all sectors including construction sector.

Management Approach : The profit margin is very high with this product but acquiring orders is difficult. The management likes to continue this product and more so to increase sales in this field.

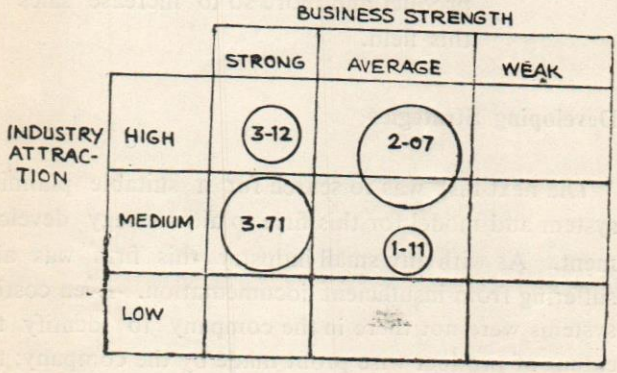
Developing Strategies

The next task was to search for a suitable planning system and model for this firm to aid strategy development. As with any small industry this firm was also suffering from insufficient documentation. Even costing systems were not there in the company to identify the extent of product wise profit made by the company; the consultant had to generate information to compute the input resources requirement for each product and the profit. Further the company cannot afford to generate information and maintain any elaborate planning system. Forecasting for a longer horizon like 5 to 10

years may produce too hazy a picture which may not be useful.

A few approaches in strategic planning models have already been tried world over for decision making on 'business operation level adaptation' and integrating planning needs successfully. To name a few, Business Screen Matrix developed by General Electric Company, Business Portfolio Matrix by Boston Consulting Group, Model for small firms by Lemmens smeet, and TOWS Matrix by Heinz Weihrich. There is also another simpler approach which recommends writing down the strength weakness etc. separately and listing down the appropriate strategy and the strategic implication and later evaluating the strategies. These methods are briefly described in subsequent paras.

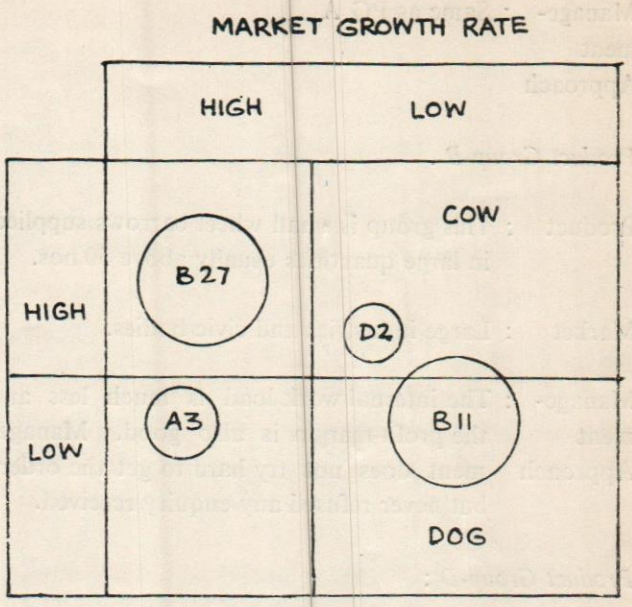
Business Screen Matrix: General Electric developed and used a matrix[3] to aid the strategy designers in developing and evaluating strategies. Exhibit-3 shows GE's Business Screen Matrix. Basically it consists of two sets of critical variables. Business Strengths and Industry Attractiveness. Each variable is divided into three ratings-high, medium and low-with a result it is a nine cell grid. The position of any product of the company in any specific grid cells is its comparative position in the two variables—Business Strength and Industry Attractions. A few factors used to evaluate the product position against the two variables are listed below :



BS—Relative Mkt share, price competitiveness, product quality competitor information, sales effectiveness. share of market

IA—Market size/growth rate, profit margin, competitive intensity, cyclicality, seasonality, scale of economics

Exhibit 3—Business Screen Matrix (GE)



Exibit 4—Business Portfolio Matrix

Business strength	Industry Attraction
Relative market share	Market size
Price competitiveness	Growth rate
Product quality	Profit margin
Knowledge of customer	Competitive intensity
Sales effectiveness	Cyclicality
Geography	Scale of Economy

This model needs a strong information base, to feed the factor and locate the product in the grid cells. Further this matrix analysis does not give adequate attention to new industries that are beginning to grow.

Business Portfolio Matrix : Boston Consultancy Group developed another matrix (Exhibit-5) which essentially shows the linkage between the business growth rate and the relative competitive position of the enterprise (identified by the market growth rate and relative market share) (3,4). This matrix is also called as Growth Share Matrix. As shown in Exhibit-4 it contains only four grid cells. However, this approach has been criticized as too simplistic and the growth rate criterion has been considered insufficient for evaluating the industry's attractiveness. Similarly the market share as a yardstick for estimating the competitive position may be inadequate.[5]

TOWS Matrix : To overcome the handicaps of the above two matrices and also other matrices like 'competitive position, vs stage of product/market evolution carrying out a situational audit and writing down a few important strengths, weaknesses, opportunities and threats. Then they are incorporated in the matrix

INTERNAL → FACTORS / EXTERNAL FACTORS ↓	INTERNAL STRENGTHS	INTERNAL WEAKNESSES
	S1 —	W1 — .....
	S2 —	W2 — .....
	S3 —	W3 — .....
	↓	↓
EXT-OPPORTUNITIES	→ SO : MAXI-MAXI	→ WO : MINI-MAXI
E1 —	1)	1)
E2 —	2)	2)
E3 —	3)	
E4 —		
	↓	↓
EXT-THREATS	→ ST : MAXI-MINI	→ WT : MINI-MINI
T1 —	1)	1)
T2 —	2)	2)
	3)	

Exhibit 5— Tows Matrix

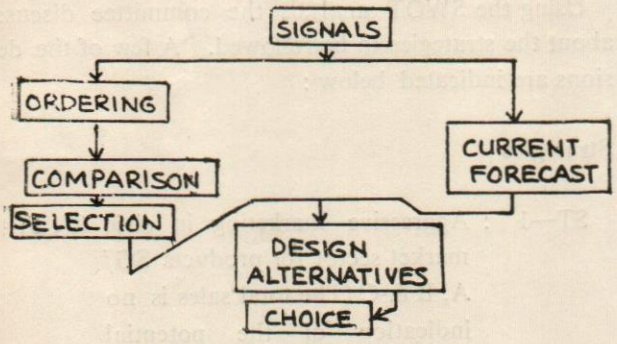


Exhibit 6—Lemmens Smeet Model in Strategic Decision Making

Matrix' (CW Hofer & D Schendel), 'Structural pressure Vs Financial Pressure Matrix', 'Degree of discretionary response potential *vs* Degree of predictability Matrix', which are developed for different specific purposes, Professor Heinz Weihrick[5] suggest TOWS Matrix for strategy development. The general format of this matrix is shown in Exhibit-5. This involves and the strategies are then thought of and written in the four grids. In the grid '50' strategies to maximise the use of strength with any matching opportunities (Maxi-Maxi) are written and so on. This helps in developing strategies to use the opportunity or strength and at the same time ensure 'synergy'. Further it helps in eliminating those which contravene with the threats/weaknesses vice versa.

Lemmens Smeets model for small firms : Mr Arie Nagel in an article based on the work carried out in about 50 firms presents a much simpler model for strategy formulation for the smaller firm (b) The model is shown in Exhibit-6.

Approach Adopted and Findings

The firm under discussion is a small firm with almost no information documented about the past. As usual

with smaller firms, here also management have thought of policy planning due to a signal-in this case it is stagnation in sales etc. The planning process may be acyclic. Hence the management and the consultant agreed to avoid any elaborate planning procedure and use a simple system which could be maintained by the internal personnel after the consultant leaves. For the purposes of developing the strategies and integrating a simple approach similar to Lemmens Smeet model and TOWs Matrix was originally adopted in this case.

Exhibit 7—Productwise analysis

Product Group	Price Rs. 1000	Profit Contribution	Own Sales	Market Share	Growth in Demand
A	80	High	High	High (90%)	High
B	25	High	High	High (80%)	High
C		Medium	High	Medium	High
D	0.5	High	Low	Low	Medium
E (Ships)	30	Medium	V.Low	Low	Low
(Railways)	50	Medium	Low	Low	High
F	80	Negative	V.Low	Low	Medium
G	200	High	Low	V. Low	Medium
H	180	High	Low	V. Low	Medium
I		High	Low	V. Low	Medium

Simple models (manual) were first developed to compute the work load, cost of material etc. required for each of the product group and to estimate the profit contributions. Past records were analysed to get the number of tenders received, quoted, matured and to compute the maturity ratio. Information were collected on market conditions through discussions with outside agencies, salesman and secondary information sources. The same are given (without figures) in Exhibit-7.

A series of management meetings were conducted to carry out SWOT analysis. The findings are listed below:

Strengths

S1 Good design capabilities.

S2 Comfortable cash flow position with bill purchasing facility from bankers.

S3 Market recognition in products PG/A, B & C and high market potential.

S4 Company's present status—registered as small industry.

Weaknesses

W1—High turnover of technical personnel

W2—Disorganised Sales force

W3—Costing & Labour control information

W4—Products are easier to copy.

Opportunities

Q1—Growing markets for products PG/A, B, C, E (Railways) G & H

Q2—Competitors for products PG/A, B & C are not very aggressive

Q3—Acceptance and success of PG-G & H by customers

T1—Imitators entering the market in PG/A, B & C

T2—Competitors with small overheads for product PG-F

T3—Competitive market structure generally for all products

Using the SWOT analysis the committee discussed about the strategies to be followed. A few of the decisions are indicated below :

Strategies

ST—1 : Aggressive marketing in civic *01*, *S1* market sector for products SG/A, B & C (The total sales is no indication of the potential demand which is much higher. Conduct demonstrations, participate in exhibitions, advertise the name of present users and and regular sales cells)

ST—2 : Develop the new market for *S1*, *W4* product Sh—A, i.e., with big *01*, *T1* housing colonies of industries,

Develop industrial use market for product SG-B and C, i.e., chemical/process industries.

ST—3 : Make sub-assemblies of SG-A & B and keep ready instead of of manufacturing to order *S2, 01*

ST—4 : Introduce special technical features and patent them for product PG-A & B. Develop total wagon handling systems and sell to Railways instead of selling only the winches. *S1, S3, 01, T1, T3*

ST—5 : Discontinue sales to shopping market (SG-E) and sales of product PG-F *T4, W5 T2, W5*

ST—6 : Reorganise sales force. Train & have 'product salesmen' for PG-A, B & C and 'common salesmen' for all other products regionwise & sectorwise. *W2, 01*

Long-Range

ST LR : Develop PG-G & H for perfection Obtain collaboration for products like load markers cleaners, etc. for civic market.

Based on the above and other strategy guidelines a plan was prepared. All the input expenses required including additional manpower, sales expenses etc. were incorporated and the total short term and long term loan and capital restructuring required were worked out. A series of discussions were held with the partners/ bankers to see the feasibility of raising funds. Bankers agreed to raise the bill purchasing facility limit but not to the extent the company required. The plan was revamped taking into consideration all the constraints.

REFERENCES

Heinz Weihrich, Long Range Planning Vol. 15, No. 2, 1982

Arie Nagel, Strategy Formulation for the Smaller Firm—A Practical Approach. Long Range Planning, Vol. 14, 1981.

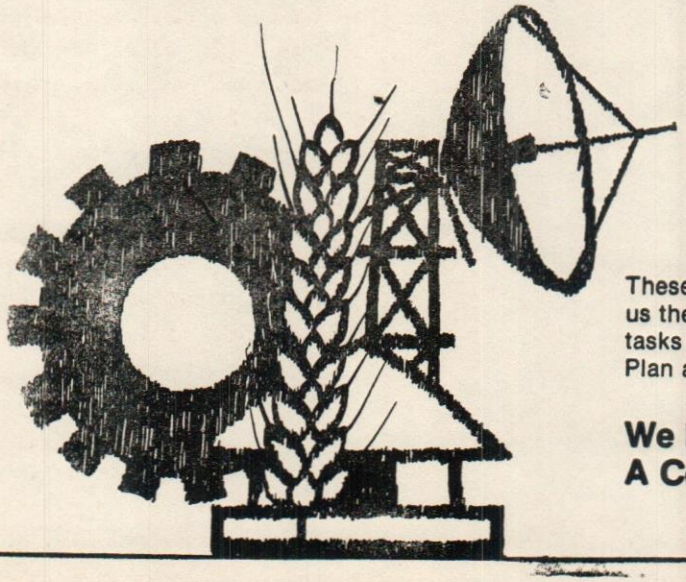


We grow enough to feed ourselves— no small achievement considering that India is the second most populous country in the world which had had to spend heavily on imports of foodgrains.

We are one of the leading industrialised nations of the world—we produce everything from radios to computers, needles to the most sophisticated machinery and equipment.

We have more trained scientists and technicians than any country in the world (except USA and USSR). Joint industrial ventures are being set up with our help in many developing countries.

Let us take pride in our achievements



These achievements have given us the skill and ability to fulfil the tasks set out in the Five Year Plan and 20 Point Programme.

We March Forward To A Confident Future

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Perceived Role Stress and Employees' Productivity

DR. A.K. SRIVASTAVA

The study aimed at determining whether or not the employees' potentiality to produce comparatively more influences their perception of role-based stress. The results indicate that the employees belonging to high and low production groups significantly differed from each other, with regard to their indices of perceived role stress. The employees producing more were observed to perceive lesser ambiguities, conflicts and workload with respect to their job roles as compared to those belonging to low production group.

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The employee in organization is not absolutely independent in performing his prescribed job activities. He has to perform in accordance with various relevant communiques and expectations of the others around him at job. Thus, performance in organization is not contingent upon only the task activities and behavioural settings, but also upon patterns of 'interpersonal connectedness' within which those task performances take place. The prescribed job activities that get to be performed in context of the organizational interpersonal connectedness are referred to as 'job role'. But on certain occasions and to certain employees the demands of the job roles might prove to threaten to exceed occupants' capabilities. A psychophysiological state of the employee resulted in by the demands imposed by job roles which threaten to exceed his capabilities may be denoted as role stress or role-based stress. Analysing the dimensions of role stress Kahn et al. (1964) and McGrath (1976) identified 'role conflict' and 'role ambiguity as its two major sources. Besides the two, perceived 'role overload' has also been reported to be a subform of role conflict.

Role stress is not an absolutely objective phenomenon, rather it is subjectively experienced, as it is contingent upon the employee's cognitive appraisal of the stressing agents. The emotional, physiological and behavioural responses viewed as indices of subjectively experienced stress are greatly influenced by employees interpretation of the objective stress situations, which, to a great extent, depends upon his relevant personal attributes

experiences. Among others employee's production capability might prove to be a prominent factor to extend significant effect on his perception of and reactions to role stress.

In the present era of high stress and anxiety there has been much emphasis in research on organizational stress : its causes, correlates and effects on job behaviour. A number of studies have highlighted the effect of stress, general as well as specific, on task performance (Hebb, 1955; Easterbrook, 1959; Cofer & Appley, 1964; Lowe, 1971; Lowe and McGrath, 1971; Greene & Organ, 1973; Schuler, 1977; Srivastava, 1980). But the proposed study purports to alternatively conceptualize the stress-performance (production) relationship, considering the second as the determinant of the first rather than vice-versa. In the framework of theoretical propositions, it is hypothesized here that the employees attributed with high productivity, due to his high motivation and confidence to adequately meet the exceeding demands of job role, would be perceiving and experiencing mild role stress as compared to those possessing low production capacity.

Methodology

Sample :—The sample of the study consisted of 60 skilled workers from the mechanical section of the Diesel Locomotive Workshop, Varanasi. The subjects were randomly selected from two specific groups, i.e. constantly high producers (N=30) and low producers (N=30) from the high and low production groups. The categorization was made on the basis of personnel production records of last one and a half year. The recorded production indices were also verified by the employees' assessment by their supervisors. The average of the "hour-saved" by the high production group has been 84.772 (σ=4.058) while it was only 39.712 (σ=8. 569) for the low production group. The two groups were kept comparable to each other with respect to the average age, length of service and salary of its members.

Variables and Measures :—The study involved measurement of two variables, i.e. productivity (I.V.) and role stress (D.V.). The official production record' was taken as an objective criterion for determining employees' productivity. The 'hours saved' by the employee in completing his assigned task in a period of six months was taken as an index of his productivity.

To ascertain the extent of employees' perceived role stress three sub scales of the Occupational Stress Index (Srivastava & Singh 1981) were used. The stress arising from role overload, role ambiguity and role conflict were taken into consideration to work out an index of role stress. The high and low production groups were compared with each other with regard to their indices of perceived role stress.

Results :—The results obtained out of the statistical treatment of the data are recorded in the Table 1 and 2.

Discussion

A perusal of the results of the present study categorically establishes that the employees maintaining a constantly high production level by virtue of their attributed productivity perceive and experience lesser stress arising from their job roles, whereas, the employees producing constantly low do contrarily. It is apparent from Table-1 that the high and low production groups of the employees significantly differ from each other with regard to their indices of perceived role stress arising from role overload, role ambiguity and

Table 1 Comparison of the High and Low Production Groups with regard to their Perceived Role Stress

Production Groups	Perceived Role Stress			
	N	X	σ	C.R.
	Perceived Role Overload			
High production group	30	15.00	4.04	3.55**
Low production group	30	18.57	3.73	
	Perceived Role Ambigutiy			
High production group	30	10.03	2.69	3.89**
Low production group	30	12.97	3.12	
	Perceivcd Role Conflict			
High production group	30	12.40	3.14	3.86**
Low production group	30	15.63	3.36	

**p>.01

Table 2 : Correlation between indices of production and perceived role stress of the employees of the combined group (N=60).

Variables	r
Production and perceived Role Overload	−.28*
Production and perceived Role Ambiguity	−.37**
Production and Perceived Role Conflict	−.37*

**p>.01
*p>.05

role conflict. The results also indicate inverse relationship between the two variables studied here. The obtained results confirm the proposed hypothesis, and alternatively conceptualize the stress-performance (negative) relationship.

The findings of the study may be explained with reference to the fact that the cognitive appraisal of the objective role stressors of high producing employee is influenced by his positively prejudiced job attitudes, resulted from his self confidence to cope with exceeding, and conflicting demands of the job roles and his high n achievement. Atkinson and Feather's (1966) postulations that high n achievement generates attraction for the task and that people with high index of n achievement voluntarily use and get tested their abilities and are attracted towards comparatively difficult and risky tasks with less apprehension about failure, suitably explain and interpret the findings of present investigation. Besides, the employee frequently facing and successfully meeting with the exceeding demands of job roles becomes 'stress resistant'.

Another prominent fact which emerged out of the study is that the stress arising from role ambiguity is perceived and experienced is least as compared to the stress caused by role overload and role conflict by the employees belonging to high productivity group. The perception of role ambiguity has been observed to be moderated to the maximum by the effect of employee's high productivity. Since role ambiguity is a direct function of the discrepancy between the information available to the employee and that what is required for adequate performance of his job roles, a highly productive employee is more likely to be more competent, well informed, and quite clear and confident about his job role and its execution, and therefore, perceives the stress arising from role ambiguities in the least.

It may also be argued that the high producing employee, as being quite confident of retaining his job, as well as of getting due promotions, does not tend to be uncertain and anxious about his 'job security' and 'advancement-opportunities'. Ambiguity also comes from high rates of changes in job role, technology, and organizational environment. But the high capacity to adjust with the demands of new situations of the potential employee makes him "immune" to particularly such stress as arising from immediate changes in the job role and work environment.

The notion of a positive relationship between productivity and job satisfaction also helps explaining the present findings. Since the high production leads to job satisfaction (Locke, 1970; Porter & Lowler, 1968; Ford, 1969; Siegal & Bowen, 1971), and job satisfaction negatively correlates with stress arising from role conflict (Miles, 1975; Schuler, 1975) and role ambiguity (Lyons, 1971; Green & Organ, 1978; Miles, 1975; Schuler, 1975; Beehr, 1976), the employees' high productivity may also be supposed to be negatively correlated with their role stress.

McGrath's (1970) formulation that perceived reinforcement or consequences of the performance can operate to reduce the level of subjectively experienced stress seems to have applied here. As the highly potential employees, selected for the present study, have been receiving 'extra wages' for their excessive production. The perceived monetary reinforcement for their efficient performance would have operated to influence the employees' perception of stress arising from job roles and its subjective experience specially in the present times of economic predominance.

Conclusion

The results of the study enable us to conclude that the employees' potentiality for better job performance influences, their perception of work-load, ambiguities and conflicts relating to their job role. The employees producing more, by virtue of their high coping capacity

and motivation, perceive lesser role stress as compared to those maintaining low production level. Therefore, it may be established that not only the perceived role stress influences employees' job performance but their performance level also determines their perception of role stress to a considerable extent.

REFERENCES

Atkinson J.W., and Feather, N.T. A theory of achievement motivation. N.Y., Wiley. 1966, 106.

Beehr T.A., Perceived situational moderators of the relationship between subjective role ambiguity and role stress. Journal of Appl. Psychology, 1976, 61, 35-40.

Cofer C.N., and Appley, N.H. Motivation: Theory and Research, New York : John Wiley, 1964.

Ford R.N., Motivation through the work itself. New York : American Managemnt Association, (1969).

Green C. and Organ D., An evaluation of causal models linking the received role with job satifaction. Administrative Science Quarterly, 1973, 18, 95-103.

Hebb D.O., Drives and Central Nervous System. Psychological Review, 1955(a), 62, 243-254.

Kahn R.L., Wolfe D.M., Quinn R.P., Snock J.D. and Rosenthal R.A., Organizational Stress : Studies in role conflict and ambiguity. Wiley, New York, 1964.

Locke E.A., Job satisfaction and job performance : A theoretical analysis. Organizational Behaviour and Human Performance, 1970, 5, 484-500(b),

Lowe R., Stress, arousal and task performance of little league base ball players. Unpublished doctoral dissertion. University of Illionis, Urbana, 1971.

Lowe R. and McGrath J.E., Strass, arousal, and performance. Some findings calling for a new theory. Project report, AF. 1161-67, AFOS B, 1971.

Lyons F., Role Clarity, need for clarity, satisfaction, tension, and withdrawl. Organizational Behaviour and Human Performance, 1971, 6, 99-110.

Miles R.N., Role requirements as sources of organizational stress Journal of Applied Psychology, 1976, 61, 172-149.

McGrach J.E., Stress and Behaviour in Organization. In M.D. Dunnette (Edn.) Handbook of Industrial and Organizational Psychology, Rand McNallay College Publishing Co., U.S.A., 1976.

Porter L.W. and Lawler E.E., Managerial attitudes and performance, Homewood, III : Dorsey Press, 1968.

Schuler R.S., Role perceptson, satisfaction and performance. A partial reconciliation. Journal of Applied Psychology, 1975, 60, 683-87.

Schuier R.S., Role perceptions, satisfaction and performance moderated by organizational level and participation indecision making. Academy of Management Journal, 1977, 20, 159-165.

Siegal, J.P. & Bowen D., Satisfaction and performance : Casual relationships and moderating effects. Journal of Vocational Behaviour, 1971, 1, 263, 263-269.

Srivastava A.K. and Singh A.P., Construction and standardization of an Occupational Stress Index : A Pilot Study. Indian Journal of Clinical Psychology, 1981, 8(2), 133-136.

Srivastava A.K., Effect of Occupational Stress on productivity of blue-collar workers (in press).

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Management of Research and Development

Dr. G. C. BERI

In recent years, research and development activity has been receiving increasing attention. However, mere quantitative expansion of this activity will not be enough. What is required is to ensure proper selection, completion and commercial application of research and development. In this respect, management can play an effective role. This article highlights the role of management in handling some major problems such as the selection of research personnel and research projects, research budgeting and linkage between technical innovation and marketing. It finally emphasizes the need for a forward looking management so that it can really be a catalyst for research and development activity.

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R & D is Growing in importance

In the modern world, there is an increasing awareness not merely of the importance of technological innovation but also of the various related problems. This is evident from a plethora of literature available on the subject. There is an imperative need for technological innovation in developing countries so that they can bring about desired improvement in the standard of living of their people.

Research and Development (R & D) activity leads to technological innovation. It can be undertaken by such agencies as business and industrial firms, research institutions and cooperative bodies like trade and industry associations. However, mere promotion of R & D activity in quantitative terms is not enough. What is required is that R & D activity should be meaningful, successfully completed and finally exploited commercially. In this respect, the role of management is crucial but it does not seem to have been fully recognised and understood. The present article attempts to highlight the role of management in R & D activity and discusses some major areas where management is required to do decision-making. Although its main focus is on R & D activity of industrial firms, many of the observations made here are also applicable to research and development undertaken by research institutions.

In view of the increasing magnitude of R & D expenditure in Indian industry, it has become all the more necessary to ensure that industrial units get the maximum benefit from it. An important factor that

does not allow them to take the fullest advantage of their R & D activity is its poor management.

Further, research and development is a joint effort where several persons are involved. In a team work, it is necessary that there should be proper understanding among the members. This calls for proper organisation, effective communication and purposeful direction of R & D activity. That is to say, principles of management become relevant for conducting R & D smoothly.

In the United States, an extensive study on R & D Productivity[1] was undertaken. It was carried out in two phases—1973-74 and 1975-77, the latter having a wider coverage. The study covered a large number of industrial organisations, R & D managers, prominent consultants, etc. Its findings clearly emphasize that productivity of R & D activity, *inter alia*, depends to a large extent on the management especially the top five percent of its technical staff—persons who possess deep insight in their areas of specialization, provide innovative ideas for further exploration to the staff, sound and crucial judgement and who are the decision-makers. It has emphasized that in the years to come greater professionalism in R & D management will be needed. At the same time, it should be realised that management of R & D activity is not so easy as it might seem at first sight. This is because it deals with something unknown and which has no existence at the moment. There is an element of risk in the very nature of R & D activity which makes its management all the more demanding and challenging. It is true that experts in a chosen field where R & D is to be undertaken would give serious thought to the extent of risk involved before finally deciding in favour of that activity. But the fact remains that there is an inherent element of risk in the very nature of R & D activity.

Management's first obligation is to recognise its own role as a catalyst for R & D activity. This implies a basic understanding of the R & D process. It has been observed by Michael Shanks that research has proved most successful where management has been most emotionally and intellectually committed to its success. It has also flourished where there is a certain fluidity and flexibility in the company structure, which permits the interplay of personality and ideas, and where management is psychologically ready to alter existing plans and patterns to accomodate change and innovation.[2] Thus management must be forward-looking and committed to research and development. If the management itself does not have its full faith in R & D activity, how can it inspire confidence amongst its technical personnel for research, development and innovation ?

Need for Specific Personnel Policies

The role of top leader in R & D is very important. There does not seem to be sufficient recognition of this. It is worth emphasizing that in many innovations it is the individual—a technical enterpreneur—who plays a key part. A study, based on ten innovations in the materials field, found that there was "a single champion who could claim responsibility and credit for seeing through the idea from germination to ultimate exploitation".[3] An organisation which offers sufficient freedom to the top people to pursue R & D activity in their own way would be more successful in innovation. Such an organisation should be people-oriented rather than product-oriented, and the people around whom the organisation is built enjoy the freedom to move about within their disciplines, from discipline to discipline, and from research to development to testing and engineering.[4]

In order to ensure that R & D personnel perform well and contribute their maximum towards the success of their research work, the firm must have a congenial environment. It is not merely physical facilities that form the environment but many other aspects should also be looked into. Officialdom and bureaucratic approach must be avoided. There must be freedom for exchange of views with each other on an informal basis. R & D personnel should feel that there exists a professional atmosphere which offers sufficient challenge. In the evaluation of their work, absolute objectivity must be adhered to and merit should be recognised and awarded. This will act as an incentive to hard working and competent people. Under such conditions, it will be possible to retain highly qualified and competent R & D personnel—within the organisation. At the same time, it may be desirable not to offer too much security of job. This may lead to complacency on the part of permanent employees; their services may continue on

the basis of their performance. Perhaps, it would be better to offer contractual appointment for a period of 3 to 5 years subject to renewal from time to time on the basis of a satisfactory performance. Too much security of job is as much harmful as excess of insecurity leading to continuous tension and anxiety on the part of the employees. The organisation should be able to develop a good system in this regard.

Many a time it has been noticed that there is lack of direction of R & D activity. While assigning the work to employees, they must be told the objectives behind it and how its fulfilment is important for the firm. Mere selection of certain problem for R & D and assigning it to the staff are not enough. There must be proper direction from time to time though excess of it is to be avoided. The latter will dampen the spirit of initiative and inquisitiveness of the employee which are so important in R & D activity.

Another aspect in regard to the human factor is that of technological obsolescence. In a society where new technical developments are taking place frequently, it may not be surprising if an R & D employee finds his knowledge obsolete unless he keeps himself abreast of such developments. Technological obsolescence will bring down the morale of the employee who will lose his self-confidence and will feel handicapped by such negative feelings. It would, therefore, be desirable for the management to impress upon R & D personnel to be up-to-date in their respective fields of specialisation. Occassionally, seminars and symposia may be arranged. It should be obvious that it is the R & D activity that leads to technological development and innovation, as such technological obsolescence cannot be tolerated in this activity itself. Persons, who tend to become obsolescent and thus are not able to contribute much to R & D activity should either be withdrawn from it or else be given some type of orientation. Suitable training programmes both within and outside the organisation should be devised for such people. Management should aim at developing them to the extent possible.

In this context, the findings of a study on industrial R & D may be cited. According to a study done by Ashok V Desai, most of the companies covered by it in a survey of industrial R & D in India have no personnel policy and "the idea of recruiting scientists with certain qualities and building up their capability overtime—of investment in human resources—is virtually absent. When questioned (during the course of the survey), most companies were of the view that turnover in their R & D departments was too high to permit long-term personnel development."[5]

These observations based on a field survey point out that Indian management has not made serious effort to develop a conducive personnel policy in respect of R & D activity. In fact, rapid turnover of R & D personnel should itself suggest that there is need for improvement in the environment in which they work. In this regard, a point that needs to be emphasized is that management should endeavour to increase creativity of the R & D personnel. A number of more or less formal methods[6] are now available for enhancing the problem-solving insight and creative capacity of individuals. These methods can be tried out and those which yield good results may be followed by management to encourage creativity of its R & D personnel.

Basic or Applied Research

A crucial issue in R & D activity is whether the management should promote only applied research or basic and applied research. In the latter case, a further question is how much of each type of research is to be undertaken. Though industry cannot be equated with university where most of the basic research is carried out, the former must do basic research as well. It must undertake enough basic research to keep its applied research healthy.

The emphasis to basic and applied research will vary from industry to industry and from one unit to another within the same industry on account of such factors as technical competence of the R & D personnel, availability of financial resources, size of the industrial unit, etc. It should be realised that basic or fundamental research, which does not give any practical advantage to the company in the immediate future, should not be given up altogether. This would otherwise lead to dissatisfaction among top scientists and engineers who may go elsewhere to have greater scope in basic research.

Choosing A Project

Then comes the question of right selection of a research project. How does one identify a problem which is not only researchable but also has a growth potential for the enterprise ? Is it the top executive who identifies a problem to be taken up by his enterprise? In several cases, many persons are involved in the process of selection of a research project. It will be advisable to form a good team comprising engineers, scientists, marketing experts, etc., to identify researchable areas. It should also be clear that in the beginning only a broad area of research has to be ascertained. It is only when one gets along in that area and some work has been done that there will be greater clarity in one's thinking. This will then help the firm in identifying the problem on which work is to be carried out. Normally, the choice of a project will be dictated by a variety of factors such as the technical competence of the staff, financial resources available with the firm, market potential and profitability of the venture, etc. In almost all cases, technical-cum-market-oriented investigation has to be undertaken. This aspect is discussed later in this article.

Social Responsibilities of Research in Business

There is an increasing realisation in the society that business should discharge its social responsibilities. Many enlightened business organisations have given serious thought to this aspect and come out with specific programmes to improve the social environment. Since R & D is an integral part of business activity, it is desirable that it is in conformity with the social objectives. For instance, our policy in recent years has been that of import substitution and export promotion. In view of this, management should give greater priority to projects falling within these categories. Similarly, research pertaining to control of air and water pollution should be given precedence over other types of research. The point to emphasize is that management's awareness of social problems and its concern to find suitable measures to overcome them should, as far as possible, be reflected in the priorities of its R & D programme.

Budgeting in Research

In order to decide the funds for allocation to R & D, the first step is to formulate the broad guidelines of the R & D programme that fits into the overall objectives of the firm. To begin with, it may be advisable for the firm to set both maximum and minimum levels of funds that can be devoted to its R & D activity. These limits, in the initial stage, will be rather approximate and may be arrived at in consultation with R & D executives and the management of the firm. The final budget on R & D activity should be built up by carefully scrutinizing and assessing the requirement of each project. "The minimum programme must be large enough to insure that the company's desired competitive position within its intended industry niche is maintained. A maximum is set on programme size by the rate at which the company can organizationally and financially assimilate new technology."[7] Within these two limits, the firm may profitably use a few guidelines in making its initial budget estimate.

These guidelines are: (i) A specified percentage of sales may be decided. (ii) Budget may be mostly guided by the R & D effort of major competitive firms though many a time such information may not be available. (iii) The firm may apply the same rate for research budget as it has planned for its growth. For example, if the firm intends to achieve an overall 10 per cent growth in its operations, then it may enhance its research budget too by the same percentage. (iv) The firm may arrive at the overall research budget by aggregating the budget for all the research projects. Each project should be considered on its merit. This involves the estimation of overall budget by working from bottom to the top. (v) The firm may follow the "Strategic missions" approach, which involves first the setting of broad strategic goals by the firm such as market penetration and profit goals for each product line, cost reduction goals, public image goals, diversification and flexibility goals, etc. It then decides on the R & D activity which supports these goals. The firm continues to allocate funds to a particular R & D activity as long as it is satisfied that the activity will further the cause of its strategic goals.

The last two approaches are obviously far more comprehensive than the earlier ones. It may be mentioned here that many other methods are also used by firms to determine their research budget. These approaches are mostly based on formulae for estimat-

ing the profitability of new research projects. However, such approaches should be used with great understanding and caution. These should not be used simply because they are available. Generally, when numerical methods are used, one is likely to be carried away by their results in total disregard to experience and judgment.

Once the overall research budget has been determined, the question of detailed budgeting arises. This involves the allocation of funds to different items such as salary and allowances of R & D personnel, travel cost, material cost, etc. A large part of the funds is obviously in the form of salary and allowances of R & D personnel. Apart from this allocation, the firm is also required to draw a capital budget indicating the proposals for acquisition of capital equipment required for conducting R & D. It may be necessary at this stage to balance and reconcile various estimates to yield the overall figure. For this purpose, the management has to discuss various apects of R & D programme with the R & D executives and other concerned officials.

It may be advisable to undertake periodical reviews of the budget in the light of progress achieved in R & D and any other additional information that has become available. Management should critically appraise the progress attained and examine whether it is commensurate with the expenditure incurred and with the detailed programme formulated earlier. While review of progress is necessary so that necessary corrective measures may be taken before it may be too late to do so, it should not be very frequently undertaken. Sufficient time must be given to R & D personnel to carry out their work without any fear and tension.

A periodical review and appraisal of R & D activity by the management will avoid the wastage of scarce resources and ensure their effective utilization. In this connection, management should set up a system of accountability among R & D personel. This could be a very effective instrument of control.[8] Apart from this it is desirable to undertake an overall cost-benefit analysis of R & D activity on an annual basis. However, this cannot be taken up initially—sufficient time, say, three to five years, should lapse before it is undertaken. But, once it has been introduced, it may be undertaken on an annual basis. This too will enable the firm to avoid wasteful expenditure.

Technical Innovation and Marketing

Finally, it may be emphasized that market potential is an important factor contributing to the extension of R & D activity to commercial exploitation. Innovation is a two-sided activity which has been compared to the blades of a pair of a scissors. On the one hand, it is concerned with scientific and technical knowledge as a result of research. On the other hand, it involves the recognition of a need, more or less in economic terms, that is, market potentiality.

It may be noted here that the literature on innovation abounds in both the aspects. There are people who emphasize original research and innovation and disregard altogether the marketing aspect. Such an approach has been called as 'science-push' theories of innovation. In constrast, there are people who emphasize the demand aspect. This approach has been called as 'demand-pull' theories of innovation. Instead of entering into controversy as to which of the two approaches is correct, what is required is an attempt to combine both the approaches. Management of R & D should be able to see both technical feasibility and market potentiality and establish a meaningful link between the two.

However, there does not seem to be sufficicnt recognition of the market potential as an important factor for the successful innovation. Aaron J. Gellman observes that "the role of market analysis and marketing explicitly in support of technological innovation seems little appreciated by those involved as innovators and by senior policy-making and decision-making executives."[9] Though this observation was made in a symposium held in 1969, it still seems to be valid since marketing aspect is not yet fully appreciated.

In this connection, it is interesting to note that the size of market is important as it will ensure sufficient demand for the new product. In several cases innovation could not be commercially exploited in Britain because of the small size of its market. In contrast, the American market, being not only geographically large

but also richer than the British market, led to the commercial exploitation of innovations in both consumer and capital goods. It has been reported that this phenomenon "has been true especially of fast-moving technologies with rapid obsolescence, where the first into the market makes monopoly profits; with prices descending, the late comers find the going hard."[10]

While the availability of a large market is a must for commercial exploitation of innovation, one cannot say that large firms always have an advantage over small ones in respect of R & D activity. Many a time, a small firm has been found to be far ahead in R & D activity on account of certain reasons. First, its small size makes it more compact in the sense that more cordial relationship among junior and senior staff exists. Secondly, it has more effective communication system at all levels. This enables its employees to appreciate how a specific R & D activity fits into its overall objectives and strategies.

So far as the Indian industry is concerned, marketing aspect has remained rather neglected. Many findings of R & D have remained on paper and could not be commercially exploited mostly because of lack of market potential. It seems that R & D activity of research institutions is subject to this limitation in a greater measure than that of business and industrial firms.

Concluding Remarks

To sum up, management of R & D activity is a crucial input on which its success largely depends. However, it has not yet received the attention it deserves. This is especially true in case of developing countries like India. In regard to R & D, management has to address itself to various tasks. To begin with, it has to set its R & D objectives in keeping with the overall corporate objectives. This is to be followed by selection of research projects, recruitment of R & D personnel, their retention and development in the organisation. Further, management has to determine the overall research budget and its allocation to various projects. Also, periodical reviews are to be made so that progress made in R & D can be appraised and corrective measures, if necessary, can be taken. Finally, management has to assess the marketing potential and set up linkages between R & D Projects and marketing.

Since these tasks are complex and inter-linked, they call for detailed and almost simultaneous consideration of numerous factors necessary for a proper decision-making. However, management that is devoted to the cause of R & D can well look after these tasks provided it is competent and vigilant. A forward looking management can play a major role in hastening the pace of technological innovation.

REFERENCES

1. Hughes Aircraft Company : *R & D Productivity*, Study Report, Second edition, 1978, pp. vi-vii.
2. Michael Shanks: *The Innovators*, Harmondworth, Penguin, 1967, Quoted by Antonie T. Kroppers: "A Management View of Innovation" In Gold Smith, Maurice (ed): Technologial Innovation and the Economy, London, Wiley—Inter Science (A Division of John Wiley & Sons Ltd.), 1970, pp 170.
3. Goldman, J. E. : "Setting the Scene One: the United States" *in* Goldsmith, Maurice (ed.): *Technological Innovation and the Economy*, London Wiley—Interscience, 1970, p. 12.
4. Ibid, p. 12.
5. Desai, Ashok V: "The Origin and Direction of Industrial R & D in India", *Research Policy*, Vol. IX (1980), p. 85.
6. Edger A. Pessemier in his book cites some studies which cover this aspect. See his book: *Product Management, Strategy and Organization*, 1977, p. 163.
7. James Brian Quinn: "Budgeting for Research" *in Handbook of Industrial Management* edited by Carl Heyel, New York Reinhold Book Corporation, 1968 (Second edition), p. 367.
8. Thomas, T.: "Management of Research and Development", *Commerce* Annual, 1978, p. 61.
9. Gellman, Aaron J.: "Market Analysis and Marketing" *in* Maurice Goldsmith (ed.), *Technological Innovation and the Economy*, London, Wiley—Interscience, 1970, p. 129.
10. Layton, Christopher, et. al.: *Ten Innovations*, London, George, Allen & Unwin Ltd., 1972, p. 8.
11. The concept of a small firm is a relative one: An average Indian firm is much smaller vis-a-vis a foreign firm. In the Indian context, it seems that medium-sized and especially large firms are most suited to undertake R & D activity. According to the official statistics of R & D for 1976-77, Pub. by Deptt. of Science & technology out of 326 R & D performing companies in India, 39 leading companies had spent 54 per cent of the 1976-77 total R & D expenditure in the private sector. p. 17.

Productivity
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Productivity Evaluation in Public Sector

S. A. KHADER

This paper presents a formal mechanism to evaluate the Productivity Performance and also a case of application of the mechanism in a Public Undertaking.

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Evaluating Productivity Performance

Managements of organisations particularly in public sector have been striving to integrate productivity objectives with performance objectives and organisational goals. During recent years, the strategic plans of organisations have been including the establishment of Work Study/Industrial Engineering/Management Services/Corporate Planning functions in order to systematise and strengthen their efforts. Organisations and Institutions like BPE, SCOPE, PECCI, NPC, BHEL, FCI etc. have been organising seminars/workshops to analyse the 'state of art on the productivity subject from time to time resulting in consolidating their experiences and achieve new heights of performance and productivity. However, making the productivity efforts systematic and more effective appears an imperative need in the wake of the present global shortages of resources of all types. It is timely that organisations introspects and audits total efforts on productivity and evaluate the out-come with a view to identifying the factors impeding productivity improvement and take suitable corrective actions. Like other outputs, productivity performance also needs to be managed i.e. planned, controlled and appraised. The formal mechanism to investigate, evaluate and expose productivity practice for Key personnel accountable is known as Productivity Evaluation or Audit.

Productivity Audit

Productivity auditing is a process of monitoring and evaluating organisational practices to determine whether functional departments/divisions, and the

organisation itself are utilizing their resources effectively and efficiently to accomplish objectives. Where this is not being achieved, productivity auditing recommends necessary action to correct and adjust short-coming, poor results, and system deficiencies.

This system tries to asses the vigour and thrust of productivity efforts in the organisations. It evaluates the quality of total productivity efforts and their effectiveness and brings out organisational factors responsible for poor use of resources and potential. problems. Such an evaluation would pave way to initiate appropriate remedial action and would lead to possible intra-firm and inter-firm comparison between all types of organisations/functions.

A Mechanism for Evaluating Productivity Efforts

Like any other evaluating system, the productivity Audit also has four distinct phases namely

(i) Deciding the purpose of audit (usually to improve productivity methods & practices)

(ii) Working out a structure or rational standards/ norms and bench mark performance in various factor components of productivity (like an evaluating plan)

(iii) Comparing performance with standards or bench marks (as an evaluation)

(iv) Identification of weaker areas and implementing corrective measures for deviations/variances.

The method of evaluating productivity is some what similar to the method adopted in traditional quantitative job-evaluation systems like "Point Rated System". This system is rather a general one to that extent, but it is systematic and tries to assess quantitatively the quality and effectiveness of total productivity efforts in the organisation.

Productivity Evaluation in Public Sector

The public sector units have been giving considerable attention to integrating productivity with performance planning and control. The total productivity effort could be arranged into the following major factor-components, with their relative importance (as a case in a hypothetical public sector unit)

1. Productivity Targetting/Actions	15
2. Productivity Standards/Norms	20
3. Resource Utilisation	20
4. Responsibility Accounting & Reporting/Organisation	15
5. Sharing the Gains/Losses	10
6. Research & Development	5
7. Human Resource Development	10
8. Social Responsibility	5
Total Productivity Eflorts	100

Like the degree concept used in job-evaluation system each productivity factor is arranged in a rating scale having different standards of achievement as bench marks. Such standards are given point-values, to evolve a rating plan of the following type :

S.No.	Organisational Factor	Weight-age	Degree-Points				
			I	II	III	IV	V
1.	Productivity Targetting/ Actions	15	15	30	45	60	75
2.	Productivity Standards	20	20	40	60	80	100
3.	Resource Utilisation	20	20	40	60	80	100
4.	Responsibility Accounting	15	15	30	45	60	75
5.	Sharing the Gains	10	10	20	30	40	50
6.	R & D	5	5	10	15	20	25
7.	Human Resource Develop-ment	10	10	20	30	40	50
8.	Social Responsibility	5	5	10	15	20	25
	Total	100	100	200	300	400	500

The definition of these standards/bench marks is an intricate and exhaustive task and should be suited to local requirements/conditions of the organisations/ functions under evaluation or comparison. Those managers undertaking internal evaluation of their organisations, should use these bench marks as guide lines and use their personal judgement and internal information to determine, the level of performance achieved in that organisational factor.

A typical application of evaluation system in an undertaking is given below. The first productivity Audit revealed that this plant had a haphazard growth, due to increasing market demand. This led to over employment and slackness in all operating systems. The employees were demotivated, absenteeism increased along with increased wastage of resources. The timely corrective actions evolved through productivity auditing have led to considerable improvement in productivity as evaluated over a three year period.

Factor	Weight	1st Year	3rd Year
Productivity Target/Actions	20	20	80
Productivity Standards	15	15	60
Resource Utilisation	25	60	100
Responsibility Accounting	10	10	30
Sharing the gains	10	10	30
R & D	10	30	40
Human Resource Development	10	20	40
Total	100	165	380

The public sector industry comprises of diversified industrial units ranging from those producing consumer goods like contraceptives to heavy machine building plants. While the physical outputs from these undertakings vary the productivity vigour in all the organisational activities remains common. If this vigour in the managerial groups of different undertakings is investigated, measured, compared and remedial actions taken, improved productivity and production performance will automatically be ensured. Such an evaluation of productivity is possible with this approach discussed earlier. Organisations like BPE, SCOPE, will be able to easily compare all PSUs against a common scale. Individual undertakings can utilise this approach to focus their attention more sharply on weaker areas of productivity. In addition inter and intra-unit comparison of divisions/departments, projects and plants is possible on rational basis.

One major limitation is that the system is only systematic and could be subjective to views/impressions of the person undertaking auditing. A defective evaluation may jeopardise the total exercise and development of the plan has to be undertaken with considerable caution, keeping in mind the purpose of the audit and also incorporating as much quantitative data as possible in the definition of standards or bench Marks. Inspite of these limitations, a system to provide a few rational guidelines for improvement is better than "no system" at all.

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Praductivity
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Transhipment Problems with Multiple Objectives

J. K. SHARMA

In the general transhipment problems, the objective is to minimize the total transportation cost. The basic assumption underlying these formulations of the transshipment model is that management is concerned only with cost minimization. In fact, business firms quite frequently place higher priorities on non-economic goals than on cost minimization. The purpose of this paper is to present the formulation of the goal programming model for the analysis of transshipment problems, where multiple conflicting objectives must be considered.

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The Goal Programming Approach

Goal programming is a mathematical programming technique through which decision makers can model and solve problems involving multiple conflicting objectives. The solution procedure is basically a modification and extension of the simplex method for linear programming. The limitations of the single objective approach of linear programming to the modelling of many real world decision making situations have resulted in an increasing interest in goal programming in recent years.

In goal programming a number of goals or aims are admitted and these goals do not have to be mutually compatible. Each goal is represented as if it were an equality constraint with the addition of two special variables which represent any under or over achievement of the goal target.

Let

n = number of activities

a_{ij} = per unit contribution of the j th activity towards the achievement of goal i

b_i = goal target for the i th goal

The i th goal can be formulated as

$$\sum_{j=1}^{n} a_{ij} - x_j + u_i - v_i = b_i$$

where

u_i = under achievement of the i th goal

v_i = over achievement of the i th goal

$u_i, v_i \geqslant 0$

If we give the same weight to under and over achievement and equal weight to each goal the objective function is then formulated simply as :

$$\text{Minimize } Z = \sum_{i=1}^{m} (u_i + v_i)$$

With the objective function formulated as just described the programme simply minimizes the total discrepancy ,between achievement and goal targets but the manager must analyse each one of the m goals considered in the model in terms of whether over or under achievement of the goal is satisfactory. If over achievement is acceptable, u_i can be eliminated from the objective function, and if under achievement is satisfactory, v_i can be eliminated from the objective function. But if the exact achievement of the goal is desired, both u_i and v_i can be given different penalty weights and different weightings may be assigned to various goals. In this way the low order goals are considered only after the higher order goals are achieved as desired.

The Goal Programming—Transshipment Model

The general transshipment problem model can be mathematically expressed as :

$$\text{Minimize } Z = \sum_{i=1}^{m+n} \sum_{\substack{j=1 \\ i \neq j}}^{m+n} C_{ij} X_{ij}$$

subject to

$$\sum_{\substack{j=1 \\ j \neq i}}^{m+n} X_{ij} - X_{ji} = a_i;\ i = 1, 2, \ldots, m$$

$$\sum_{\substack{j=1 \\ j \neq 1}}^{m+n} X_{ij} - X_{ji} = b_i;\ i = m+1, m+2, \ldots, m+n$$

$$X_{ij} \geqslant 0\ i, j = 1, 2 \ldots\ldots m+n\ (i \neq j)$$

where i, j = 1, 2 ... m represent the m sources

i, j = m+1, m+2,...,m+n represent the n destinations

C_{ij} = the unit cost of shipping from any i to any j ($i \neq j$)

a_i = the supply at source i ($i = 1, 2, \ldots, m$)

b_i = the demand at destination i ($i = m+1, m+2 \ldots m+n$)

X_{ij}, X_{ji} = the quantity shipped from i to j; j to i ($i \neq j$)

In order to demonstrate model building of goal programming for the analysis of a transshipment problem it is assumed that the company in question supplies a single product to four warehouses at various locations from three origins (supply points). A summary of the transshipment problem is shown below :

Sources		Destinations: 1 (Plant 1)	2 (Plant 2)	3 (Plant 3)	4 (Warehouse A)	5 (Warehouse B)	6 (Warehouse C)	7 (Warehouse D)	Supply
1	1	—	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	a_1
2 Plant	2	x_{21}	—	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	a_2
3	3	x_{31}	x_{32}	—	x_{34}	x_{35}	x_{36}	x_{37}	a_3
4	A	x_{41}	x_{42}	x_{43}	—	x_{45}	x_{46}	x_{47}	
5 Ware	B	x_{51}	x_{52}	x_{53}	x_{54}	—	x_{56}	x_{57}	
6 House	C	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	—	x_{67}	
7	D	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	—	
		Demand			b_1	b_2	b_3	b_4	

The goal programming formulation for the transshipment problem is given as below :

(i) *Supply*. The supply is restricted to the maximum capacity of the plant, i.e.,

$$\sum_{j=2}^{7} X_{1j} + \sum_{i=2}^{7} X_{i1} + u_1 = a_1$$

$$X_{21} + \sum_{j=3}^{7} X_{2j} - X_{12} - \sum_{i=3}^{7} X_{i2} + u_2 = a_2$$

$$X_{31} + X_{32} + \sum_{j=4}^{7} X_{3j} - X_{13} - X_{23} - \sum_{i=4}^{7} X_{i3} + u_3 = a_3$$

The deviational variable v_1 are excluded since it is assumed that supply can not exceed the stated amounts for $i = 1,2,3$.

(2) *Demand*

$$\sum_{i=1}^{3} X_{i4} + \sum_{i=5}^{7} X_{i4} - \sum_{j=1}^{3} X_{4j} - \sum_{j=5}^{7} X_{4j} - v_1 = b_1$$

$$\sum_{i=1}^{4} X_{i5} + X_{65} + X_{67} - \sum_{j=1}^{4} X_{5j} - X_{56} - X_{57} - v_2 = b_2$$

$$\sum_{i=1}^{5} X_{i6} + X_{76} - \sum_{j=1}^{5} X_{6j} - X_{76} - v_3 = b_3$$

$$\sum_{i=1}^{6} X_{i7} - \sum_{j=1}^{6} X_{7j} - v_4 = b_4$$

The deviational variable u_1 is excluded since it is assumed that quantities demanded must be met for $i = 4, 5, 6, 7$.

(3) *Union Agreement Goal* : The union agreement specifies that atleast 25% of shipping out of any plant be direct to one or more of the warehouses. The goal constraints for this are :

$$\sum_{j=4}^{7} X_{1j} + u_5 - v_5 = \frac{25}{100} \times a_1$$

$$\sum_{j=4}^{7} X_{2j} + u_6 - v_6 = \frac{25}{100} \times a_2$$

$$\sum_{j=4}^{7} X_{3j} + u_7 - v_7 = \frac{25}{100} \times a_3$$

(4) *Road Hazard Goal* : The firm's goal is to discontinue shipping from plant 1 to warehouse 6, due to road hazard along that route. The goal constraint for this is

$$\sum X_{16} - v_8 = O$$

(5) *Minimum Satisfied Demand* : In order to avoid gross in-equalities of demand satisfaction among various warehouses, the management of the firm feels that amount transshipped through each plant should be 50% of its capacity. Thus the goal constraints are as follows :

$$\sum_{i=2}^{7} X_{i1} + u_9 - v_9 = \frac{50}{100} \times a_1$$

$$X_{12} + \sum_{i=3}^{7} X_{i2} + u_{10} - v_{10} = \frac{50}{100} \times a_2$$

$$X_{13} + X_{23} + \sum_{i=4}^{7} X_{i3} + u_{11} - v_{11} = \frac{50}{100} \times a_3$$

(6) *Transportation Cost* : Management of the firm wants to minimize the total transportation costs. Thus, the goal level for the constraints is set to zero and v_{12} is minimized.

$$\sum_{i=1}^{7} \sum_{\substack{j=1 \\ i \neq j}}^{7} C_{ij} X_{ij} - v_{12} = O$$

Goal and their Priorities

The final specifications of the goals with their priorities (P_1 = highest priority) is given as follows :

P_1 = Minimize shipping from plant 1 to warehouse 6 to zero.

P_2 = Meet no less than 25% of the requirement of each warehouse.

P_3 = Minimize the quantities transshipped through each plant to warehouse to a 50% of total capacity.

P_4 = Minimize the total transportation costs for quantities transshipped.

The goal programming model for objective functions is given as follows :

$$\text{Minimize } Z = P_1 V_8 + P_2 (u_5+u_6+u_7) + P_3 (v_9 + v_{10} + v_{11}) + P_4 v_{12}$$

Conclusion

The general goal programming model has been presented to demonstrate how GP may be applied to transshipment problems with an assumption that total supply equals total demand. Of course the transshipment problem with unequal demands and supply may also be formulized. Goal programming approach allows model experimentation with numerous variations of constraints and priority structure of goals. Solid multi-dimensional transportation problem could also be treated as a goal programming problem.

REFERENCES

1. Lee, Sang M. and LJ. Moore, Optimizing Transportation Problems with Multiple objectives, AIIE Transactions Vol. 5, 1973.
2. Orden Alex, The Transshipment Problems, Management Science. Vol. 2, 1956.

Productivity
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Optimising the Cost of Production

P.C. SETHIA

This paper deals in brief about the what and how of process capability analysis and then highlights how it can optimise quality as well as cost of production by way of improved productivity.

The methodology suggested here actually provides the logic on the basis of which a production man in batch manufacturing industries, should select a machine out of the many available for manufacturing a particular quality characteristic such that a minimum of reject takes place.

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Introduction

The quality control techniques suggest that even nature is not able to produce two exactly identical pieces—so what of a Man-Machine system ? Measured quality of manufactured product is always subject to a certain amount of variation as a result of chance. Some stable "System of chance causes" is inherent in any particular scheme of Production and Inspection. Variation within this stable pattern is inevitable. The reasons for variation outside this stable pattern can be always discovered and corrected. And Statistical Control Charts ($\bar{x}$ and R chart for variable characteristics) by themselves suggest that whether a stable system of chance causes is present in a Production-Inspection System or some foreign system has crept into the system. Further—as long as the "Stable System of chance causes" is acting in a particular Production-Inspection System, then, the natural variability of such a system is often referred to as its "Process-Capability i.e., the capability of the system to give inherent quality variation. This amount of variability being 'natural' or 'inherent', because it arises from the fact that raw-materials vary, machines cannot exactly reproduce the identical movements on successive cycles of operation, and people cannot perform a repetitive task in precisely the same manner. The numerical measure of this inherent variation being 6 σ' (six sigma prime) where, σ' 9 (sigma prime) is the standard deviation of measured values of entire population which is supposed to be homogeneous at this juncture (produced under the stable system of chance causes).

Determination

What is needed to find out Process capability for a given quality characteristic from a particular Production-Inspection system is to

(1) take a lot of manufactured and inspected items from the system

(2) collect data about the variation of quality characteristics in the $\bar{x}$ and R chart data form

(3) compute $\bar{X}$, $\bar{X}'$, R, $\bar{R}$, $\sigma_{\bar{x}}$ and σ'

where

$\bar{X}$ — the average value of quality characteristic for each sample of size say n (preferably n being 4 or 5)

$\bar{X}'$ — the average of averages (Centre of the process)

R — range for each sample—being the difference of highest and lowest value of measured characteristics in the sample

$\bar{R}$ — average of the ranges of the samples

$\sigma_{\bar{X}}$ — standard deviation for the sample population $=\bar{R}/(d_2\sqrt{n})$ where d_2 being constants depends upon the value of n

σ' — Standard deviation of the entire population $=\bar{R}/d_2$ or $\sqrt{n}\,\sigma_{\bar{X}}$

(4) Compute trial control limits for $\bar{X}$ and R charts as σ

$UCL_{\bar{X}} = \bar{X}' + 3\sigma_{\bar{X}}$

$LCL_{\bar{X}} = \bar{X}' - 3\sigma_{\bar{X}}$

$DCL_R = D_4\bar{R}$

$LCL_R = D_3\bar{R}$

where D_3 and D_4 are again constants whose values depend upon sample size n.

(The values of these constants can be had from any statistics book or from the references).

(5) Plot $\bar{X}$ and R chart and depict control limits on to it $\bar{X}$ Chart : Say on graph, against each sample no. mark the values of $\bar{X}$ for the respective sample. Plot $\bar{X}'$ by a line and also control limits by lines.

R Chart : Against each sample plot, its range. Plot its control limits also.

(6) Verify whether all the plotted points in each case lie within the control limits and in case of $\bar{X}$-chart, the plotted points are evenly distributed about the central lines. If so, then the whole Production-Inspection system is said to operate under the Stable system of chance causes. If not it would mean process is not operating under stable system of chance causes and thus needs correction.

(7) Once the stable system of chance causes is verified, then next is to compute σ' and $X' + 3\sigma'$ and $\bar{X} - 3\sigma'$ values.

Plot all measured readings (inst. X against their respective no. and impose the $\pm 3\sigma'$ limits on to it. It will be found that 99.97% of the readings fall within these limits.

Thus entailing that within these limits of variability the system will be able to produce 99.97% of the products. This difference of $+3\sigma'$ and $-3\sigma'$ about the centre line $(\bar{X}') = 6\sigma'$ referred to as process capability or spread of the process or system. This way process capability study reveals (1) centering of the process (the mean value of the quality characteristic the system is able to produce) and (2) the natural spread of the process. Further, if all the plottings are consolidated into a frequency distribution it will result into a normal distribution.

Use of the Approach

This approach first of all calls for knowing the process capabilities of each and every production inspection system for each and every possible combination of man machine and materials for all possible quality characteristics which can be accomplished by such systems. Once these are known, then these should be used in future production for making the optimal selection of a process (system) for producing a particular quality characteristic on a specified type of products by simply matching the process-capability for that quality characteristic of the product and the tolerances specified on to it (1 and 2) as shown in Figure 1.

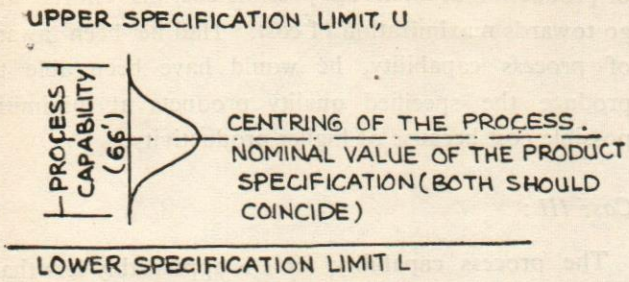

Fig. 1: Matching of Process Capability and the Specifications of the Product Characteristic

[All figures show the upper and lower specification limits specified on the characteristics on to which the spread of the process as well as its frequency distribution have been superimposed.]

Optimising Quality & Cost of Production

In the absence of process-capability studies, on the production floor often the foreman tries to schedule a job on a process (system) which is time being free (not engaged) without giving any consideration to whether the process will be at all able to produce specified quality characteristics on the job within the specification limits or not. This ignorance on the part of production person can resuit into any one of the following consequences :

Case I :

The process capability ($6\sigma'$) is appreciably greater than the difference between the specification limits (U-L) as shown in Figure 2.

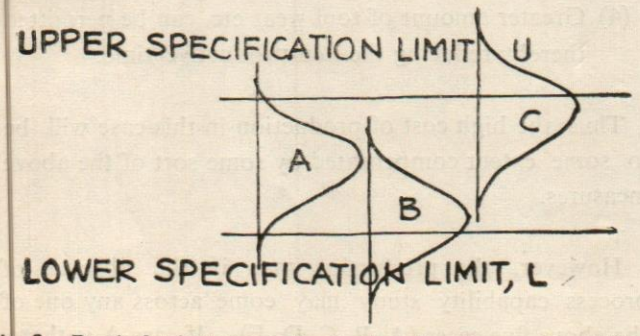

Fig. 2: Particular instances in Production when Process Capability in Wider than Specification Limits

From this Figure 2 it is obvious that even though the process is in statistical control but in neither of the above three possible cases (A, B and C) specifications will always be met. There will always be a certain percentage of reject and/or rework. Further if the three cases A, B and C are compared then again it will be seen that the percentage of reject and/or rework in case of A are quite less compared to case B or C. If at all production is to be carried out on this process efforts should be concentrated to see that matching of process capability is done with the specification limits by way of proper centering of the process, so that there is a minimum possible percentage of reject and/or rework. Ideally speaking, this situation should also be avoided as far as possible. Nevertheless, in case A the cost of quality of conformance will be least, compared to case B or C.

The production man, however, can never get the above said picture without the process capability study. As such in his sincere efforts to adhere to quality specification—he will often try to make frequent adjustments with machines and its tooling, will hire and fire the operators, will try to tighten inspection, will have 100% inspection, will blame the design persons who have given so tight tolerances, may also blame materials supplier and so on and so forth. Consequent upon his these actions—the quality of the product will go further down[1] and thus will make him get lost in the problem. In turn there will be reduced production from the process and the amount of reject and/or rework will further be increased thus affecting the productivity of the process adversely. Thus, precipitating a heavier cost than what it could have been.

This all suggests that a lot of cost saving in production is possible provided that the process capability of the process is known before actual production and then during production proper matching of this process spread is done with the specification limits.

Case II :

The process capability ($6\sigma'$) is approximately equal to the difference between the specification limits (U-L) as shown in Figure 3. From this it is evident that the process is in statistical control and further if the process is exactly centered then there will be hardly any reject or rework (probability theory suggests that if there is exact matching between the process-capability

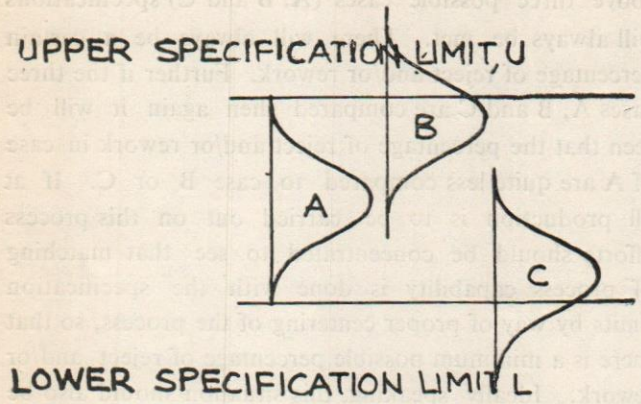

Fig. 3: Particular instances in Production when the Process Capability is approximately equal to the Difference of Specification Limits

and specification limits then there will be 0.27% reject and rework—of course it implies that the process is in statistical control) as in case A. Whereas in case B or C again there will be lot of reject and/or rework. Ideally speaking, it will always be economical to produce quality products if process-capability match exactly with the specification limits or more truly if the process-capability is slightly less than the specification limits (U-L) and there is proper centering of the process as suggested in Figure 1, because in such case there will be no reject or rework.

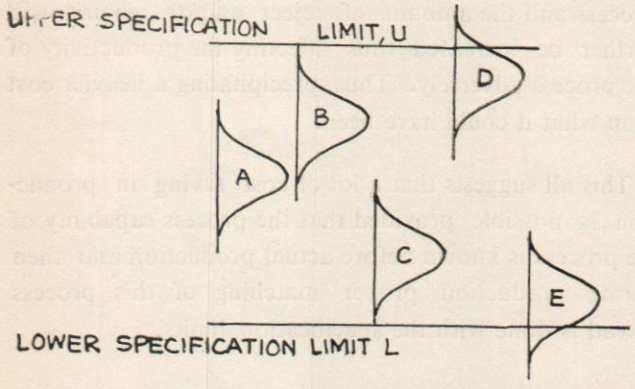

Fig. 4: Particular instances in Production when the Process Capability is less than the Difference between Specification Limit

However, the production person on the shop floor in the absence of the above knowledge, will never be able to know these intricacies and as such will take all these actions as listed previously which in turn will be quite wasteful in the sense that instead of improving quality of production at minimum possible cost his efforts will go towards maximization of cost. Had he been aware of process capability, he would have been able to produce the specified quality products at minimum possible cost because of higher productivity.

Case III :

The process capability ($6\sigma'$) is appreciably less than the difference between the specification limits (U-L) as shown in Figure 4. From this figure it is obvious that the process is highly precise and hence under the given condition it will not be economical to produce the product characteristic with wider specifications on this precise process. (This implies of course, that there is proper centering of the process also, as shown in case A). Ideally speaking, the production should be carried out on a process where the process-capability is slightly less than the difference between the specification limits. In this case the cost of production will be minimum. Nevertheless, if in the production this is the only alternative left for manufacturing, then proper centering of the process should be done and then the extra cost of production should be recovered by adopting the following cost saving measures :

(1) Adopt reduced inspection—say adopting sampling inspection to cent per cent inspection, to relax the condition of inspection

(2) Increasing time interval between sampling-inspection

(3) Relaxed amount of supervision for quality control

(4) Greater amount of tool wear etc. can be permitted thereby reducing the non-productive time.

Thus, the high cost of production in this case will be to some extent compensated by some sort of the above measures.

However, the production man in the absence of process capability study may come across any one of the above five cases (A, B, C, D, E). If case A is there, then here he is making a costly production, because he is not aware of the above facts so that he can recover the extra cost as cited above. If case B or C is there, in that case not only he is employing costly process but

also making production which may be objectional from interchangeability point of view, in which case he may have to change over to selective assembly system meaning thereby additional cost on sorting type of inspection. And if case D or E is there, then again, not only he is employing a costly process (highly precise compared to specification limits) but at the same time producing certain amount of reject and/or rework also and thus lowering productivity. These ways are precipitating additional cost over already high cost of production.

Conclusion

The foregoing discussion suggests that a Production man in the absence of "Process Capability Studies", is always liable to manufacture products of specified quality at considerably higher cost, On the contrary, if the Process Capabilities at the initial stage are undertaken and then if the results are implemented as suggested above then the extra cost incurred on process capabilities can always be paid back by one or two production runs and afterwards there can be enormous savings by way of increased productivity of systems meeting the quality requirements also.

REFERENCES

Ireson & Grant : Statistical Tolerance Limit for Determining Process Capability; Journal of Industrial Engineering (U.S.A.), March-April 1961.

J.M. Juran, Leonard A. Seder, Frank M. Gryna, Jr.; Quality Control Handbook, McGraw Hill Book Company, Inc. Second Edition (1962).

Eugene L. Grant, Richard S. Leaverworth; Statistical Quality Control, McGraw Hill Kogakusha Ltd., Fourth Edition (1972).

Acheson J. Duncan; Quality Control and Industrial Statistics, T.B. Taraporewala Sons & Co. Pvt. Ltd., Third Edition (1969).

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1983, XXIV, 2, 199-203

The Theory-Practice Gap in Assembly Line Balancing

DR. SADANANDA SAHU

This paper highlights the major developments in assembly line balancing from the development of the first analytical technique in 1954 to the present day models. The theoretical survey indicated that much of research effort is directed towards heuristic, deterministic and single-model cases. The survey of assembly line balancing practices indicated that manual and trial-and-error methods are in common use. Hence there is evidence of considerable gap between theory and practice. Conjectures are made as to the possible reason for the gap. Finally, current trends and speculations as to the future are discussed.

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Introduction

Henri Ford is credited with the development of the first real example of assembly line in automobile industry in 1913.[1] His original work has led to the widespread use of assembly lines in mass production systems. In assembly lines, the production (assembly) of the product is normally divided into a number of small operations, each of which can be performed repetitively by the same operator. Each unit of product spends the same amount of time (theoretically) at each station. This time, called the cycle time, becomes the basic interval within which the line generates one complete unit of product.

Efficient working of the assembly calls for assigning the operations to the stations such that the technological considerations, often known as precedence relationships, are satisfied and the total idle time of each operator is minimized. In the literature, this problem is referred to as the "assembly line balancing problem".

Line Balancing Problem

Several variations of the line balancing problem are found in the literature. Attention, however, is focussed on the two fundamental approaches as follows :

(a) Given a required cycle time, allocate operations to stations so as to minimize the sum of idle times over all the stations and distribute the idle times evenly among the stations.

(b) Given the required number of stations, assign operations to stations so as to minimize and evenly distribute the sum of idle times over all stations.

Theoretical Developments

Bryton[2] developed the first analytical technique for the line balancing problem in 1954. But Salveson[3] produced the first published study on the problem. Since then, over the years a large number of solution methods for solving the line balancing problem have beed proposed, many of which have been reviewed by Kilbridge and Wester[4], Ignall[5], Cauley[6], Mastor[7], Buxey et al[8], Panwalkar[9] and Dar-El[10].

The line balancing methods can be classified on the basis of :

(i) the number of models (or versions) of the product assembled on the line—single-model, mixed-model or multi-model (batched assembly),

(ii) the nature of the operation times—deterministic or stochastic, and

(iii) the type of solution approach—mathematical, heuristic or empirical.

An attempt is made in this section, in a summary review of the theoretical developments, to ascertain time trends, if any, in (a) total research effort, and (b) type of research effort.

Figures 1 through 3 attempt to provide the necessary insight.

In viewing Figure 1 which plots the number of approaches versus the year in which they appeared, a sizable effort begins to appear in the late fifties (stimulated by the classic works of Bryton[11], Salveson[12]) and continues through the sixties and seventies. In this figure, multi and mixed-model research is separated from those related to single-model. Effort in multi and mixed-model line balancing started around 1962 and continues, although they represent only 20% of the total effort. 1970's and late 1960's show an increase in this area of effort. These problems, though difficult, are more realistic.

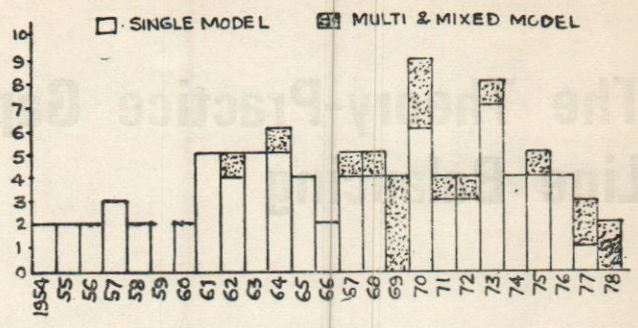

Fig. 1: Number of Techniques versus Year

Figure 2 shows, by year, the percentage of effort in deterministic versus stochastic approaches. The deterministic approaches claim about 85% of total research effort to date. The early work on stochastic line balancing started around 1965 when Moodie and Young[13] proposed an efficient heuristic approach. Over the years, relatively more, though not adequate, effort has been spent on stochastic line balancing. In 1973, four stochastic line balancing and smoothing techniques were reported by Reeve and Thomas[14]. In order to overcome the difficulties encountered in solving stochastic line balancing problems, a compromise formula has been suggested by Sphicas and Silverman[15], who propose deterministic equivalents to stochastic line balancing for certain types of operation time distributions. This transformation is quite useful in the sense that good balances for stochastic problems can be obtained by employing efficient and relatively less complicated deterministic techniques.

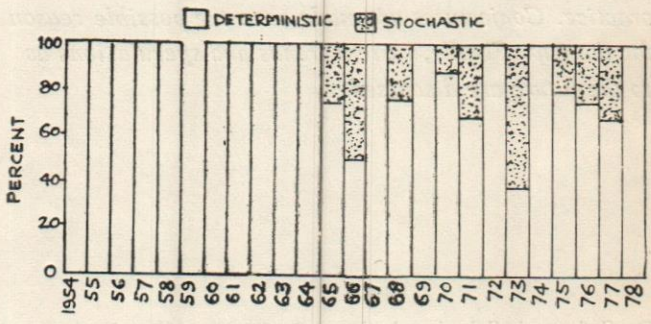

Fig. 2: Deterministic versus Stochastic Approaches by Year

Figure 3 shows three types of approaches by year of occurences. Total effort over the years can be broken down approximately as follows :

Mathematical approaches 35%

Heuristic approaches	50%
Empirical approaches	15%

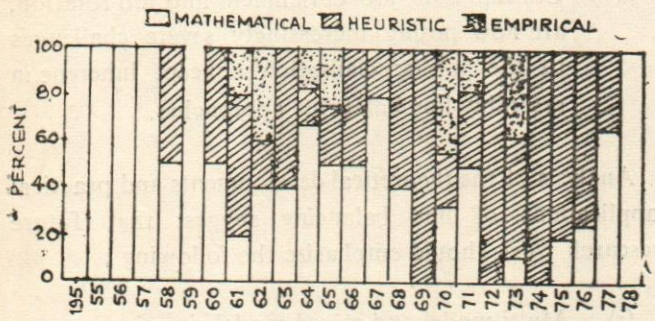

Fig. 3: Type of Approach by Year

Heuristic approaches constituting half of the total effort had their beginning in late fifties and continue to grow because of their ability in providing compromise between solution quality and computational effort. Empirical approaches developed since early sixties, offer in certain situations, superior solutions.

Industrial Applications

To what extent are the formalized line balancing methods, that have appeared in the literature, applied to actual assembly situations ? What are the current practices ? Attempts have been made to answer these questions for the American industry by Lehman[16] and Chase[17] and for the British industry by Wild[18]. Although no consolidated effort of this type has been made for Indian industries, some useful inferences can be made from a number of projects carried out in various Indian industries (Banerjee[19], Bhattacharya[20], Das[21], Jain[22], Mukherjee[23], Panda[24], Sahu[25], Sangal)[26].

Lehman, while summarizing the findings of the National Survey of Assembly Operations[27], reports on the extent of usage of the various methods as follows :

Manual Methods (using precedence diagram)	40%
Trial and Error Methods	41%
Computer Methods	15%
Other Methods	4%

As regards computer methods, three fourths of the companies have written their own programs.

The Survey of paced assembly lines conducted by Chase[28] also aims at finding the extent to which formalized line balancing methods are being used by American firms engaged in progressive assembly. This study reveals that only 5% of the 85 respondents use formalized published techniques, and 39 respondents are familiar with the techniques.

The Gap

A close look at the above two sections indicates that there is considerable amount of gap between theory and practice. This can be explained in terms of the Venn diagram shown in Figure 4.

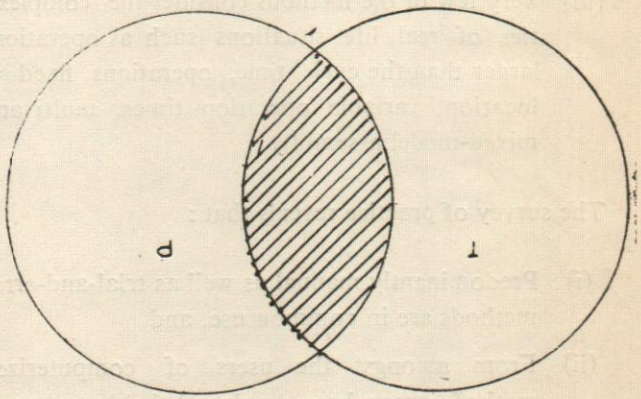

Fig. 4: Venn Diagram

The set represents the theoretical developments in assembly line balancing methodology, while the set P represents the real world of line balancing problems. The intersection $T \cap P$ (cross-hatched area) represents the methods used in practice, which are computationally feasible and which actually originated from theory. Thus, the gap between theory and practice can be measured by :

$$\text{GAP} = \frac{1-(T \cap P)/P}{(T \cap P)/P}$$

so that if $(T \cap P)/P = 1$, GAP = O,

whereas if $(T \cap P)/P = 0$, GAP $= \infty$

Hence, it is desirable to have a feel of the magnitude of $(T \cap P)/P$. This can be obtained by the survey of theory and practice of line balancing.

Conclusions

Given the information in the above three sections, it becomes necessary to compare them in order to have a better understanding of the gap between theory ond practice of assembly line balancing.

A review of the theory of line balancing indicates that :

(i) single-model assembly line balancing has been predominantly studied,

(ii) maximum effort has been devoted to heuristic methods compared to other types, and

(iii) very few of the methods consider the complexities of real life situations such as operations larger than the cycle time, operations fixed in location, variable operation times, multi and mixed-model assembly.

The survey of practice reveals that :

(i) Predominantly manual as well as trial-and-error methods are in common use, and

(ii) From amongst the users of computerized methods, many have developed their own computer programs.

Comparison of the above two lists shows that there is considerable amount of gap between theory and practice of assembly line balancing. Possible reasons for non-use of the formalised techniques are as follows :

(i) Many of the users are not familiar with the techniques.

(ii) The techniques are inflexible and in many cases represent idealized situations.

(iii) These techniques, in certain situations take more time to balance the lines than subjective judgment and experience.

(iv) Much of the research work is rather abstract; the authors do not appear to have considered the need to understand the effect of various factors on the performance of the line. These factors include : operators' work-time distributions, buffer storage between stations, number of operators at each station, number of stations on the line, non-steady operating conditions.

(v) Concepts of job enrichment and job rotation, are now posing increasingly severe challenges to the job specialization concept inherent in assembly line balancing approaches.

Analysis of the theoretical developments and practical applications of line balancing suggest that future research work should emphasize the following :

(i) Multi-model and mixed-model situations,

(ii) Inclusion of effects of various factors like variability in performance times, and paralleling,

(iii) Consideration of various relevant costs in line design,

(iv) Development of more flexible approaches such as the interactive approach of Moodie [28], and

(v) Consideration of behavioural aspects.

REFERENCES

1. Wild, R (1972), Mass Production Management. John Wiley & Sons, London.

2. Bryton, B (1954), Balancing of a continuous production line. M.S. Thesis, Northwestern University, Evanston, Illinois.

3. Salveson, M.K. (1955). The assembly line balancing problem. Trans. of ASME, 77, Aug., 939-948.

4, Kilbridge, M.O. and Wester, L (1962). A review of analytical systems of line balancing. Operations Research, 10, No. 5, 626-638.

5. Ignall, E.J. (1965). A review of assembly line balancing. J. Ind. Eng., 16, No. 4, 244-254.

6. Cauley, J.M. (1968). A review of assembly line balancing algorithms. Proc, 19th Conf. of AIIE, New York.

7. Master, A.A. (1970). An experimental investigation and comparative evaluation of production line balancing techniques. Management Science, 16, Np. 11, 728-746.

8. Buxey, G.M. Slack, N.D. and Wild, R. (1973). Production flow line system design—A review. AIIE Trans., 5 No. 1, 37-43.

9. Panwalkar, S.S. (1978). A survey of assembly line balancing techniques, Deptt. of Industrial Engg., Texas Tech. University, Lubock.

10. Dar-El, E.M. (1978). Mixed-model assembly line sequencing problems. Omega, 6, No. 4, 313-323.

11. Bryton, B. (1954). Balancing of a continuous production line. M.S. Thesis, Northwestern University, Evanston, Illinois.

12. Salveson, M.L. (1955). The assembly line balancing problem. Trans. of ASME, 77, Aug., 939-948.

13. Moodie, C.L. and Young, H.H. (1965). A heuristic method of assembly line balancing for assumptions of constant or variable work element times. J. Ind. Eng;, 16, No. 1, 23-29.

14. Reeve, N.R. and Thomas, W.H. (1973). Balancing stochastic assembly lines. AIIE Trans., 5, No. 3, 223.

15. Sphicas, G.P. and Silverman, F.N. (1976). Deterministic equivalents for stochastic assembly line balancing. AIIE Traas.. 8, No. 2, 280-282.

16. Lehman, M. (1969). What is going on in product assembly. Ind. Eng., 1, No. 4, 41-45.

17. Chase, R.B. (1974). Survey of paced assembly lines. Ind. Eng., 6, No. 2, 14-19.

18. Wild, R. (1974). Mass production in Engineering. Int. J. Prod. Res. 12, No. 5, 533-545.

19. Banerjee, G. (1976). A heuristic approach to line balancing with multiple stations. M. Tech. Thesis, Industrial Management Centres, Indian Institute of Technology, Kharagpur.

20. Bhattacharya, T.K. (1978). Deterministic and stochastic line balancing for a mine safety appliances industry, M. Tech. Thesis, Industrial Management Centre, Indian Institute of Technology, Kharagpur.

21. Das, S.K. (1970). A heuristic approach to assembly line design. M. Tech. Thesis, Deptt. of Mech. Engg., Indian Institute of Technology. Kharagpur.

22. Jain, H.K. (1975), An optimum station balance programme for the design of unpaced manual assembly line with multiple stations. M. Tech. Thesis, Industrial Management Centre, Indian Institute of Technology, Kharagpur.

23. Mukherjee, S.K. (1962). A heuristic approach to assembly line balancing. M. Tech. Thesis, Department of Mechanical Engineering, Indian Institute of Techology, Kharagpur.

24. Panda, R.B. (1974). Application of multi-model assembly line and job enlargement concepts to the design of a mass production system. M. Tech. Thesis. Industrial Management Centre, Indian Institute of Technology, Kharagpur.

25. Sahu, S. (1972). A heuristic approach to multi-model assembly line balancing problem. M. Tech. Thesis, Department of Mechanical Engineering, Indian Institute of Technology, Kharagpur.

26. Sangal, A.K. (1977). Some studies on balancing and smoothing of stochastic assembly lines. Unpublished M. Tech. Thesis, Industrial Management Centre, Indian Institute of Technology, Kharagpur.

27' Lehman, M. (1969). What is going on in product assembly. Ind. Eng., 1, No. 4, 41-45.

28. Chase, R.B. (1974). Survey of paced assembly lines, Ind. Eng., 6, No. 2, 14-19.

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EXECUTIVE READINGS

Quantitative Techniques for Managerial Decision Making

U. S. Srivastava, G. V. Shenoy, S. C. Sharma

Wiley Eastern Limited
Price : Rs. 63.50

Reviewed by : R. K. Jain,
Deptt. of Management
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Kurukshetra—132119

Managerial decision making is becoming an increasingly complex job. The rapidly changing dynamic environment in which the manager has to perform, the uncertainties involved, the risk involved due to magnitude of the impact of decisions and the quickness with which the decisions have to be arrived at, have all commulated to the point where the manager finds himself ill-equipped to make effective decisions on the sole basis of judgement and experience. As the management profession has developed, marketing researchers, corporate planners, operations researchers, statisticians, computer specialists and other staff specialists have been called upon to contribute to the solution of increasingly complex problems. This trend in turn has led to the need for finding better ways to formulate and explicit models of executive decision-making process. Thus, the dependence of executive decision making process on intution is giving way to 'Quantitative models'.

With access to the computer ability of storing large mass of data and logical manipulation at very high speed these 'quantitative models' are becoming a reality of the management decision-making process.

Under the present dynamic environment in which the manager has to operate, it has become necessary for the manager and analyst to come closer to the extent that it is becoming more and more desirable for the manager to be 'analyst' as well. More important, is the association of the manager with process of analysis' rgiht from the formulation stage to the implementation and evaluation stage. This underscores the need for teaching Quantitative techniques and skills to the young graduates aiming for careers in management area as well as to the practitioners who have been in the field for long. This is precisely the reason that courses of quantitative techniques have become an integral part of Management syllabi.

Therefore these techniques find place in, as part of syllabus, of every course that deals with management or related areas viz. Economics, Public Administration etc. In many of these courses the quantitative techniques in one form or the other have two to three semester progammes. The book fulfills the long felt need of this group of students who so far had to depend on various references and (mostly foreign books with illustrations based on the country of origin).

The book is divided into three parts viz. Part-I Statistics for Managerial Decision Making; Part-II Operation Research for Managerial Decision Making and Part-III as supplementary readings on Mathematical concepts that are used or required at various stages in the earlier two parts.

This is a book which brings for the first time, most of the relevant quantitative techniques, in one place. With illuminating, simple treatments of topics without over emphasis on mathematical rigour. Every chapter has solved examples and exercises which add to understanding and extend the horizon of comprehension through displaying diverse kind of application of these tools in managerial functions. The book should be sufficient for a two semester course and if mathematical concepts are to be included, a three semester course. Depending upon individual requirements specific chapters can be ignored.

Because this book basically deals with decision-making techniques, the chapter No. 10—"Decision Making under uncertainty" could have been made more elaborate through introduction of solved examples clarifying step by step process of treatment of the topic in its various facets.

Since, the topics have been discussed keeping mathematical rigour to bare minimum, the book will also prove to be useful to application oriented practitioners in various fields. A good buy at the price.

Alternatives to the Multinational Enterprise

Mark Casson
The Macmillan Press Ltd.;
London, 1979
Price : £ 10.00
PP xiii+116

Reviewed by : P. Chattopadhyay
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Calcutta-700029

The advent of multinational enterprises in the third world economics has been essentially based on two types of propelling forces. One, the exploration of means for international diffusion of proprietary technology and managerial skills and thereby maximization of profits in conditions in which political dominance has become, subservient to commercial dominance particularly, due to the liquidation of empires, occupied territories and colonies. Two, the desperate need experienced by these poor third world countries to bridge the technological gap, particularly for expediting industrialization, amelioration of the living conditions of people, provision of more employment and augmentation of production for domestic and export sales.

This book by Mark Casson addresses itself to an exploration of the possibility of host governments to seek ways of importing technology without surrendering their power.

The book is divided into six chapters. Chapter one is concerned with a statement of the issues. The second chapter deals with the concept of efficiency and its application to proprietary information. Chapter three highlights the rationale of the multinationals enterprise. A theory of foreign direct investment, technology transfer, trade and capital movements are presented in chapter four. The second, third and fourth chapters comprise the author's discussion on theoretical issues. Chapter five underlines a policy for foreign direct investment while the last chapter deals with the future contractual basis for technology transfer. The fifth and sixth chapters together comprise an analysis of policy. While reviewing the basic issues in multinational enterprise, discussing host country relations and summarizing empirical evidence on the subject in the first chapter, the basic concepts in the theory of resource allocation are dealt with in chapter two and a discussion of the origination of the rationale of the multinational firm in industrial economics, various institutions for administering the allocation of resources and factors that govern the optimum size of firm are highlighted in the third chapter. The purpose of chapter four is to integrate the theory of the firm with the orthodox theory of trade and to explain the factors that govern the participation of multinational firms in international trade and investment. The costs and benefits of foreign direct investment are underscored in chapter five, where as the last chapter assesses the potential scope for alternatives to foreign direct investment and appraise the relative merits of licensing, subcontracting and other forms of contractual relationship.

Interesting sidelights are provided in the book. For instance, the author mentions that since production lags and the use of durable equipment are both reflected in the capital-intensity the greater will be the difficulty of organizing an efficient external market for the intermediate product. This suggests that when multistage production is associated with increasing returns to scale or high capital intensity there will be strong incentive to internalize. Internalization of an intermediate product market generates

vertical integration. When factor prices differ between locations and barriers to trade are relatively low there is normally an incentive to base different stages of production at different locations, so as to match factor intensity at each stage to factor abundance. When the locations are in different countries vertical integration creates an MNE. He is logical in his observation that the degree to which internalization fragments the market depends mainly on the nature of the product. However, it is possible for several firms to be involved in exploiting the similar, closely substitutable items of proprietary information. The balance between the costs and benefits of internalization determines not only the type of market which is internalized but also the optimal size and structure of the firm.

The author notes that the final discrepancy as between expected performance and actual performance arises mainly because the foreign direct investor does not bear the full cost of his mistakes, encouraging the firm to underinvest in information about the host government in the first place. He believes that it should be possible to subsidize the diffusion of relevant information to the firm; to tax its mistakes by way of imposing fines for particular types of anti-social behaviour; and to regulate the firm by requiring its actions to be vested by a government body. He, therefore, pleads for reform of the patent law to give additional products for giving non-integrated competitors access to the market when they require it and to introduce statutory formulae for the determination of internal prices in cases where no comparable external price exists. He also suggests that it should be possible to amount the laws of bankruptcy and limited liability as also the relevant parts of labour law for reducing the incentive to vertical integration.

Thus, in the context of the increasingly critical attitude of host countries towards foreign direct investment, he underlines the need for revitalizing the concept of international market for proprietary technology, where transfers of technology at present internal to firms are externalized by contracts between nationals of different countries. Host countries, in his view, can promote market alternatives to the multinational enterprises by offering legal safeguards to complement the patent system through maintaining the confidentiality of marketing and managerial expertise transferred to them. Licensing of technology can be encouraged by offering the licensor the option of buying back production and marketing experience from the licenses at a fixed price. The author laments that the international agencies like the UNCTAD have not so far taken any positive steps for promoting the alternatives to multinational enterprises, while the negative proposals for regulating and restricting the behaviour of multinational enterprises have already proved to be of limited efficacy. He considers that while such proposals may indeed attract wide political support in the developing world, they in fact represent a wasted opportunity for countries dependent on foreign direct investment.

A good lot of material, empirical and analytical, has been presented in this short volume in support of the contentions of the author. The discussions of both theory and practice and the presentation of policy issues have come in a clearer light while profuse documentation has made his observations authentic. Indeed the book opens up a new chapter in the debate on multinational corporation and the widespread exploitative behaviour that they have shown so that their creative role could be better appreciated while their negative approaches could be held in check. That there are several ways of retention of control over investment and employment decisions, while international cooperation for technological uplift is sought, has been amply demonstrated by the author, albeit in a capsule form. The discussion of current issues in multinational enterprises in a theoretical frame has made the observations widely acceptable on both sides.

Trade Union Recognition

B. N. Datar
Published by : Lala Lajpat Rai College of Commerce and Economics
Price : not mentioned
pp : 37

Reviewed by : Ms. Mani K. Madala, Senior Consultant, National Productivity Council Lodi Road, New Delhi-110003

Based on talk delivered by Datar, as a part of Lala Lajpat Rai Memorial Lectures, this booklet at the beginning presents a bird's eye view of the Indian Trade Union

movement. Following this the recognition of the trade unions is discussed under five broad heads : Recognition by Government, Recognition by Employers, Recognition by Workers, Recognition by Rival Unions and Recognition by the Society with many examples drawn both nationally and internationally.

India is a vast country in which a variety of complex situations keep arising in different regions and the situations keep changing with time. What is applicable in Kerala may not be applicable in Bihar and so on and so forth. The stipulations for recognition of trade unions by the Act, Datar advocates should not be so stringent that the trade union organisers should feel helpless and the movement itself should get a set back. Mr. Datar advocates flexibility. If any stipulations are set out, enough time should be allowed for them to sink in the minds of all concerned. While talking about how the law with regard to the recognition of trade unions be framed Mr. Datar throws up a pertinent point—"law will not recognise charisma and charisma in some circumstances can muster adequate strength to beat the law." Should this be allowed to happen ? Take the case of Dutta Samant.

The booklet is definitely worth a perusal. Avoidable printing errors disallow smooth reading.

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A Select Bibliography

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1. BOOKS

Andrews, Kenneth R. : *The Concept of Corporate Strategy*, Illenois, 1941, 245pp.

Ansoff, H. Igor : *Corporate Strategy*, New York, McGraw Hill, 1965, 241pp.

Argenti, John : *Corporate Planning*, London, George Allen & Unwin, 1968, 272pp.

Argenti, John : *Corporate Planning Practical Guide*, London, George Allen, 1974.

Argenti, John : *Practical Corporate Planning*, London, George Allen & Unwin, 1980, 221pp.

Argenti, John : *Systematic Corporate Planning*, London, Thomas Nelson & Sons, 1974.

Batty J : *Corporate Planning Budgetary Control*, London, Macdonald and Evans, 1970, 433pp.

Baynes, Peter (Ed.) : *Case Studies in Corporate Planning*, London, Sir Issac Pitman, 1973, 187pp.

Bell, DJ : *Planning Corporate Manpower*, London, Longman, 1974, 179pp.

Bhattacharya, S : *Corporate Planning*, New Delhi, Oxford & IBH 1981, 226pp.

Brooke, Michael Z & Beusekom : *International Corporate Planning*, London, Pitman, 1979, 323pp.

Chandra, Durgesh : *Plan for Success : The PERT Way*, New, National Productivity Council, 1975, 181pp.

D'Aprix, Roger M : *Search of Corporate Soul*, NY AMACOM, 1976.

Denning, Basil W : *Corporate Planning-Selected Concepts*, New York, McGraw Hill, 1971, 373pp.

Ferguson, Charles R : *Measuring Corporate Strategy*, Illinois, Dow Jones Irwin, 1974.

Franks, Julian R & Scholefield, Harry H : *Corporate Financial Management*, Essex, Gower Press, 1974, 376pp.

Friend JK & Others : *Public Planning : The Inter Coraparate Dimension*, London, Tavistock Publication, 1974, 534pp.

Gee Edwin A & Tyler Chaplin : *Managing Innovation*, New York, John Wiley, 1976, 267pp.

Gorle Peter & Long James : *Essentials of Product Planning*, London, McGraw-Hill, 1973, 100pp.

Gupta, LC : *Corporate Management and Accountability*, Delhi, Macmillan, 1974, 128pp.

Hilton, Peter : *Planning Corporate Growth and Diversification*, New York, McGraw Hill, 1970, 245pp.

Hussey, De : *Corporate Planning Theory and Practice*, Oxford, Pergamon Press, 1974, 399pp.

Hussey, De (Ed) : *Corporate Planner's Yearbook*, 1974-75, Oxford, Pergamen Press, 1974.

Hussey, De : *Introducing Corporate Planning*, Oxford, Pergaman Press, 1971, 210pp.

Jacoby, Neil Hevman : *Corporate Power and Social Responsibility: A Blue Print for Future*, New York, Macmillan, 1973.

Jones Cooper, D : *Business Planning and Fore-casting*, New York, John Wiley, 1974.

Jones, Harry (Ed) : *Preparing Company Plan*, London, Gower Press, 1974, 258pp.

Kastens, Merritt L : *Long Range for Your Business*, New York, AMACOM, 1976, 160pp.

Kleine, Olaf & Kumar, Rakesh : *Corporate Planning : A Management Tool*, New Delhi, National Productivity Council, 1978, 32pp.

Kuntz, Walter N : *Modern Corporate Management*, Englewood Cliffs, Prentice Hall, 1978, 226pp.

Lawton, Tom : *Financial Aspect of Corporate Planning*, London, I.C.A. 1975, 95pp.

Lorange, Peter : *Coraporate Planning : An Executive Viewpoint*, New Jersey Prentice Hall, 1980, 294pp.

Lyneis James, M : *Corporate Planning and Polcy Design: A System Dynamics-Approach*, Cambridge. The MIT Press, 1980, 519pp.

Mayo, R. Britton : *Corporate Planning and Modeling*, Reading Addison Wesley, 1979, 454pp.

Naylor, Thomas H : *Corporate Planning Models Reading*, Addison Wesley, 1979, 390pp.

Ross, Joel E & Kami, Michael J : *Corporate Management in Crises, Why the Mighty Fall*, Englewood Cliffe, Prentice hall, 1973, 263pp.

Sengupta, Nitish, K : *Corporate Management in India*, Delhi, Vikas Publishing House, 1974, 242pp.

Skitt, John (Ed) : *Practical Corporate Planning in Local Government*, Beds, Leonard Hill Books, 1975, 260pp.

Venu, S : *Successful Management in Development Countries, Corporate Planning*, Calcutta, Orient Longman, 1975.

2. ARTICLES

Ackoff, RL : On the use of Models in Corporate Planning. *Strategic Management Journal*, 2(4), 1981, 353-9pp.

Ansoff, HI : Strategic Issue Management, *Strategic Management Journal*, 1(2), 1980, 131-48pp.

Argenti, John : Corporate Planning and Corporate Collapse. *Lang Range Planning*, 9(6), December 1976, 12-17pp.

Argenti, J : Strategic Planning in a Rapidly Changing Environment. *Long Range Planning*, 12(5), 1979, 110-12pp.

Bagade, MV : Development of a Plan for Transport Industry. *Journal of Transport Management*, 5(2), Sept. 1981, 27-32pp.

Balu, V : Corporate Planning; Theory and Practice *Chartered Secretary* : 11(3), March 1981, 200-209pp.

Bandyopadhyay, R : Planning in Banks-interlinkage, *Prajnan*, 4(2), April-June 1975, 133-143pp.

Banerjee, A : Some Aspects of Company Planning, *Productivity* : 16(4), 1976, 1062-71pp.

Banerjee, BP : Corporate Planning : Some Issues *Decision* 8(3), July 1981, 243-248pp.

Basu, PC : Corporate Planning in a Multi-product Organisation, *Productivity*, 16(4), 1970, 1043-9pp.

Beck, PW : Corporate Planning for and Uncertain Future—*Long Range Planning*, 15(4), Aug. 1982, 12-21pp.

Bender, PS & Others : Practical Modelling for Resource Management. *Harvard Business Review*, 59(2), 1981, 163-73pp.

Berry, Waldron : Beyond Strategic Planning. *Managerial Planning*, 29(5), 1981, 12-15, 40pp.

Bhatia, VS : Need for Professional Managers Participation in Planning, *Capital*, February 24, 1977, 135-136pp.

Bhattacharya, SK & Chakravarti G : Initiating Corporate Planning; Content. Process & Roles, *Decision* 8(3), July 1981, 249-266pp.

Bhukhanwala, Harsha S : Corporate Plan for a Bank, *Prajnan* 4(2), April-June 1975, 215-266pp.

Bitondo, D & Frahman, A : Linkage Technological and Business Planning. *Research & Management*, 24(6), 1981, 19-23pp.

Blanning, RW : How Managers Decide to Use Planning Models. *Long Range Planning*, 13(2), 1980, 32-5pp.

Blanning, RW & Crandall, RH : Heuristic Modelling and Technological Impact Analysis. *Technological Forecasting & Social Change*, 15(4), 1979, 259-71pp.

Blue RN, : Managing Turnover Strategically, *Business Horizons*, 25(2), March-April 1982, 6-12pp.

Bouamrene MA & Flavell R : Airline Corporate Planning a Conceptual Framework. *Long Range Planning* 13(1), Feb. 1980, 62-69pp.

Boulton, WR, Franking, SG & Lindsay, WM & Rue, LW : How are Companies Planning Now ? A Survey, *Long Range Planning*, 15(1), February 1982, 82-86pp.

Bourgeois, LJ & Astley, WG : Strategic Model of Organizational Conduct and Performance. *International Studies of Management & Organisation*, 9(3), 1979, 40-66pp.

Bowman, EH : Some Reflection on Corporate Strategy and Corporate Governance *International Studies of Management and Organization*, 9(4), 1979-80 110-7pp.

Brown, JL & McK Agnew, N : Corporate Ability, *Business Horizons*, 25(2) March-April 1982, 29-33pp.

Brandi WK & Others : Pitfalls in Planning for Multinational Operations. *Long Range Planning*, 13(6) 1980, 23-31pp.

Burton, George : How Planning Concentrated the Minds at MK Group, *Accountancy*, 93(1061), Jan. 1982, 65-68pp.

Burton, RM & Naylor, TH : Economic Theory in Corporate Planning. *Strategic Management Journal*, 1(1), 1980, 17-22pp.

Camillus, JC : Corporate Strategy and Executive Action Transition Stages and Linkage Dimensions, *Academy of Management Review*, 6(2), 1981, 253-9pp.

Camillus, JC : Evaluation the Benefits of Formal Plannings Systems, *Long Range Planning*, 8(3), 1975, 33-40pp.

Camillus, JC : Planning Managers Roles : an Operational Framework. *Vikalpa*, 3(2), April 1978, 99-109pp.

Capon, N & Others : International Diffusion of Corporate and Strategic Planning Practices. *Columbia Journal of World Business*, 15(3), 1980, 5-13pp.

Carman, JM & Langeard, E : Growth Strategies for Service Firms *Strategic Management Journal*, 1(1), 1980, 7-22pp.

Chakravarthy BS : A Promising Metaphor for Strategic Management, *Academy of Management Review*, 7(1), 1982, 35-44pp.

Chakraborty, SK : Corporate Long Range Planning : Some Basic Approaches, *Decision*, 8(3), 1981, 175-90pp.

Chakraborty, SK : Measuring the Need for Corporate Planning—an Operational Framework, *Productivity*, 16(4), 1976, 1016-31pp.

Chandler, WJ : Plans-Their Preparation and Implementation. *Long Range Planning*, 11(6), Dec. 1970, 14-20pp.

Chatterjee, BK : Evolution of the L.R.P. System in Large Marketing Organisation in India. *Decision*, 8(3), 1981, 227-241pp.

Cohn, David M : Strategic Business Planning : A Critical Management Tool. *Survival Management Planning*, 29(4), Jan.-Feb- 1981, 4-10pp.

Cooley, PL : Managerial Pay and Financial Performance of Small Business. *Journal of Business Research*, 7(3), 1979 267-76pp.

Dasgupta, MR : Need for Corporate Planning in General Insurance Industry, *Capital*, 188(4692), Feb. 1, 1982, 12-14pp.

Datta, SK : Dilemmas of Commercial Banks in India and Corporate Planning. *Prajnan*, 4(1), January-March 1975, 1-13pp.

Datta, Y : New Directions for Research in Business Strategy. *Journal of General Management*, 6(1), 1980, 48-60pp.

Degueldra, J : Corporate Planning and Modelling in a Large Bank. *Long Range Planning*, 13(4), 1980, 43-50pp.

Deswart, JMM : Personnel Planning—a Strategic View. *Long Range Planning* 12(3) June 1979, 8-15pp.

Devanna, Mary Anne : Strategic Planning and Human Resource Management. *Human Resource Management*, 21(1), 1982, 11-17pp.

De Kluyver, Cornelis A & McNally, & Greame M : Corporate Planning Using Simulation. *Interfaces* 10(3), June 1980, 1-7pp.

De Kluyver, Ca, McNally, GM : Developing a Corporate Planning Model for a Small Company, *Long Range Planning*, 15(1), Feb. 1982, 97-106pp.

Diffenback, J : Finding the Right Strategic Combination, *Journal of Business Strategy*, Autumn 1981, 47-58pp.

Dill, WR : Integrating Planning and Management Development, *Long Range Planning*, 8(5), 1975, 8-12pp.

Dill, WR : Public Participation in Corporate Planning —A Strategic Management in a Kibitzers World, *Long Range Planning*, 5(1), 1975, 57-63pp.

Dimma, WA : A Perspective on Presidents and Planning, *Business Quarterly*, 46(4), Winter 1981, 47-55pp.

Dobbie, JW : Strategic Planning in Large Firms—Some Guidelines, *Long Range Planning*, 8(1), 1975.

Donnelly, Robert M : Controllers, Role in Coroporate Planning, *Management Accounting*, 63(3), Sept. 1981, 13-18pp.

Dundas, KNM & Richardson, PR : Corporate Strategy and the Concept of Market Failure, *Strategic Management Journal*, 1(2), 1980, 177-88pp.

Dutta, Nath : Role of Macro-Economic Factors in Corporate Planning, *Capital*, 181(4526), August 17, 1978, 1160-1161pp.

Dutta, BK & King WR : Matagame Analysis of Competitive Strategy : *Strategic Management Journal*, 1(4), 1980, 357-70pp.

Ein-Dr Phillip & Segev ELI : Strategic Planning for Management Information Systems, *Management Sciene*, 24(15), Nov. 1978, 1631-1641pp.

Fairaizl Lan F & Mullick Satinder K : Corporate Planning System, *Management Accounting*, 57(6), December 1975, 13-16 & 20pp.

Finlay, PN : Introducing Corporate Planning in a Medium Size Company—a case history, *Lang Range Planning*, 15(2), 1982, 93-103pp.

Finlay, Paul N : Introducing Corporate Planning in the Medium Size Company—A Case History, *Long Range Planning*, 15(4), Oct-Dec. 1980, 255-271pp.

Fleming John E : Linking Public Affairs with Corporate Planning, *California Management Review*, 23(2), Winter, 1980, 35-43pp.

Ford, TM : Strategic Planning-Myth or Reality? A Chief Executive' Review, *Long Range Planning*, 14(6), 1981, 9-11pp.

Frohman, AL & Bitondo, D : Co-ordinating Business Strategy and Technical Planning, *Long Range Planning*, 14(6), 1981, 58-67pp.

Ganguli, Siddhartha : Form Crisis Handling to Strategic Management, *Capital*, 188(4692), Feb. 1, 1982, 10-11pp.

Geoffrion Arthur M & Van Roy Tony J : Caution Common Sense Planning Methods can be Hazardous to Your Corporate Health, *Sloan Management Review*, 20(4), Summer 1979, 31-42pp.

Gilbert X & Lorange, P : Five Pillars for Your Planning, *European Business*, 1974, 57-63pp.

Gluck, FW & Others : Strategic Management for Competitive Advantage, *Harvard Business Review*, 58(4), 1980, 154-61pp.

Godiwalla Yezdi M & Others : Corporate Planning and the Chief Executive, *Long Range Planning*,12(2), April 1979, 2-15pp.

Goldstein, SG Mike : Involving Managers in System-Improvement Planning. *Long Range Planning*, 14(1), Feb. 1981, 93-99pp.

Goodall, AJ : Corporate Planning, at Batchalors Foods Limited,—A Case Study, *Long Range Planning*, 7(5), 1974, 47-50pp.

Govindarajan, PS : Corporate Planning in Public Enterprises-Perspective and Problems, *Lok Udyog*, 14(3), 1980, 7-13pp.

Grunewald Hans Gunter & Vellmann, K : Integrating Regional and Functional Plans at Henkel, *Long Range Planning*, 14(2), April 1981, 19-28pp.

Harris DJ : Corporate Planning and Operational Research, *Journal of Operational Research Society*, 29(1), January 1978, 9-17pp.

Harris DJ & Davies BCL : Corporate Planning as a Control System in United Kingdom Nationalized Industries, *Long Range Planning*, 14(1), Feb. 1981, 15-22pp.

Hawkins, K & Tarr, RJ : Corporate Planning in Local Government—A Case Study, *Long Range Planning*, 13(2), 1980, 43-51pp.

Hayashi, Kichiro : Corporate Planning in the Japanse Cultural Milieu, *Management Japan*, 13(2), Autumn 1980, 6-11pp.

Hayashi Kichiro : Corporate Planning Practices in Japanese Multinationals, *Academy of Management Journal*, 21(2), June 1978, 211-226pp.

Higgins, JC : Value of Accuracy in Information for Planning and Control, *Long Range Planning*, 7(4), 1974, 67-72pp.

Higgins, RB : Long Range Planning in the Mature Corporation, *Strategic Management Journal*, 2(3), 1981, 235-250pp.

Hinomoto, Hirohide & Reddy, James M : Corporate Planning Using Government Information Systems, *Long Range Planning*, 10(6), Dec. 1977, 79-83pp.

Hograth, Robin M & Makridakis, Spyros : Forecasting and Planning : An Evaluation, *Management, Science* 27(2), Feb. 1982, 115-130pp.

Horovitz, JH : Strategic Control : A New Task for Top Management, *Long Range Planning*, 12(3), June 1979, 2-7pp.

Horovitz, JH : Top Management's Involvement in Strategy Formulation and Evaluation : Issues and Perspectives, *International Studies of Management & Organization*, 11(2), 1981, 84-96pp.

Horvath, D & McMillan, CJ : Strategic Choice and Structure of Dicision Processer, *Internatianal Studies of Management and Organization*, 9(3),1979, 87-112pp.

Horowitz, Ralph : Corporate Ptanning : A Conceptual Critique, *Long Range Planning*, 12(1), Feb. 1979, 62-66pp.

House, William C : Dynamic Planning for the Smaller Company—A Case History, *Long Range Planning*, 12(3), June 1979, 38-47pp.

Hunsicker, J Quiney : The Malaise of Strategic Planning, *Management Review*, 69(3), March 1980, 8-14pp.

Hydegger, F & Singer V : Corporate Planning Combines Strategy and Spontaneity in an Optimal MIX, *Management Focus*, 28(6), Nov.-Dec. 1981, 12-15pp.

Ishihara, Z : Business Strategy in Theory and Practice : A Case Study of Chemical Industry, *Management Japan*, 12(2), 1979, 22-30pp.

Jackson, Donald W & Aldog, RJ : Planning for Corporate Social Actions, *Managerial Planning*, 29(2), Sept-Oct. 1980, 28-33pp.

Jambunathan S : Planning & Control Systems in ST Undertakings, *State Transport News*, 10(5), 1975, 12-14pp.

Keppler, W & Others : Organization for Long Range Planning—A Survey of German Companies, *Long Range Planning*, 12(5), 1979, 69-90pp.

Kingehott, AL : Planning in a Nationalised Industry Range Planning, 8(5), 1975, 58-65pp.

King William R & Cleland David I : Information for More Effective Strategic Planning, *Long Range Planning*, 10(1), Feb. 1977, 59-63pp.

Klesin, Harold E & Linneman, Robert E : Use of Scenarios in Corporate Planning—Eight Case Histories, *Long Range Planning*, 14(5), Oct. 1981, 69-77pp.

Klopotowski, AJ : Strategy Formulation and the Public Enterprises/Corporation Accountability, *Management Development*, 11(1), 1982, 1-7pp.

Kluyuer, CA Se & McNally M : Developing a Corporate Planning Model for a Small Company, *Long Range Planning*, 15(1), 1982, 97-106pp.

Kluyvek, Ca De & McNally GM : Corporate Planning Using Simulation, *Interfaces*, 10(3), 1980, 1-7pp.

Kohli PK : Corporate Planning for Research & Development, *Eastern Economist*, 77(2), July 10, 1981, 53-55pp.

Kono, T : Comparative Study of Strategy, Structure and Long Range Planning in Japan and U.S., *Management Japan*, 13(1), 1980, 20-34pp.

Kudla, RJ Cesta, JR : Planning and Financial Performance : A Discriminant Analysis, *Akron Business and Economic Review*, 13(1), 1982, 30-6pp.

Kumar, R : Corporate Planning Process—A New Approach, *Productivity*, 16(4), 1976, 1033-41pp.

Lawrence, La Forge : Corporate Planning and Operations Research; do they go together, *Long Range Planning*, 15(3), June 1982, 152-156pp.

Lenz, RT & Lyles, MA : Tackling the Human Problems in Planning, *Long Range Planning*, 14(2), 1981, 72-77pp.

Leontiades, Milton : Dimensions of Planning in Large Industrialized Organization, *California Management Review*, 22(4), Summer, 1980, 82-86pp.

Leontiades, Milton : Stratagic Theory and Management Practice, *Journal of General Management*, (2), 1979-80, 22-32pp.

Lontiades, Miltion & Tezel, A : Planning Perceptions and Plannning Results, *Strategic Management Journal*, 1(1), 1980, 65-75pp.

Lewn, AY & Shakun, MF : A Structured Framework for Integrating the Corporate Perspective into Public Policy Formulation, *Scima*, 9(1), 1980, 1-17pp.

Lewy PM : Colliery Model a Computer Aid to Planning at a Colliery, *Journal of the Operational Research, Society*, 30(2), December 1979, 1085 1095pp.

Lientz Bennet P & Chen Myles : Long Range Planning for Information Services, *Long Range Planning*, 13(1), Feb. 1980, 55-61pp.

Litechert, RJ & Nicholeon, EA : Corporate Long Range Planning Group—Some Different Approaches, *Long Range Planning*, 7(4), 1974, 62-66pp.

Lorange, Peter : Divisional Planning : Setting Effective Direction, *Sloan Management Review*, 17(1), Fall 1975, 77-98pp.

Machin John LJ & Wilson LYN S : Closing the Gap Between Planning and Control, *Long Range Planning*, 12(2), April 1979, 16-32pp.

Mahon JF & Murray, EA : Strategic Planning for Regulated Companies, *Strategic Management Journal*, 2(3), 1981, 251-262pp.

Mascarenhas B : Firm Responses to Environmental Instability, *Journal of General Management*, 7(2), 1981-82, 54-61pp.

Mason, JB & Resnik, A : Marketing : The Prospects for the 1980, *Long Range Planning*, 15(1), Feb. 1982, 34-39pp.

Matsuda, Takeshiko & Hirani, M : Study on the Structure of Planning Behaviour, *European Journal of Operational Research* 9(2), Feb. 1982, 122-132pp.

Michael SR : Tailor-Made Planning Fit the Firm, *Long Range Planning*, 13(6), 1980, 74-9pp.

Miller, George : Management Guide Lines : The Art of Planning, *Supervisory Management*, 26(5), May 1, 81, 24-31pp.

Mukherjee TK : Corporate Plan for Business Growth, *Economic Times*, 1 Jan. 1976, 65.

Mukhopadhyay Sampat : Corporate Planning Process, *Chartered Secretary*, 7(5), Aug. 1977, 306-308pp.

Nadler Gerald : Corporate Planning : A Systems View *Long Range Planning*, 11(6), Dec. 1978, 67-68pp.

Narayanan, VK, Fahey L : The Micro-politics of Strategy Formulation, *Academy of Management Review*, 7(1), 1982, 25-34pp.

Nanus B : Quick Environmental Scanning Technique, *Long Range Planning*, 15(2), 1982, 39-45pp.

Naor Jacob : New Approach to Corporate Planning, *Long Range Planning*, 11(2), April 1978, 56-59pp.

Naor, J : How to Make Strategic Planning Work for Small Business, *Sam Advanced Management Journal*, 45(1), 1980, 35-9pp.

National Seminar : On Corporate Planning in Public Enterprises—A Report, *Institute of Public Enterprise Journal*, 1(2 & 3), Oct-Dec. 1977 & Jan-March 1978, 49-58pp.

Naylor TH : Integrating Models into the Planning Process, *Long Range Planning*, 10(6), Dec. 1977, 11-15pp.

Natel P. Finlay : Introducing Corporate Planning in a Medium Size Company. A Case History, *Long Range Planning*, 15(2), 1982, 93-103pp.

Nielsen RP : Toward a Method Job Building Consensus During Strategic Planning, *Sloan Management Review*, 22(4), 1981, 29-40pp.

Nydegger, Frederick & Singer, V : Corporate Planning Combines Strategy and Spontaneity in an Optimal Mix, *Management Focus*, 28(6), Nov-Dec. 1981, 12-15pp.

O'Connell JJ, Immerman JW : Scanning the International Environment, *California Management Review*, 22(2), 1979, 15-23pp.

Ortman, Richard F & Blackman, Dennis D : Corporate Planning—How Successful is it ? *Management Accounting*, 63(1), July 1981, 16-20pp.

Padhye AG : Corporate Planning : Perspective and Problems, *Productivity*. 19(2), July-Sept. 78, 175-178pp.

Paramesvar, KR : Corporate Planning—The Case of Bharat Heavy Electricals Ltd., *Decision*, 8(3), July 1981, 201-207pp.

Pearce JA : An Executive-level Perspective on the Strategic Management Process, *California Management Review*, 24(1), 1981, 39-48pp.

Pearson Barrie : Business Development Approach to Planning, *Long Range Planning*, 9(6), December 1976, 54-62pp.

Pomeranz, Felix & Gale, James : Is This Strategy Working? A New Role for Acccountants, *Management Review*, 63(3), March 1980, 14-18pp.

Quinn, James Brian : Managing Strategic Change, *Sloan Management Review*, 21(4), Summer 1980, 3-20pp.

Rakesh Kumar : Corporate Planning—Basic Steps, *Management in Government*, 9(4), January-March 1978, 381-389pp.

Rakesh Kumar : Corporate Planning Process : A New Approach, *Productivity*, 16(4), Jan-March 1976, 1033-1041pp.

Ramanna, HC : Long Range Planning—Part II, *Integrated Management*, No. 119-120, March-April 1976, 21-22pp.

Ramanna HC : Long Range Planning—Part II, *Integrated Management*, No. 119-120, 1976, 21-22pp.

Rammana, NC : Long Range Planning—Part I, *Integrated Management*, No. 18, Feb. 1976, 19-21pp.

Rangrajan, C : Corporate Planning in the Context of National Planning, *Productivity*, 16(4), Jan-March, 1976, 985-1000pp.

Rao, BA : Long Range Planning, *Indian Management*. 19(7), 1980, 35-7pp.

Razzell, EJ : Planning in Whitehall—is it possible ? Will it survive ? *Long Range Planning*, 13(1), 1980, 34-41pp.

Reilly, DN : Bringing Planning Systems to the Manager. *Long Range Planning*, 7(3), 1974, 45-8pp.

Robinson, RB : Importance of "outsiders" in Small Firm Strategic Planning. *Academy of Management Journal*, 25(1), 1982, 90-93pp.

Ronchi, L : Decision-making Process for Strategic Adaptation. *Long Range Planning*, 13(1), 48-54pp.

Rossiter PM : Corporate Planning at Dunlop, *Long Range Planning*, 12(1), Feb. 1979, 17-21pp.

Ruefili, T & Sarrazin, J : Strategic Control of Corporate Development Under Ambiguous Circumstances *Management Science*, 27(10) 1981, 1158-1170pp.

Saradhi, S. P. Vijaya : Planning Process in Public Sector Enterprises *Lok Udyog*, 15(3), June 1981, 11-15pp.

Saunders, CB : Strategy Formation as a Political Process. *Journal of General Management*, 2(3), 1975, 80-6pp.

Savage, DA : Identifying the Problem Areas in Corporate Planning. *Management Accounting*, 58(8), Sept. 1980, 26-27pp.

Schoen, Donald R : Responsibilities of Corporate Planning. A checklist, *Management Review* 66(3), March 1977, 26-27pp.

Sedler, P : Management and the Social Environment. *Long Range Planning*, 8(4), 1975, 18-22pp.

Sekhar, RC : Corporate Planning Styles in Public Sector. *Economic & Political Weekly*, 6(22), 1981, M76-M80pp.

Sen, Basudeb : Corporate Planning in Public Sector; economist-planners dilemmas. *Decision*, 8(3), July 1981, 191-200pp.

Sethi, Narendra K : Operations Planning. *Productivity*, 21(2), July-Sept 80, 197-213pp.

Sethi, Narendra K : Corporate Planning Process—an analytical study, *Management in Government*, 7(4), Jan-March 1976, 312-329pp.

Sethi, Narendra K : Enterprise Planning *Integrated Management*, 16(4 to 6), April-June 1981, 31-39pp.

Sethi, Narendra K : MIS and Planning Interface. *Integrated Management*, 15(5), May 1980, 30-44pp.

Sethi, Narendra K : Multinational Corporate Planning. *Industrial Management*, 21(3), May-June 1979, 5-9pp.

Sethi, Narendra K & Sethi, Kiran K : Case Study in Corporate Planning Procedure. *Integrated Management*, No. 118, Feb. 1976, 22-28pp.

Sethi, NK & Ahuja, M : Corporate Planning in India: a survey of 30 companies. *Business Standard*, March 9, 1982, p5.

Sethi, Narendra, K & Ahuja, M : Planning Functions Objectives Plans-integration-implementation *Ambit*, 11(4), April 1982, 3-7pp.

Sethi, NK & Ahuja, M : A Survey of Corporate Planning Practices, *Indian Management*, 21(4), 1982, 3-5pp.

Sethi, Narendra & Ahuja, Manju : Survey of Corporate Planning. Practices, *Ambit*, 11(6), June 1982, 6-11pp.

Sethi, Narendra K & Sengupta, Mridul K : Planning Process a Scientific and Intellectual approach. *Integrated Management*, 15(1), Jan. 1980, 5-32pp.

Sethi, Narendra K & Slade, MH : MIS and Planning Process. *Industrial Management* 23(5), Sept-Oct. 1981, 9-15pp.

Shanklin, William L : Strategic Business Planning : yesterday, today and tomorrow. *Business Horizons*, 22(5), Oct. 1979, 7-14pp.

Simmons, William U : Strategic Planning Program for the Next Decade. *SAM Advanced Management Journal*, 41(1), Winter, 1976, 31-37pp.

Simmons, William W : Planner & Look at Planning Again. *Managerial Planning*. Jan.-Feb. 1981, 29(4), 11-12, 17pp.

Simmons William W : Strategic Planning Program for the Next Decade *SAM Advanced Management Journal*, 41(1), Winter 1976, 31-37pp.

Singh, Sampat P : Banting in Nineteen Eighties; understanding key issues in strategic planning *Prajnan*, 10(4), Oct. Dec.-1981, 351-370pp.

Smith, J De & Rade, NL : Rationale and Non-rationale Planning, *Long Range Planning*, 13(2), 1980, 87-101pp.

Smith, JG : Strategy—The Key to Planning in the Public Corporation, *Long Range Planning*, 14(6), 1981, 24-31pp.

Smith, Ward C : Catastrophe Theory Analysis of Business Activity, *Management Review*, 69(6), June 1980, 26-28, 37-40pp.

Snyder, N & Glueck, WF : How Managers Plan the Analysis of Managers Activities, *Long Range Planning*, 13(1), 1980, 70-6pp.

Srinivasan, S : Long Range Corporate Planning, *Management Accountant*, 15(9), 1980, 375p.

Subba Rao SR : Corporate Planning : A Model for Banks, *Productivity*, 21(2), July-Sept. 1980, 173-180pp.

Subramaniam, SC Sharma CK : Corporate Planning in Domestic Airlines an Indian Case Study, *Long Range Planning*, 8(4), 1975, 64-9pp.

Suman JC : Corporate planning in Small Companies—A Survey, *Long Range Planning*, 8(5), 1975, 81-90pp.

Tavernier, G : Making Managers Look at the World Outside, *International Management*, 34(12), 1979, 48-50pp.

Tavernier G : Swedish Firm Alters its Approach to Planning, *International Management*, 30(3), 1975, 36-8pp.

Taylor Bernard : New Dimensions in Corporate Planning, *Long Range Planning*, 9(6), Dec. 1976, 80-105pp.

Taylor, DE : Strategic Planning as an Organizational Change Process—Some Guidelines for Practice, *Long Range Planning*, 12(5), 1979, 43-53pp.

Taylor, G : Strategies for Planning, *Long Range Planning*, 8(4), 1975, 27-40pp.

Taylor, TCL : Management Course (17)-Corporate Planning, *Bankers' Magazine*, 1974, 25-8pp.

Thietart, RA & Vivas, R : Strategic Intelligence Activity. The Management of the Sales Force as a Source of Strategic Information, *Strategic Management Journal*, 2(1), 1981, 15-25pp.

Thomas, FA : Corporate Planning in an International Environment, *Long Range Planning*, 7(5), 1974, 13-16pp.

Tomas, PS : Environmental Analysis for Corporate Planning, *Business Horizons*, 17(5), 1974, 27-38pp.

Thomas, PS : Environmental Scanning the State of the Art, *Long Range Planning*, 13(1), 1980, 20-8pp.

Timmons Jeffery A : Business Plan is More than Financing Device, *Harvard Business Review*, 58(2), March-April 1980, 28-34pp.

Tomlinson OS : Developing a Database for Planning – A Shipping Industry Case, *Long Range Planning*, 13(6), 1980, 42-5pp.

Van Hoorn TH. P : Strategic Planning in Small and Medium Sized Companies, *Long Range Planning*, 12(2), April 1979, 84-91pp.

Vijayasaradhi, SP : Planning Process in Public Sector Enterprises, *Lok Udyog*, 15(3), 1981, 11-15pp.

Vincent, Joh D : Long Range Planning of Paper and Board Supplies, *Long Range Planning*, 13(2), April 1980, 60-66pp.

Walsh, C & Mock E : Setting Corporate Objectives Using Market Required Earnings, *Long Range Planning*, 12(5), 1979, 69-90pp.

Weithrich H : The Tow 9 Matrix—A Tool for Situational Analysis, *Long Range Planning*, 15(2), 1982, 54-66pp.

Wheelwright SC : Japan Where Operations Really are Strategic, *Harvard Business Review*, July-August 1982, 67-74pp.

Wind Y. Mahajan V : Designing Product and Business Port-folios, *Harvard Business Review*, 59(1), 1981, 155-65pp.

Yasaswy. NJ : A Broad Framework of Corporate Planning, *Financial Express*, 27 March 1981, 4p.

Young A : Corporate Planning are Accountants Fully Committed? *Management Accounting*, 55(3), March 1977, 121-122pp.

Zettergren, L : Financial Issues in Strategic Planning, *Long Range Planning*, 8(3), 1975, 23-32pp.

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Strategy for Higher Productivity

L. K. JHA

The author, in a very lucid way traces the various reasons, why productivity in the Indian context has not attained the desired levels. In his inimitable style, making use of his rich experience, the author presents several suggestions for remedying the situation.

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I

Introduction

Ever since independence we have been striving for higher production. The rate of growth, which measures the increase in output from year to year, rightly receives a good deal of public attention. The shortage of resources, particularly capital, has been identified as the main hurdle in the way of stepping up growth ever since we embarked on planning. People with low incomes cannot save much; many cannot save at all. The paucity of savings results in low capital formation. The consequent inadequacy of investment comes in the way of raising production and income levels. It is this vicious circle of low income resulting in low capital formation which perpetuates low incomes in which India like all developing countries, was caught in the early phases of development.

Additional Resource Mobilisation

To mobilise more savings by curtailing consumption, we have been raising the level of taxation from year to year. For each Plan, the Planning Commission fixes targets for additional resource mobilisation. In the reckoning of resources, account is taken of savings in the household sector as well as surpluses generated out of investment both in the public sector and in the private sector. In actual fact, particularly because of surpluses in the public sector falling far short of targets, the exercise of additional resource mobilisation, referred to as A.R.M. for short, becomes synonymous with arm—twisting taxation.

Enviable Rate of Savings

Even so, we can certainly congratulate ourselves on having succeeded in more than doubling the rate of savings in the economy which has for a number of years been above 20% of our national income. This rate of savings is not only unparalleled in any democratic country with such low income levels, but is well above the rate of savings in many affluent countries. On hearing the Indian rate of savings, the U.S. Secretary of State, Mr. Shultz, himself an economist of high repute, said, "I wish we could achieve a similar level of savings in our country".

But this increase in the level of savings has not led to a corresponding increase in the rate of growth. Over the last three decades, the growth has not been rising proportionately to the increase in the rate of savings. In fact, there has been a trend in the economy to use more capital per unit of output than in the past. The rise in the capital output ratio which means a decline in the productivity of capital, has undermined the success of our resource mobilisation effort.

Why Low Growth ?

Unfortunately, instead of asking why the productivity of capital has gone down, the trend has been to try to mobilise more resources in order to step up the rate of growth. But clearly the level of production is determined not just by the volume of resources which are harnessed into productive channels but also on how efficiently they are utilised and how high their productivity is. Recent research into the economic performance of different developed countries has brought out very sharply that the major factor which explains the different rate of growth in different industrialised countries is not the savings generated in their economy but the manner in which the savings are deployed. Considering how heavy is the burden of taxation which falls even on the lowest income groups in the country, the time has surely come when we, in our effort to achieve higher levels of production, must place much greater emphasis on improvements in productivity than on more taxation.

Judicious Resource Deployment

The importance of raising the productivity of resource is not of course limited to capital alone. There are many other inputs which are involved in production. There is energy and there are raw materials. In the context of the oil price explosion, every country has made tremendous efforts to reduce energy consumption through appropriate changes in technology. We have done not too much in this direction. Lowering the consumption of energy per unit of output in industries, like fertilizers, steel and aluminium and many others, would reduce their costs and relieve the power shortage and thus help raise the levels of production generally.

Raising the productivity of land is of special importance in agriculture. The availability of arable land, particularly irrigated land is low. Only by improving yields per hectare can we hope to remain self-sufficient in regard to our needs of foodgrains despite the rising population and higher levels of consumption. We have also to pay attention to raising the output of oilseeds because we are spending hundreds of crores of rupees in foreign exchange on the import of vegetable oil. Cotton, jute and sugarcane are other key crops for us. It is only through higher productivity that we can not only be self-sufficient in agricultural products as a whole but have exportable surpluses in some of them. The Green Revolution in fact was nothing more than an attempt to improve the productivity of land by the judicious use of fertilisers, water and high-yielding varieties of seeds, but this quantum jump in productivity has been confined only to certain crops, mainly wheat, and certain areas. It has to affect our agriculture as a whole.

The productivity of land is relevant in the non-agricultural sector also. For urban housing, a more intensive use of sites through the construction of multi-storeyed complexes instead of the single storeyed residences which were affordable in the past, can make more housing available. Many industrial units acquire far more land than they really need. Any land which is not usefully employed lowers its average productivity.

Finally, about the labour. Because we have a very large unemployment problems, there is some measure of opposition to improving labour productivity lest it should aggravate unemployment. Since we have a

surplus of manpower, *prima facie* it seems better that industry should engage more labour than it really needs rather than attempt to reduce the number of man-hours needed per unit of output. It is a subject on which deeper thought is clearly needed.

First of all, the benefits to the workers from an increase in the productivity of labour need to be more widely recognised. If less of capital, less of energy, less of land and less of labour are employed per unit of output, prices would come down. Workers would be able to buy more out of their wages. Further as productivty of labour goes up, wages must be raised. If some countries can afford to pay their workers as much for an hour's work as the Indian workrs earn in a whole day or even a whole week and yet sell their products at cheapter prices than we can, it is because of improvement in productivity.

Secondly, the fear that rise in productivity would result in unemployment because fewer workers would be needed for particular volume of production presupposes that the volume of production would remain static. In fact cheapening of costs brings products within the range of consumers with lower incomes and therefore enlarges the volume of production. In consequence employment usually rises.

The point is best illustrated by looking at the historical experience of developed countries. When the steam engine was invented, there were riots because it was seen to pose a threat to employment. But over the years the countries which replaced manpower by mechanically-generated horse power forged ahead industrially and the number of workers engaged in mechanised production began to increase by leaps and bounds.

A further point to note is that sometimes as a result of improvement in labour productivity, employment in one sector shrinks but in other sectors it gets a boost. The railways, trucks and buses have no doubt reduced employment for those plying animal driven vehicles but they have generated a tremendous volume of employment for others by enabling apples produced in the hills of the north to be sold in the south, by moving coal from Bihar to provide energy for industries in Gujarat or Kashmir, and by making it possible for coir-matting produced in Kerala to be sold at a cheap price in Delhi, Bombay and Calcutta.

In saying this, one is not arguing against labour intensive techniques being fostered in Indian conditions. Their main advantage lies in the fact that they need relatively less capital and, therefore, the higher productivity of capital offsets the lower productivity of labour. Since we are very short of capital and have a surplus of labour, the special incentives given to the handloom industry and other similar industries are fully justified. But even in such industries, attempts should be made to improve the productivity of labour with a view to raising their wage levels.

II

Improving Productivity

Having said so much about the importance and significance of raising productivity, let me now ask what steps can be taken to give a special boost to productivity in India. The prime responsibility for improving productivity is that of the producer himself. If he can economise on the use of capital, he can raise his output without having to seek more funds. Further he can lower his costs. His profits would improve on two counts: firstly because he would sell more goods and secondly because his profits per unit would go up. In conditions of keen competition, units whose productivity is low begin to lose ground to those whose productivity is high. Therefore, there is a race to raise productivity, to find new methods of production, to improve technology, to eliminate waste, to ensure better industrial relations and do all the other things that would raise output and lower the costs. In the process, not only the producer but the consumer benefits as prices come down.

Unfortunately in India there is very little by way of competition. Most products enjoy a sellers market. Demand is in excess of supply. In such conditions not much attention is given to productivity.

The prime reason why industries in India do not have to face much competition lies deep rooted in the paucity of resources. On account of the shortage of foreign exchange, imports of products made in the

country had to be severely restricted and external competition was virtually shut out. In addition the shortage of domestic capital also reduced, if not eliminated internal competition. Through industrial licensing, capacity in each industry has as a rule been restricted so as to be not more than the estimated demand. Since in actual fact demand usually turned out to be higher than the estimate, while the capacity on the ground fell short of the licenced capacity, most of the industries developed after independence enjoyed a somewhat monopolistic position and were not exposed to the chastening influence of competition.

Some of the well-intentioned measures taken to deal with the problem only aggravated it. To curb monopolistic trends, restraints were placed on the larger business houses expanding their output. In consequence, competition was further reduced and the bigger producers sought to enlarge their profits by raising prices which in conditions of scarcity the consumer could not resist. The attempt to control prices also led to some unfortunate side effects. The practice in fixing controlled prices was to allow for costs in full and to provide for a certain rate of return on the capital employed. As a result, industrialists had no incentive to reduce their costs, as lower costs would not mean more profits to them but would only lower prices. On the other hand they began to be lavish in the use of capital because the administered price would give them an adequatc return on the capital even if it was extravagantly used. Such an approach to price fixation had an adverse impact on productivity. Industries which lost interest in cost reduction had no reason to worry about productivity and the prodigal use of capital actually tended to lower its productivity.

Of course, side by side with the pursuit of these policies there were agencies which did try to focus public thinking on the importance of productivity. Somehow in the prevailing atmosphere they did not make much of an impact.

Fortunately in 1982, a radical change in outlook was introduced. When the Prime Minister designated the year 1982 as the "Year of Productivity", many of the old practices came under reveiw.

The actual increase in production in 1982-83 has, for a variety of reasons, such as the failure of monsoons, a prolonged textile strike in Bombay and shortage of power among others, been rather poor. But during the year certain imortant policy decisions were taken which were calculated to increase productivity.

Industrial Licensing

The most significant of these related to industrial licensing. The trend which had developed of treating the licensed capacity of an industry as a ceiling on its output was reversed. Instead of asking a unit which produced more than its licensed capacity to explain why it had done so, its licensed capacity was enhanced to a still higher figure than the production it had achieved. The distorted view which had crept into industrial licensing that to produce more than the licensed capacity was a crime, if not a sin, was abandoned. Since industrial licensing had been introduced to conserve capital with the intention that the demand should be satisfied with the minium deployment of scarce capital, the change in policy was not in derogation but in fulfilment of the basic objectives of industrial licensing. Unfortunately, often those who administer a control forget its objective and begin to treat it as an end in itself rather than as an instrument to achieve certain ends.

Another significant reform was to relax some of the rigours of the MRTP Act in respect of industries of national importance, which needed huge investments which in the private sector, only the bigger business houses could undertake. The object was to expose the monopoly houses to greater competition from each other in order that they may pay greater attention to costs and consumer interests.

Government have decided, in principle, that capacity in key industries should be regulated not on the basis of short-term estimates of demand but with a longer time perspective in view, particularly for industries in which it takes quite a few years to set up new units. I hope that in consequence the fact that some units are unable to sell their products will not be treated as evidence of inadequacy of demand, and that instead there would be an examination of the reasons why some producers have a well-filled order book, while others are accumulating unsold stocks.

Similarly, in regard to controlled prices, while there have been significant moves in the right direction, as in the case of cement, there is need to be more questioning of the trend for industrial units to seek a higher price merely by claiming to have higher costs. It is only when industries realise that those with higher costs must make lower profits or even suffer losses that due attention will be given to the importance of productivity.

To bring about this change in outlook, as said earlier, there must be more competition. With a large number of products on the Open General Licence for imports, external competition is on the increase. However, imports cost foreign exchange of which we are short. More than competition from imports, we should rely on increased domestic competition. That there should be freedom to import a product without a licence but similar freedom should not be available to produce it at home seems to me to be somewhat illogical.

In raising productivity, technology and management make the maximum contribution. Technological research in the country is too often directed towards finding indigenous technology to replace imported technology. It would be desirable to shift the focus of research to the more specific tasks of improving productivity, discovering ways of minimising the use of capital, energy and other scarce resources. Further, a more liberal attitude towards import of technology, which is calculated to improve productivity should be adopted. Let us not forget that when we import a product, we are not only importing the materials that have gone into its manufacture but also importing and paying for the technology embodied in it. For items under Open General Licence for imports, a very liberal attitude towards import of the technology to produce them in India should be adopted.

Finally, in regard to management, there is a growing awareness of its importance in the economy as a whole. Graduates of the Institutes of Management have no difficulty in getting employed. This is a healthy sign. The only suggestion on the subject would be that much greater attention should be paid to management in the public sector which should get the best men in position to do the job and give them the requisite freedom from bureaucratic or ministerial interference in the discharge of their responsibilites.

III

The importance of productivity needs to be recognised and reflected much more than it has been in the formulation of plans and in the critical debates which follow their presentation. Planning has so far concerned itself primarily with new investments to attain certain targets of output. Getting more out of investments already made in the previous Plans, is not treated as a part of the plan exercise and the resources needed for the purpose have to be found outside the plan. Accompanying this approach is the view that plan expenditure should have priority over non-plan expenditure.

Modernisation Imperative

In consequence, while there is money available for a new project, old projects may languish and become unproductive because there are no resources to replace worn-out equipment or buy spare-parts. We have the sorry spectacle of new power plants being put up while power generation by the existing plants is far below their capacity because resources to improve their performance seem to be lacking. This happens in other fields as well. New steel plants are being put up, even while the existing steel plants are desperately in need of funds for modernisation to improve their productivity; and when the productivity in one key sector goes down, it affects productivity in other sectors as well. This is particularly so in regard to power. Production in many key industries like steel, cement, aluminium and others is below par because of the shortage of of power and we have to spend huge sums on imports when domestic production capacity is partially idle.

The low productivity of huge investments already made in the past is in evidence not in the industrial sector alone. If we turn to agriculture, we again find that massive irrigation projects which have harnessed tremendous quantities of water at a very high cost to the economy are not irrigating as wide an acreage as they should be because a relatively small investment

needed within the Command Areas to provide feeder channels to the fields has not been made. Our dependence on the monsoons can be drastically reduced if in further investments in irrigation, priority is given to sectors which would result in the maximum increase in the productivity of the soil.

Need for Productivity Orientation

Against this background, one can suggest that in the next plan, the outlays in different sectors should be determined not on the basis that they must go to new projects only, but with due regard to the possibilities of fulfilling the production targets, partly by improving the productivity of existing projects and partly by setting up new ones. If such an attempt is made, it is my expectation that the growth rate can be stepped up with much less of additional resource mobilisation. In short there should be a productivity-oriented plan and not an investment-oriented plan.

Such a re-orientation will necessitate a change in the conventional yardsticks which are used when each plan comes to be evaluated, criticised and commented upon in the press and in the legislatures. We have got into the habit of assessing each plan and its priorities in terms of the outlays it provides for and not the output it aims at. Investments, like controls, should not be looked upon as ends in the themselves; they are but the means to achieve certain ends. The judgement of both planning and performance should be based not on the volume of investments but on the returns which the investments give in the shape of production and also profits which can be ploughed back for more production.

That the Seventh Economic Development Conference has decided to focus on "Strategy for Higher Productivity" is, to my mind, a most encouraging development and one hopes what has been said above will be helpful to those participating in it to come out with concrete constructive ideas.



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Productivity and Social Change

DR. MAN MOHAN SINGH

Dr. Man Mohan Singh, focusses on Productivity from various angles and more importantly from the social angle. The paper is based on Silver Jubilee Lecture delivered by him on April 26, 1983, at New Delhi.

Dr. Man Mohan Singh, Governor, Reserve Bank of India.

In a poor overpopulated country like India characterised by scarcity of both land and capital, the importance of securing maximum possible returns from these scarce resources can hardly be overemphasised. This is indeed the central message conveyed by the productivity movement.

Productivity growth has basically two components even though it is not easy to decompose productivity changes into these two components :

(i) Technical progress, i.e., the introduction of new technology which leads to an expansion of the best practice production frontier and thereby yields higher output even with given inputs of resources.

(ii) Improvements in efficiency which yield higher output even with a given state of technical knowledge, higher output being the result of improved management practices, better industrial relations, gains flowing from experience in the process of learning by doing, improved mechanisms for anticipation and adjustments to external exogenous shocks, etc.

Thus viewed, productivity growth is the result of a complex interaction of a large number of technological, political, institutional, psychological and economic variables. There is no agreement among social scientists about the precise mechanism of their interaction or even about the choice of what may be regarded as strategic or control variables. Having been associated

countries of West Asia.

If this technological gap is to be closed early, there is clearly no alternative to a liberal import of technoabilities and perception of new opportunities and challenges on the part of the management group. Availability of material resources has no doubt an important influence on the growth process, but no less

with the process of policy formulation in our country for more than a decade, I venture to submit some tentative thoughts on measures designed to secure higher productivity in our economy.

constraints, it may cease to be a major determinant of the pace and direction of investment. As a result the information provided by such a plan may turn out to be a misleading guide to the likely developments in

important is the task of organising and mobilising human capacities for making the most effective use of available resources. A far sighted management can play a major role in enlarging the national pool of scarce resources and in bending skilfully the constraints on the growth process.

Clearly, if Indian industry is to meet successfully the challenge of modernisation, business management must have a deep commitment to growth and social change. Management has to recognise its role in the realisation of national priorities, particularly in the areas relating to technical progress, conservation and economy in the use of energy and orderly management of our balance of payments through a judicious mixture of export promotion and import substitution. Operating in the framework of an open society, managements must recognise that modern industry is a cooperative activity and they must, therefore, seek active cooperation of other agents, particularly the workers and consumers, for the proper performance of their functions.

Industrial Relations

Industrial relations have assumed a central role in corporate strategies all over the world. There is a growing recognition that productive efficiency depends ultimately on the effective mobilisation of human capacities represented jointly by the management and the work force. Modern industry is characterised by considerable economies of scale. As a result, concentration of a large labour force in a single enterprise is unavoidable. Industry is increasingly becoming a co-operative endeavour and, therefore, it is necessary to create a proper social environment in which all agents of production work in harmony to achieve the full potential. Worker participation in decision making processes is increasingly being accepted as a superior alternative to autocratic management patterns where all decision making powers are concentrated in the hands of a few individuals at the top of the hierarchy. After all, increased morale of workers is an important determinant of efficiency, and systems which seek to increase workers' morale by giving the workers sense of involvement make a major contribution to the removal of psychological barriers to efficiency. It is, therefore, essential that our enterprises should develop an effective long range perspective with regard to industrial relations. Any such perspective must recognise that workers want to be involved and consulted. That trade unions are an essential element of the institutional structure of a democratic polity and that, therefore, their influence on public policies cannot be wished away in a democracy. We have to evolve appropriate institutional structures, inter-personal relations, personnel policies and work practices consistent with this design of industrial relations. This requires an updating of the legislative regulatory framework for industrial relations which would lay greater emphasis on participation to secure more effective involvement of all productive forces in industrial processes. But legislation can achieve its objective only if there is willing acceptance of a more democratic and participatory approach to the solution of problems on the part of management. Recent analytical studies of industrial relations in Europe suggest that a more democratic leadership style is likely to be associated with a more positive attitude to work and a greater sense of involvement in the job on the part of workers. A more democratic leadership style does not necessarily imply a weak or indecisive leadership. In fact, a management which is conscious of its obligations to its workers and consumers at large, and believes in effective consultation and fair-play, is likely to be a much stronger wicket in dealing firmly with unreasonable demands from whatever quarters they may originate. For, in all such cases, it can rely on the firm support of public opinion which constitutes a powerful sanction in a democratic polity.

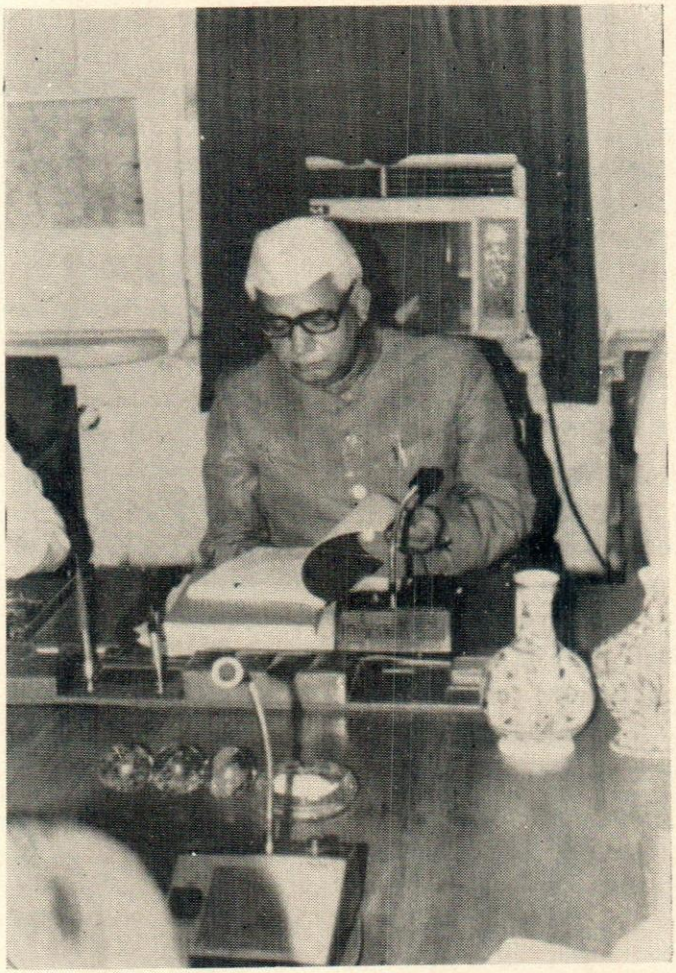
Some recent developments in industrial relations in our country, particularly the prolonged textile strike in Bombay, suggest that the time has come when we ought to have a fresh look at the existing approaches and mechanisms for dealing with the complexities of Industrial relations. India is too poor a country to countenance prolonged strikes or lock-outs as a normal means of settling industrial disputes. We must search for more constructive and humane mechanisms, which seek to promote the resolution of conflict by rooting out its basic causes. So long as India remains committed to the ideals of a humane and open society, the only viable path for securing harmonious industrial

relations is that of industrial democracy. The experience of both Japan and West Germany is a powerful indicator of the potentialities of a viable system of industrial democracy for mobilising latent human capacities in the cause of higher productivity.

Containing Elite-Mass Contradictions

A high rate of capital accumulation is necessary to secure the gains of technical progress since new technology is often embodied in new equipment. I have also referred to the important role of adequate investments in the nation's education and health services in raising productivity. Thus a substantial increase in national savings rate is essential. We cannot expect these savings to come from those living below the poverty line. These have to be provided essentially by those having secure jobs or otherwise earn incomes above the minimum essential level of consumption. In this context, special responsibility rests on the better off sections, or the elite, whether they are Civil servants, politicians, managers or businessmen.

A modern technological society requires leaders in various walks of life and a certain amount of distance between the elite and masses is perhaps unavoidable. But if not controlled, elite-mass contradictions can be highly disruptive and destabilising. If the elite sections use their power and influence for personal material gain and comfort this will lead to distortions in the allocation of scarce resources. At the present stage of our development, overall resources being limited, the insistence of a small privileged minority to enjoy living standards comparable to those prevailing in advanced post-industrial societies will inevitably result in the production structure being biased in favour of luxury goods at the very time when the great mass of our people do not have access even to elementary necessities of life. The insistence of the elite on a life style incompatible with India's resource endowment can give rise to serious political and economic tensions which can affect the growth of productivity and much more. For one thing, under such conditions the elite will be unable to persuade the mass of working classes to accept a degree of restraint on their consumption and, therefore, on wage claims, in the interest of faster accumulation of capital. The resulting struggle between workers and employers for a higher share of the national cake can easily degenerate into hyperinflation of the type, one comes across in Latin America. It can also give rise to authoritarian political and economic structures which seek to preserve, through the use of brute force, the privileges of a ruling oligarchy. If we really cherish the values of an open society, we must ponder over the consequences of a small elite group appropriating for consumption a disproportionate amount of national resources. A democracy will find it difficult to operate an economic system which lays emphasis on incentives for the rich and the super rich and harsh discipline for the poor.



Shri Narayan Datt Tiwari, Union Minister of Industry and President, NPC examining the reports on Productivity Improvement in Blue Potteries and Lock Manufacturing

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Quest for Higher Productivity

S. K. BHATNAGAR

Development is a trans-disciplinary process requiring team-work and strong links between innovation and productivity. The determinants of productivity vary with changes in the human values and attitudes of the society. There is thus a continuous need for re-assessment, and devising of new and appropriate strategies modulated to the changing needs, according to the author.

Shri S. K. Bhatnagar, Secretary, Ministry of Industry & Chairman, National Productivity Council.

The progress of productivity movement in India during the past 25 years is certainly a matter of satisfaction. The National Productivity Council which spearheaded this movement has played a key role and its Silver Jubilee marks a turning point for evolving plans and strategies to gear itself to meet the emerging needs and challenges in the years ahead, particularly in relation to management technology, manpower development, resource mobilisation, conservation and re-cycling.

In retrospect the experience of productivity movement has been that productivity improvements are of a positive nature in societies which are characterised by fairness of justice, favourable working conditions, appropriate rewards, and improvement in the education systems giving due cognizance to the economic and social environment prevailing in the country. The concept of productivity now embraces much more than economic or technical efficiency. In its expanded context, it is not merely related to the production of goods and services, but is forced to recognise that "quality of life" is different from, and somewhat more than what is meant by "standard of living", and that the two are not identical.

Our first Prime Minister, Pt. Jawaharlal Nehru, a great visionary, and an ardent believer in productivity, had rightly stressed the paramount need of the Indian economy "to maximise production and productivity". His words still beacon us :

"...The National Dividend depends on Productivity. Wages and salaries—in fact, all forms of

remuneration—depend on the National Dividend. The need, therefore, of higher productivity is obvious not only from the country's point of view, but for individual workers, etc. The first thing to do is to create an active atmosphere in favour of higher productivity, and of better techniques. But mere atmosphere and enthusiam are not sufficient unless we have some practical ways of dealing with the situation...".

The Early Phase

The direction given to the productivity movement in its earlier stages rightly recognised that higher productivity was not an end in itself, but a means of promoting social progress and strengthening the economic foundations of human well-being. Its approach strategy had two basic considerations—the 'popular approach' which concentrated on depending the public understanding towards productivity and, particularly, at the industry level in generating an awareness about the usefulness of productivity methods and techniques; and the other, the 'scientific approach' to achieve effective deployment of resources through the application of productivity techniques, methods and processes. As a result, productivity has now transcended its narrow boundaries into a more purposeful approach both in economic and non-economic systems. In fact, as one goes through the past record, the impression is rather indelible. The upsurge in favour of productivity in the sixties was visible and industrial managements, trade unions, government and international agencies like the International Labour Organisation (ILO) and the Asian Productivity Organisation (APO) all extended their whole-hearted support to productivity efforts. Productivity movement was thus put on the rails, and what it needed was the necessary momentum and the speed. In the seventies a major task faced by the productivity movement was to create a multiplier effect through the development of trainers and consultants and it was rightly recognised that general exhortations and platitudes on productivity had to give way to more specialised field services in conformity with managerial and technical requirements of business, industry, commerce and administration.

The Eighties

As the productivity movement entered the eighties, the need to generate surpluses both in the industrial and agricultural sectors became essential to plough back the resources for greater invertment, and for creation of more employment as the prime determinant of growth with social justice. Generation of surplus at the corporate level was further regarded as the product of managerial efficiency combined with technology development and its application. Management of technology became the focal point of economic growth process posing a major challenge of human resource development, its adaptability and its competence tc handle technology. The growth of value added operations further unleashed immense potentialities of diversification in the manufacturing sector for the dispersal of employment far across the nodal centres of economic activity.

Apprehensions and Misgivings

Despite the acceptance of the importance and the need for higher productivity, it was found that productivity application at the operational level continued to be somewhat inconsistent. This was primarily because of certain distortions and misgivings about productivity. The term "productivity" was reckoned as a qualitative or, at best, a semi-quantitative exercise. It was argued that there was hardly any linking between wages and productivity, and that any drive towards increased productivity in the traditional and the rural sector or the application of new technologies in the manufacturing sector could lead to either reduced employment or decreasing employment potential in the future. Another factor mentioned was the complexity of the measurement of productivity and sharing in the gains of higher productivity. It was further argued that any exercise to arrive at a total factor productivity had a direct bearing on technology and R & D efforts, organisation and management, and not merely labour productivity. It was considered difficult to delineate each one of these factors to identify their respective roles in the framework of socio-political considerations and to ensure that micro concepts of productivity did not run counter to the socio-economic benefits to the community.

National Planning and Productivity

The basic objective of national economic planning has been to provide to the people the opportunity to

lead a good life. This is sought to be achieved by democratic measures in a rapidly expanding and technologically progressive economy under a social frame which would promote human and social welfare. The national economic planning has to operate under certain pressures, compulsions, perspectives and directions which supervene over the idea of productivity in terms of input-output ratios or technology advancements or capital-output ratios. The over-riding considerations have four major components which constitute the segments of economic planning. The first is the development of economic infrastructure; the second is the specific development of production in nodal economic areas, such as industry, agriculture, etc.; the third is the essential input scenario to the very sectors of economy in terms of materials and machinery, teconology training and research; and the fourth is the planning of social utilities like health, housing, as well as basic education. As such, any approach to productivity based merely on production planning has no validity unless it is supported by output services in terms of foundational as well as infra-services which should be planned to function as a network. This is important since in our country production centres have to be as widely dispersed as possible, to cater to the vast Indian market of 700 million people. It is a dismal situation that in the economic sense, the Indian market has not been exposed beyond 25 per cent. In fact, our untapped or virgin market is larger than possibly the markets of several countries put together. We cannot open new markets without distributing, diffusing and decentralising the purchasing power. The only solution to the problem in our situation is how best we can horizontalise the centres of economic activity to generate more employment. Pitted against the socio-economic realities of our country in which 40 per cent of the people have an income of less than Rs. 5,000/- a year, the state of technology or the advances in technology cannot have an over-riding consideration.

In formulating a pragmatic approach to productivity, we have to strike a balance between the demand for distributional justice and the need for work incentives. Inflationary pressures can be resisted only through higher output and increased wages in the form of incentives, recognition of the power of collective bargaining and the social needs to articulate priorities by holding fast to the long-term social and economic objectives. An emerging feature in the industrial scenario has been the growth of the public sector which has to catch up fast and at the same time provide for the emerging social needs. Productivity planning has to be adapted to various stages of growth and the capacity of the system to measure up to the task, and to radically alter the character of work and work behaviour.

In the ultimate analysis, productivity reflects the will of the people, a sense of determination based on an abiding faith and the need to have a positive link between the social objectives and the planning mechanism. While technical advances and improvement in the quality of working life are regarded as important instruments for increased productivity, the two do not run in congruity. The spread of technology and the evolution of attitudes have to be considered in the context of the development achieved, and the symptoms of a transformation in the way of life leading to newer patterns in the cultural ethos and life styles. During the past several years, factors which have gained precedence over mere economic considerations are the requirements of health, education, conditions of work and environment, and opportunities for growth and advancement.

Experience of Productivity Year 1982

On the clarion call given by our Prime Minister, Smt. Indira Gandhi, the country observed 1982 as the Year of Productivity. It marked a turning point in the drive for higher productivity by making coordinated efforts to maximise capacity utilisation in all sectors of the economy and to achieve greater efficiency in the implementation of projects. While launching the Productivity Year, our Prime Minister had rightly stated:

> "We must get more out of every acre under the plough, out of every spindle and machine, out of every technologist and worker, out of every rupee spent. Decision-making must be expedited and there should be a greater delegation of financial and administrative powers, simplification of procedures, improvement in work environment, better maintenance of plant and equipment for increased capacity utilisation....."

The efforts made at all levels and particularly by the National Productivity Council have established the imperative for improvement in the capacity utilisation of plant and equipment, and to achieve cost effectiveness and quality improvement through reduction in the unit cost of production. It has further highlighted the need for balancing between generation of additional capacity and the effective use of the existing facilities. The improvement of productivity in the core sectors of economy which provide the infrastructural support can lead to an acceleration process in productivity in public utilities and public services. Six specific areas of national endeavour were identified, *viz.*, Energy Conservation, Materials Management, Maintenance Management, Labour-Management Relations, Pollution Control, and Small Scale, Khadi and Village Industries.

Two major achievements of the Productivity Year deserve special mention. It was for the first time that Industry-wise Productivity Boards were established for 7 major industries, *viz.*, Power Generation, Transmission and Distribution Equipment; Industrial Machinery; Cement; Machine Tools; Automobiles & Ancillaries; Paper, Pulp and Allied Industries; Leather and Leather Goods, with the following tasks assigned to them:

(a) Preparing plans incorporating technology, manpower, energy and marketing for achieving higher productivity and integrating the same with the national economic plans;

(b) Identifying productivity constraints and advising the government, industry and trade unions on the measures to be taken to overcome the bottlenecks;

(c) Monitoring implementation of productivity plans, evaluating the actual results achieved and identifying the specific factors which have helped or hindered in achieving higher productivity;

(d) Advising the Government on policy issues such as establishing industrywise norms for major inputs/factors of production, linking wages with productivity, instituting productivity awards for higher performance etc.; and

(e) Establishing a standard data base for evaluating Productivity performance.

The Productivity Boards have already embarked on a 7-point action plan which include (1) Quality improvement and Cost Effectiveness, (2) Productivity Measurement and Monitoring, (3) Generation of Productivity Data Base Service, (4) Preparing Industry Plans on Productivity, (5) Generating Productivity Consciousness, (6) Improving the Quality of Working Life, and (7) Productivity Agreements and Sharing the Gains.

A national scheme of Productivity Awards which was launched for the core sector industries, *viz.*; Heavy Engineering, Cement, Paper, Coal, Fertilizer, Sugar, Thermal Power Generation, Road Transport (Passenger) and the Small Scale Sector comprising Chemical, Engineering, Electrical and Electronics. The important criteria for evolving the scheme were the inclusion of those factors which were identified as major areas of national endeavour during the Productivity Year 1982, *viz.*; Capacity Utilisation or Value Added, Energy Conservation, Materials Utilisation, Maintenance of Plant and Equipment and Manpower Utilisation. Constant vigilence of these factors has certainly helped in improving capacity utilization, promoting productivity audit mechanism, and establishing macro-micro linkages for productivtiy improvements.

Human Resource—Axis of Development

In the entire gamut of productivity, it is recognised that manpower resource has a key role to play. The expanding and diverse requirements of the economy need a large reservoir of skilled manpower and managerial talent. In this context the role of Research for Productivity becomes highly significant, and adequate resources have to be made available. Also emphasis has to be laid on Productivity in education. In addition utmost attention has to be given to the training of workers and supervisors in productivity and occupational safety. Orientation of trade unions in productivity is equally important to dispel the lurking apprehensions and mis-givings in the minds of workers, and to convince them of the usefulness of its application under defined parameters.

Looking Ahead

Development is a trans-disciplinary process requiring team-work and strong links between innovation and

productivity. The determinants of productivity vary with changes in the human values and attitudes of the society. There is thus a continuous need for re-assessment, and devising of new and appropriate strategies modulated to the changing needs.

Productivity is certainly not an end in itself, but a means to an end. As such, it is necessary to take an overall view of socio-cultural factors in order to achieve the broader objective of providing human satisfaction as against material goods and services which are not enough. Change is inevitable. It might even be painful, but it is certainly needful. We can't overlook the welfare of the people. They have to be involved in the process of decision-making. Social pressure, therefore, becomes important for generating positive response of the society. The success of productivity efforts ultimately lies in the basic faith in progress, in expansion and growth, in the willingness to experiment with new ideas, to accept risks, to adjust to social changes, regional and occupational mobility, and awareness to social responsibilities in order to contribute to higher productivity which is the prime need for nation's progress and prosperity.





Shri Narayan Datt Tiwari, Union Minister of Industry and President, NPC, Shri S.K. Bhatnagar, Secretary, Department of Industrial Development and Chairman, NPC and Shri D.V. Kapur, Secretary, Department of Heavy Industry discussing the recommendations of the Inter-Ministerial Working Group on Utilization and Conservation of Energy

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Emerging Strategies for Trade Unions

DR A. N. SAXENA

Organisations and associations of workers are not ends in themselves. They are formed with a view to enabling the workers to give strength to their demands and to bargain effectively with their employers. However, with the passage of time and collective ownership of productive resources the militant approach has given place to more constructive one namely negotiation and participation. The author says, it is no more necessary for the unions to dissipate their energies in 'Strikes'. They should become pace setters of mutual negotiations and collective bargaining to ensure that productive process continues unhampered in the interest of large socio-economic well being.

Dr A. N. Saxena, Director General, National Productivity Council.

Keeping in view the compulsions of our Economy labour movement has to evolve new strategies and pursue policies which are conducive to the national economic development. Experience of countries similar to ours have proved that labour organisations in these countries have tried to restrict their activities to collective bargaining within the legal fremework provided by the national legislation on industrial relations. This they have tried to achieve without being overdependent on the State machinery. They have also recognised that any over dependence on the State Machinery in the long run may weaken the very fabric of the labour movement.

With the advent of freedom a new social order has come in the making and it is realised that industrial relations have to operate in the new setting. The powers and forms of business and organised industry are changing. The business enterprise in the growing collective economy is no longer as self-sufficient or as self-determining as it was formerly. National economic policy and economic Plans reflect on its working in various ways. Instruments of taxation, subsidies and licences operate as deliberate means of economic control. Private rights in industry have to give way to collective needs. Public administration penetrates into the sphere of industrial management on many points. Many industries are operating at the nationalised level. The National Goverment is seeking ways to create an economy more stable, more efficient and more equitable than that of the competitive capitalism. This radical change in the growth of collective economic machinery and policy has altered the character of industrial relations.

Consumption cycle—it is continuous

Traditionally Economists have always viewed Trade Unions as economic institutions. It is no wonder that the economic and industrial functions are pre-dominant even today despite a growing realisation of the changing pattern in the conduct of trade unions. The economic and industrial functions as traditionally evolved have had three objectives : (1) raising the levels of wages; (2) impovement in the working and living conditions; and (3) organisation of labour. Another constraint to which Trade Unions are being subjected is that our industrial economy cannot be subjected to—capital output ratio as a measure to increase labour output ratio proportionately, because in developing economies sometimes inflationary or deflationary situations are caused due to extraneous fluctuations which are so sudden that a mere spiralling up of wages is hardly of any avail unless it is adequately matched by a corresponding productivity rise. Moreover, owing to lack of incentives and the deployment of traditional methods and techniques of production the level of consumption, savings, and investments does not operate in the same manner as in the case of developed countries. Such implications bring about the need for orienting the pattern and behaviour of labour organisations in economic matters. Their responsibilities fall under two broad categories :

1. To restrict consumption.
2. To bring about an increase in the level of production.

The need for restricting consumption is of vital importance because any undue increase in the demand for consumer goods or semi-necessities manufactured indigenously or imported from abroad does exercise a pressure on the price level as a result of demand outstripping the supply.

Political Environment—its impact

In our country labour management has evolved in an atmosphere of political consciousness. In the post independence period it has developed under the structure of political democracy. Since the success of democracy is basically dependent on party system, each political party in India has tried to establish its base and influence on labour. There can be no doubt that labour orgenisations have certain legitimate political functions and it will not be desirable to restrict their activities only to economic and industrial fields. Workers, when they come to work, do not cease to be citizens and as members of the community, they have every right to exercise their civic and political rights. Therefore, if they look to the trade unions for advice and guidance in these matters, it cannot be denied.

Labour orgnisations today exercise an effective role in the enactment of laws and they want these laws to be progressive and to be concerned more with social security and equality of status in society. They have, therefore, to secure representation in the parliament and legislatures and for this they even need to have political funds. However, what is more important in the labour movement is a realisation that in the long run socio-economic needs should not be subjected to political needs or should be deferred until the instrument of political power is captured. In fact the proper course would be that socio-economic needs should precede the determination of the areas of political operation.

Inherent Conflict—its relevance

It is believed that there is an inherent conflict between the workers on the one hand and the management on the other as to the sharing of the gains. Even if it be so, it can still be possible to place industrial relations on such a footing so as to enable both workers and management who depend for their living upon the output, to make the maximum productive effort. It is an unquestionable fact that between the two partners of industry, i.e. workers and the management there is an identity of interest in so far as their livelihood depends on the results of their labour.

A frank recognition and acceptance of this fact is a prerequisite to the determination of policies designed to soften this inherent conflict and to spotlight the mutual interest of both the management and workers, establishing the best and most friendly relations which enables them to cooperate in the production process of goods and services of right quality at the minimum cost.

Union Management Cooperation

A categorical meaning of the term 'Union Manage-

ment Cooperation' may be defined as 'joint action'. Usually formal in nature; in areas of mutual interest beyond the issue of wages, hours of work, working conditions and grievance which normally come under the scope of collective bargaining. There are two phases of cooperation one which deals with union bargaining and their representation in matters concerning collective bargaining with the management which may not be purely voluntary and the other as suggested above which are purely voluntary.

Obviously union management cooperation can be based on harmonious collective bargaining and relationships. Only after this stage has been reached that it is possible to expand the sphere of joint action into new areas of cooperation. Cooperation does not imply in the absence of militancy on either side, rather it signifies mutual respect and recognition of the inter-dependence for major goals.

Importance of Industrial Harmony

Industrial harmony implies that the state of industrial relations in which the two elements of industrial organisation viz. management and labour are fully and adequately harmonised, that is to say, all such factors which lead to disrupt this harmony are eliminated. It is the state of bliss in the realm of industrial relations, and such a state can be achieved only when there is identity of purpose and identity of interest between labour and management, a situation which is sometimes referred to as difficult to comprehend under the present conditions. Industrial harmony in the absolute sense may not be feasible. We may, therefore, interpret the term industrial harmony as an instrument of fostering harmonious relations and not merely negation of conflict.

In fostering harmonious relations, it is necessary to minimise as far as possible the influence of actions and interactions of forces which often lead to industrial conflict. Such factors mainly are 'wages', working and service conditions and recognition of the personality of labour and its organisation. Wages and working conditions are essentially the subjects of collective bargaining.

An effective and purposeful collective bargaining is feasible only when the personality of labour and its organisation has been recognised by the management. The recognition of the personality of labour and its organisation takes concrete form in joint consultation, together with effective communication, collective bargaining and participation in the management.

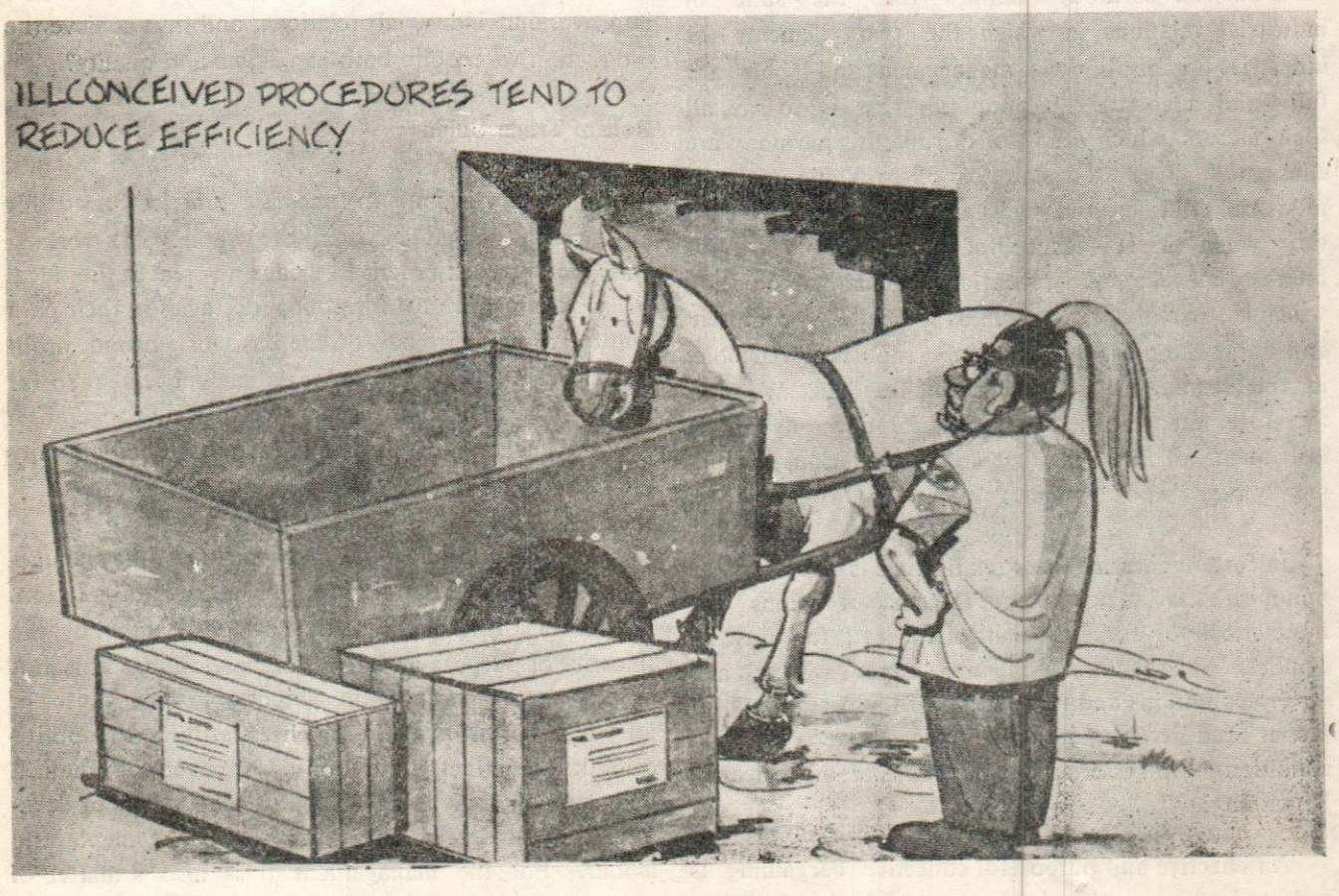
It is no less necessary if good relations are to be fostered and maintained, to afford the trade union, or unions, complete recognition and provide facilities for the union officers to carry out their duties effectively and ensure that agreements once made are strictly observed. Personally I feel even guaranteeing the above things will not meet the justice. The sense of distrust has got to be eliminated, and a sense of confidence and goodwill restored. The mere fact that during the last one year there has been a remarkable reduction in the industrial stoppages cannot be taken as a sine-qua-non of good order and good relations in the industrial realm. We still have a long way to go. Production is still insufficient to enable us to be self sufficient. The obvious question remains. Can we improve our industrial relations and thus achieve the production we require both in volume and quality?

Role of Trade Unions

Democracy in modern times is a practical need for a Government that serves all the people. The working class have to seek practical means to reach the ideal of social justice, to surmount obstacles in their path and to adjust their goals on the basis of current problems. In adopting to change, labour movement so far has no fixed philosophy except that of trying to find a way to make a better nation and a better community life.

The question of workers' participation in management is primarily a question of attitude-orientation. Favourable attitudes can be developed only by the sincerity of purpose and depth of conviction. It is not at all a matter of paying lip sympathy to the cause of lofty ideals or a tongue-in-the cheek attitude to a political fad; it is in fact, a question of discovering practical and mutually advantageous ways and means of developing an understanding between management and labour. For the management it is also a matter of

enlightened self-interest. As such to hold that these schemes are idealistic and impractical will be real short-sighted. It is also no less significant to recognise that any basis of coercion, duress or confrontation can never promote participation. It can grow only under a situation and belief of mutual trust, cooperation and understanding. Reasoning, thinking and taking a wider and a perspective view is essential for a sustained process of participation. Small but definite beginnings born out of sincerity of purpose will see us through the "crisis of confidence" which has been afflicting our organisations and particularly the industrial life in the country. Time does not wait for any one and Trade Unions have also to carve a way out to make themselves more meaningful and satisfying in the larger interest of human and social welfare.



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Productivity of the Professionals

DR. DAVID S. BROWN

Some professionals have argued successful over the years that the work they do cannot be quantified and that to attempt to do so would result in a reduction in its quality. The author contends performance measurement is a fact of life and those that will not practice it will not survive in this competitive world.

Dr. David S. Brown, Professor of Management, School of Government and Business Administration, George Washington University, Washington, D.C.

Increasing Productivity

The message of the 1980s is clearly one that calls for increased productivity. This is a message that transcends national boundaries and cultures. It is one also that must be heard by all levels of society and, more to the point, all levels of the work force. Most important among these are white collar professional workers.

Decades of "business as usual" where ancient customs, traditional divisions of labor, long-standing patterns of performance, extravagent executive perquisities, and non-productive individual styles have determined what one does, and how it is done are no longer acceptable. As populations and their needs multiply, better ways must be found of meeting them. Said another way, we must improve sustantially existing administrative practices.

National planners usually focus their attention upon particular segments of the economy. A nation's agriculture may be falling short of supplying domestic needs. Its industries may not be competitive. Its transportation system may be unable to deliver goods in an assured or predictable fashion. The nation may suffer from the inability to market successfully what it produces. It may lack both energy and skilled manpower. It is no longer innovative.

National plans aimed at remedying these problems make good sense from a macro-economic point of view, but unless they give attention to the administrative support that each will require, they will probably fail

once more. This support must come primarily from the white collar work force.

The Professional

By its nature, it includes a wide variety of members, some professional, some not—which perhaps helps to explain why they are so often excluded from productivity improvement efforts. Among the white collar workers are directors and chief executives at the top; high level and middle managers immediately below them; the professionals with knowledge and expertise in a hundred different fields; the technicians who are asked to apply what the professionals have laid out for them; the functionaries who abound in all organizations; and, finally, the clerks and menials at lower levels.

These make up the great bulk of the bureaucratic systems which govern and administer both public and private enterprises. In the United States, they represent over 65% of the total work force and similar proportions hold in many other countries as well. That a high level of white collar performance is essential to a nation's welfare must certainly be accepted by all who have looked into the matter.

Not only do white collar workers represent an organizational elite but those who are managers and professionals are a primary source of ideas and influence without which their institutions cannot properly function.

They bring a greater knowledge to the organization than do others, and often a greater personal commitment as well. Many of them have been with their organizations for years, with a corresponding knowledge of institutional history which goes with it. (This is true of much of the clerical force as well.) And yet, for a variety of reasons, many of those in these positions are falling far short of performance levels they are capable of achieving or the organization needs.

Undoubtedly, much of this is due more to the nature of the systems in which they work than to either a lack of zeal or initiative on their part. The histories of organization reveal patterns that no longer serve objectives they once did. Work systems without strenuous efforts to the contrary easily become bureaucratized. Rules and regulations that once performed a useful purpose remain as vestigial reminders of another time. Promotions take place because of length of service, or by class, rather than because of performance or ability. There are few rewards for individual risk-taking, and much punishment if they do not work out. Employee development lags and dysfunctionalism is everywhere in evidence. Professor Galbraith says of what is happening: "The corporate organization—the technostructure—has a tendency, as does any large organization, public or private, to clone itself." Unless some thing drastic is done, "Corporate senility" is the result[1].

The white collars themselves, of course, are not without responsibility. Professional and technical emloyees have, for one reason or another, become more satisfied with the status they have acquired than with the achievements of their organization. A position in government or major industry is often seen as the ultimate goal of one's career, not the beginning. Those at lesser levels find that the power to direct subordinates and clients, or to prevent them from receiving some benefit to which they may be entitled, is sometimes a satisfaction in itself.

Resistance

There is evidence also that the white collar work force, even more than their associates at lesser levels, resists efforts to improve productivity *per se*. Some professionals have argued successfully over the years that the work they do cannot be quantified and that to attempt to do so would result in a reduction in its quality. Many professions feel that they should be permitted to determine their own standards and that they should not be judged by others.

This has helped to create what Herbert Simon, the winner of a Nobel prize for economics, calls "satisficing" behaviour. One does what is acceptable, not necessarily what the situation calls for.[2] This is an old

1. John Kenneth Galbraith, "Corporate Senility", *The Washington Post*, Op. Ed. page, Feb. 11, 1981, (Dr. Galbraith is a farmer U.S. Ambassador to India).
2. Herbert Simon, *Administrative Behavior: A Study of Decision Making Processes in Administrative Organizations* (New York; Macmillan, 2nd ed., 1960), See pp. XXIV, 38-41, 80-1, and 240-4.

complaint and leads to the development of a general managerial malaise[3] which, like all communicable diseases, rapidly spreads throughout the organization. It is tolerated because most professions, including those charged with the organization's management, find it convenient to close ranks against those who question what the system is doing. As Hannah Arendt has said, bureaucracy is "rule by Nobody" because "there is no one left who could ever be asked to answer what is being done".[4]

Yet despite the rationale which the system provides itself, those in white collar positions at whatever levels must recognize that they are being judged as their organizations are being judged, *on performance*. A private sector company that is unprofitable cannot long exist. A government agency that does not achieve goals within its budget will surely face parliamentary scrutiny—and will have to take time from other things to defend itself. All institutions, in fact, must be prepared to meet their commitments to their suporters. Performance measurement is a fact of life and those that will not practice it will not survive.

Defining Productivity

Wanting improve productivity is, of course, not the same as getting it. A first step in this direction is understanding what it is and what it involves.

Broadly defined, productivity improvement concerns itself with the goals and objectives of the organization as well as with the manner in which they are to be achieved. It involves both "doing the right things" (which is *effectiveness*) but also "doing them right" (*efficiency*).

Organizations are created and maintained in order to achieve goals, purpose and objectives. Over time, however, their specifics change. Such changes occur because condition change and new and sometimes substantially different approaches must be undertaken. Often also, individual and organizational patterns depart from the original as new problems develop. Continuing attention must accordingly be given to organizational effectiveness. Is the agency or the company doing what it should be doing ? Is it meeting the clients needs ? If not, what should be done ? This is an area where professional workers can make some of their most substantial contributions to productivity improvement.

Efficiency, on the other hand, is a comparative term. We are more (or less) efficient in doing what we are doing than we were before; or we are more (or less) efficient than someone else doing the same things. It is a ratio between input and output. A focus on efficiency alone, however, overlooks the importance to objective achieving of what we ought to be doing. We may be greatly efficient, for example, in producing goods or services no one any longer needs or wants. That does not mean we are being more productive.

Productivity is, accordingly, a combination of effectiveness *and* efficiency but with two additional factors. One of these is client acceptance. The other is member satisfaction. Both are important to the organization and must be addressed.

These are the outputs, the performance units. The input is the cost of what we do. This can be measured in terms of monetary units (dollars, rupees, pounds, etc.) or in terms of the time invested by employees. Sometimes one is preferable, sometimes the other.

The equation this produces is a complex one but there is no easy way around it:

$$\text{Productivity} = \frac{\text{Effectiveness} + \text{Efficiency} + \text{Client Acceptance and Member Satisfaction (Output)}}{\text{Cost (input)}}$$

Such a formula cannot easily be expressed by a single figure althogh macro-economics may produce one. The manager will, therefore, find it simpler to use a number of numbers. More will be said about this later on.

The Agenda For Action

For a productivity improvement program to succeed among white collar workers, it must be carefully

3. For more on this subject, see, David S. Brown, "The Manager's Responsibilities for Productivity Improvement" *Armed Forces Comptroller*, Summer 1983, pp., 5-15.
4. Hannah Arendt, *On Violence* (New York: Harcourt, Brace and World, 1969) pp. 38-9.

prepared. This requires a logical and systematic approach. Preliminary to undertaking it, the following five points should be considered.

1. *Manager Commitment.* Basic to any really successful approach to productivity improvement is a commitment by those with major program responsibilities to it. A truly committed manager will first of all be well prepared for the assignment. This means not only having a familiarity with the techniques/approaches to productivity improvement but an understanding of the problems which are associated with it.—and a willingness to persevere against them.

One undertaking such an assignment, particularly where there is likely to be substantial resistance to it, should be thoroughly conversant with what others have done in similar circumstances, how they have done it, what has caused them to succeed or fail, and what might better have been done. This is not an assignment for those of faint heart or small courage.

One must, of course, be thoroughly conversant with the activity one seeks to modify and, if possible, with the views of those who operate it.

2. *Support from the Top.* A program for increased productivity will not ordinarily succeed without the knowledge and active support of those in leadership positions in the organization. Some may feel they can mount such an effort without this and a few have actually succeeded—but most such programs call for support and resources which those higher up the organization ladder have a large say in providing. A manager committed to improving the performance of his own people should not hesitate to take the initiative in involving higher ups if they are not already interested.

How this is to be managed, assuming that those in leadership position have not urged it first, will depend upon already existing relationships between the manager undertaking the program and those in higher level positions. Whether it is to be announced as such or not is a matter which individual circumstances should determine preliminary to its being undertaken.

Gaining top level support is often not as it sounds and frequently has personal advantages to the initiator as well. The point is that the backing of secretaries or ministers is vital at those times when the specifics of productivity programs are questioned by subordinates, clients, the press, or all three, as they sometimes are. They provide credibility and resources, and also moral encouragement as well.

3. *Measuring Performance.* It is essential that standards of measurement be developed for all productivity improvement efforts. (Without them, how is one to know whether there has been achievement or not?) It is not enough to depend on eyeball assessments, no matter how experienced the assessor. Likewise seat-of-the pants judgements—to use another anatomical term—can also be disputed. So can clientele endorsements, no matter how welcome, unless one is clear how representative they are. This is why the wise manager will need to find quantifiable ways by which objectives can be set and achievement determined.

Quality of performance can, of course, be measured along with quantity. The latter may be more easily done and is the more traditional but there are many examples at hand where quality is expressed in quantifiable terms. We judge art, dramatics, a variety of athletic events (such as gymnastics and figure skating) university work and many other kinds of performance by the ratings which experts give them. There are hundreds of examples in both government and business where the quality of a good or a service is expressed in terms of numbers or scales. For such measurements to be acceptable, however, there should be agreement between manager and members concerning them and their applicability.

4. *Involving the participants.* The most delicate part of a productivity program—but also the most rewarding—is the involvement of one's associates and subordinates in it and the gaining of their support for it. Most people, whether white collar or otherwise, are likely to suspect new programs foisted upon them from above, particularly those which are critical, whether directly or indirectly, of present performance. And, as every manager knows, they are capable of thwarting those which for any reason they distrust.

This, however, should not be taken to mean that they will necessarily be opposed to the idea of performance improvement, particularly where the system

itself is being addressed. Many will be well aware of its shortcomings, some will have already suggested ways of approaching it which have fallen on deaf ears, and others will see improvement efforts as an opportunity for their own upward progress. One should never forget that the members of the organization have its interests at heart, and that they too want to be associated with programs that are successful ones. They also have strong feelings about self-improvement as well as national improvement.

There are good reasons, of course, why they must be involved—and good reasons also why some of them may not be too happy with a number of the things which are likely to be proposed. They may accept, for example, a need when it is properly presented, but may take strong exception to the specifics of what is being asked of them. Or they may have other—sometimes better—ideas which over time no one has listened to.

There are numerous instances in which one's associates and subordinates have been successfully involved, and many instances where they have given strong support as a result. The wise manager is well advised to proceed cautiously in this area, with proper consideration not only to the feelings of those who are likely to be most intimately concerned but with an awareness of their power to block, if they care to do so, much of what the systems analysts have devised.

5. *Standards and Goals.* Work norms exist in almost all organizations, white collar as well as blue collar, but much of the time they are the result of habit or "standard practice"—Simon's "satisficing" behavior. The undertaking of a productivity improvement program requires that new ones be set—conciously set—and work directed to their fulfilment. Their achievement becomes a point of satisfaction and self-fulfilment. When shortfalls occur, it is merely a time for re-examination and analysis.

Organizations, like individuals, work best when they understand their goals and objectives, how these are to be achieved, and the part each is to play in the process. This is why the time that managers spend in refining and articulating these goals and making clear to others what they are is so important. A part of the process they should not forget is that of listening to what others have to say about them.

Gaining Support

Knowing What is Going On. There is an old rule that an attorney should never ask a withness in court a question to which he does not already know the answer. Likewise, those who undertake productivity improvement programs should be well aware before they undertake them of what needs to be done and, in general, how it can be brought about. This calls for an understanding in as much detail as necessary of what is currently taking place within the organizational unit for which he or she has responsibility. It calls also for an awareness of what others in similar fields are already doing.

Knowing intimately both the systems and the equipments that are being used in one's office or shop is an essential background requirement. This is not to suggest that the manager will have answers to the problems found there but there must be a familiarity with the on-going processes if credibility and motives are to be accepted.

All of this is preliminary to undertaking the productivity improvement program itself.

Distinguishing White Collar Differences. While white collar workers can be distinguished from those who perform industrial tasks, farm labor, and, in fact, manual labor of any kind, there are, as previously noted, distinctions between them which managers will be well-advised to observe. Some, as previously noted, hold important managerial positions themselves. They belong to adminitrative cadres with long traditions and high status. Others are professionals on whose contributions a modern society must depend. Still others fill service, technical, and clerical roles.

The manner in which individuals with such varied backgrounds can be asked to work together on specific assigments of, say, a team-building nature will depend upon the manager's judgement of the need for it or their willingness to do so. (They are, of course, a part of the same agency or company and do work together within it.) There are many examples in Britain, the

United States and Japan where the team approach has been highly successful. But there are examples also where more selective approaches have been undertaken. This is a matter that is best left to individual decision. It should be noted, however, that some of the most useful results are obtained when there is a suitable mix of participants.

By definition, of course, professionals at whatever level—and that includes managers and administrators whether they are traditionally thought of as professionals or not—have a personal commitment to productivity improvement. The successful passing of an examination, whether in one of the administrative services, in law, in medicine, or any other professional area, is merely the *pro form* requirement of entrance to a sphere of work which demands more than basic job descriptions prescribe. Professionals carry our organizational tasks. They fulfil responsibilities which often go beyond their professional roles. They are part of an intricate system in which they influence others and are influenced by them. By becoming managers, they obligate themselves, as do other managers, to act morally *and productively.* This is the genesis of professionalism.

It is also the *ethos* which professions demand. Professionalism implies quality of performance. It underlines professional standards. It demands a commitment to excellence.

Providing Information. White collar employees must be informed not only what being done but also of the rationale for it. This should be on a continuing basis for all white collar workers. While there is sometimes information that is a sufficiently confidential in nature that it cannot at once be shared, it is better to err on the side of too much rather than too little.

People work best when they know what is wanted of them, why, and what the alternatives are. They also support what they help to create. All of this is of particular importance to professionals (who have so much to give) but it should have bearing on one's relationships with all white collar workers as well.

Working with others is not a one-way street and individual consultation and meetings with various sized groups are to be encouraged. If business as usual is no longer the order of the day, those directly involved should be aware of it. Information-sharing meetings provide a precedent for suggestion-making ones. An investment in such a process will pay long-range dividends even if not always immediate ones.

The "No Blame" Approach. Habits become practices and practices, systems. Systems that have been permitted to go on unexamined for a long time are usually both effective and inefficient. This is one of the major criticisms of bureaucracy, private as well as public. Marc Holzer, one of the leading proponents of public productivity in the United States, says flatly that "dramatic increases in productivity...are achievable only if we recognize an enemy that contains both public and private productivity: bureaucracy." He continues: "Supposedly an efficient tool for organizations in both sectors, it is increasingly apparent that the unintended consequences of the bureaucratic structure have a very limiting effect on productivity."[5]

The blame for permitting this to happen is better placed on the existence of traditional systems, many inherited from other times, than on those who are currently members of the system. Certainly, to blame the latter if one wishes their support in helping to rectify what time and inattention have done, makes little sense.

One of the major roles of the modern manager is that of negotiator. Performance improvement will put this to the test. He/she must negotiate with all those involved—higher-ups, outsiders, associates, and subordinates—the acceptance of new work norms. The ability to persuade others—and persuation is a major element in such an assignment—that new approaches must be found is the mark of the modern manager.[6]

The Search for Improved Performance. Those most directly concerned must inevitably be involved in the productivity improvement effort. After all, they are most knowledgable as to what can be done and certainly among the most committed.

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5. Marc Holzer, "In Defense of the Public Sector" in *Public Productivity Review*, March/June, 1982, p. 104.
6. These new managerial roles are discussed in some detail in David S. Brown, *Managing the Large Organization: Issues, Ideas, Precepts, Innovations* (Mt. Airy, Md. : Lomand Publications, 1982) Chap. XX, pp. 217-226.

They must see this not as a means of getting them to work harder but of working smarter. Nor should they be permitted to believe that they will be working themselves out of a job. If management is to get their cooperation, then it has certain commitments to make to them. If a smaller staff is likely to result, it is to the organization's interest to make it clear that this will be accomplished in an incremental why—by not filling vacancies, preferably. (Perhaps also, a smaller staff will even make possible higher pay for those who remain.) Opportunities for training and individual development should certainly be provided for employees who remain but whose duties have changed. And, of course, transfers to other units should be made for those who become redundant. The good intentions of organization must be made clear to all.

Obtaining the commitment of those in the work force to productivity improvement can be expected to have its problems. There will be those who, given their previous experience with the organization, will be reluctant to believe new promises. There will be unions and employee associations which need to be convinced that what is being asked of them is fair and reasonable. Getting employee support, in fact, is often an exercise in trust and most managements will need to demonstrate clearly their trustworthiness.

There are, however, few alternatives to such an approach. The key to the problem is the rationale for it. If the case can be made that it is in the interest of the nation, the organization, and the individual that productivity be improved, there is a strong likelihood that it will occur.

Performance Measures, Standards, and Feedback. Employees, whether at high or modest levels, must understand the importance of the measurement of their performance and the setting of acceptable work standards. This is often one of the more difficult tasks the manager will face, yet it is one of the most important.

People who readily accept the need for greater productivity often object to its being measured, or at least to its being done in conventional ways. Professionals in particular object to certain kinds of standard setting although, it is interesting to note, that they have traditionally accepted other performace guidelines. The manager who undertakes an improvement program should be familiar with the many ways, individual as well as organizational, by which meesurement is had.

The other side of this coin is that measurement, once instituted and accepted, becomes important to the employee as well as the organization. It is a yardstick *both* can use. There should be regular (continuing) feedback of performance to both the individual and the group concerned so that adjustments as needed can be made.

Timing is important—and so is agreement upon the measures to be used. Figures should be available frequently enough so that one is able to relate them to what has been done. Otherwise, they lose their meaning.

The emphasis here upon measurement should not be interpreted to mean that everything that is done must be measured. Quite to the contrary. Peters and Waterman in a book that has had a profound impact on American management (*In Search of Excellence*) have emphasized the importance of "simultaneous loose-tight controls".[7] What this means is that there should be selectivity in setting measures of achievement. Standards should be visible, meaningful, and achievable but not overwhelming.

For a number of reasons, a variety of standards may be set, an acknowledgement that changing circumstances will make it difficult or impossible for all of them to be met. Those, however, who fail to meet certain goals will often exceed others. Managers as well as members learn from such experience as new goals are undertaken.

Productivity improvement is not a one-shot undertaking. It is a continuing process. What is good enough for today will hardly meet the requirements of tomorrow. Thomas Jefferson said that "eternal vigilance is the price of democracy." A continuing concern for what goes on in the organization is the price of competence.

7. Thomas J. Peters and Robert H. Waterman *In Search of Excellence* (New York: Harper and Row, 1982). See in particular Chap. 12.

Recognition and Reward. An important contribution to productivity improvement deserves *both* recognition and reward. Of the two, recognition is always easier to provide and often the more important motivator.

There is always recognition before one's peers. Citations, letters, and certificates of appreciation are welcome, as are medals and similar awards. Special assignments can be made: membership in special purpose committees, new responsibilities, positions of honor, training assignments, support for activities in which the individual has an interest, and the like.[8] A recent article in the prestigious *Wall Street Journal* told all in a headline: "Why Not Try Saying Thank You". To many, it will come as an interesting and novel idea.

Private companies have an advantage over most government agencies in that they can, if they wish, make cash or salary awards for exceptional performance, but an increasing number of governments now are able to do the same. Certainly, improved productivity can—and should—be taken into account in promotions. If the saving result in major advantage to the organization, it is only fair that those most responsible share in some way in them.

There can be no doubt of the importance of "positive reinforcement" as a means of inducing behavioral change. It can, as the above suggests, be used in a variety of ways. The manager should remember that all of those who are part of the organization joined it with the idea of contributing to it. They will not usually respond to efforts which point to better ways by which this can be done.

There is an added factor which often works to the advantage of the productivity-minded. Many tasks which individuals are already performing-high level as well as mundane ones—are demanding, unpleasant, superflous, and unwarranted. Some of these can certainly be eliminated. With the assistance of his associates, many a manager has seized upon these as the first area of attack. It is an idea well worth thinking about.

Ways to Improved Productivity

If one will now return to the productivity formula previously indicated, it will be immediately apparent how productivity can be improved. One, in fact, has only to improve upon *any one* of those factors above the line, while keeping others constant, to improve upon present performance. Or, assuming those above the line remain the same, one has only to reduce the inputs required.

Some approaches, of course, offer greater opportunities at less cost than others. One of those is in the area of effectiveness. Is what is currently being done what is needed or wanted? Are objectives being met by current methods? Has technology revealed new and better products, approaches, services, and methods than what we now have? Can others do what we are doing? Do our forecasts correctly report what our needs are? Have we done the right kind of planning? Are we prepared to meet contingencies?

New equipments are often available which will improve performance. The Japanese have shown the importance of robotics, and other nations-even those long committed to manpower-intensive undertakings—must meet their change.

It is important to reduce waste and redundancy wherever they occur. Some of our systems have for years been obsolete but for many reasons, chief among which is that they have not really been looked at, they have been permitted to continue. The solution lies in exploring what others are doing, or at the very least in examining what is occuring under one's own nose.

By increasing organizational size, we increase opportunities for waste and inefficiency. The common approach to re-organization is to add new units, new levels, and' ultimately, new people. Parkinson's Law reminds us of some of the things we do. Have we thought of reducing levels? Have we seriously tried to hold size in check? Have we really explored ways of making organizations less complex? Increasing organizational size, we increase opportunities for waste and

8. For an assessment of non-economic incentives, see Gerald T. Gabris and William A. Giles, "Improving Productivity and Performance Appraisal through the Use of Non-Economic Incentives", *Public Productivity Review*, June 1983, pp. 173-189.

inefficiency. Can size be held in check? How can our organizations be made less complex?

Ways need to be found to improve individual performance. Increasing the work week, whether through overtime or in other ways, is not the answer. New blood needs to be added regularly even to the best-performing systems. People need more and better training. Poor morale usually burdens performance. Ways can be found, as the Japanese have found them, to reduce errors and defects. Maintenance can certainly be improved. So can safety. We can reduce absenteeism, one of the real dysfunctions of modern organisations, if we really try.

Much needs to be invested in most organizations in discovering new ways of doing things: new products, new methods, new clients, new systems of marketing, new ways of involving the client or customer, better use of space and facilities, and the like. As Drucker has pointed out: "There is little doubt in my mind that entrepreneurial innovation will be as important to management in the future as the managerial function itself is currently. Indeed, it may be more important in the years to come."[9]

The difficulty is not with devising ways and means of improving productivity. It is with getting them accepted and making them operational.

Among all of those in the nation's workforce, none is more important to both public and private sectors than the white collar workers; male and female. Their productivity can—and *must*—be improved. This is a message for all nations. Those failing to understand this will be failing their commitment to their people.

9. Peter Drucker, "Management's New Role", *Harvard Bussiness Review*, Nov-Dec 1969.

REFERENCES

Robert R. Blake and Jane Syrgley Mouton, *Productivity: The Human Side* (New York: Amacom, 1981)

David S. Brown, *Managing The Large Organization: Issues, Ideas, Percepts, Innovations* (Mt. Airy, Md. : Lomond Publications, 1982)

Vernon M. Buehler and Y. Krishna Shetty, *Productivity Improvement: Case Studies of Proven Practice* (New York: Amacom, 1981)

Gary Dessler, *Improving Productivity at Work: Motivating Today's Employees* (Reston, Va.: Reston Publishing Co., 1983)

John M. Greiner, Harry P. Harty and others, *Productivity and Motivation: A Review of State and Local Government Initiatives* (Washington, D.C. : Urban Institute Press, 1981)

Mark Holzer, ed., *Resource Guide to Public Productivity* (New York: National Center for Public Productivity, 1983)

Elizabeth K. Kellar, *Managing With Less: A Book of Readings* (Washington, D.C. : International City Management Association, 1979)

David Macarove, *Worker Productivity: Myths and Reality* (Beverly Hills, Cal. : Sage Publications, 1982)

Shan Martin, *Managing Without Managers* (Beverly Hills, Cal.: Sage Publications, 1983)

National Science Foundation, *The Process of Technological Innovation: Reviewing the Literature* (Washington, D.C.: National Science Foundation, 1983)

Thomas J. Peters and Robert H. Waterman Jr. *In Search of Excellence: Lessons from America's Best Run Companies* (New York: Harper and Row, 1982)

John R. Schermerhorn, Jr., *Management for Productivity* (New York: John Wiley and Sons, 1983)

Y. Krishna Shetty and Vernon M. Buehler, eds., *Quality and Productivity Improvements: U.S. and Foreign Company Experiences* (Chicago, III.: Manufacturing Productivity Center, 1982)

their own benefit, Particularly the Japanese have kept productivity increase a national goal—and can now cash in on reverse flows of Europeans and North Americans spending a whole week or even two in Japan to "learn the lessons of the continuing miracle".

The march which Japan and the NICs have stolen on Europe has been the easier as European governments have continued during the '70s to use organisations, and particularly enterprises, as their "privileged levers of social policy", thereby burdening them with constantly growing taxes. This has meant that levels of profit have declined and, with them, levels of investments. What investments there have been have concentrated on saving unskilled labour, a possibility facilitated by new technological developments which have increasingly impacted also on women-power in the tertiary sector.

It is in fact currently in service activities that a significant productivity push is becoming apparent, whether or not these activities are located within manufacturing companies. One reason for this is found in the estimates of investment figures, prone though they are to the illogicalities of accounting—a telephone has no value on a company's books : $ 3000 for every office worker compared with $ 45,000 for every factory worker. With the current numerical equality between corporate direct and indirect workers, coupled with the presumed advent of the office technological revolution, companies are paying increasing attention to white-blouse productivity.

Overall, however, there has been a slowdown worldwide in productivity growth, irrespective of whether it is measured by Gross Domestic Product per employed person or manufacturing output per hour or more elaborate multifactor methods.

Groups' responses

This "productivity crisis" has been recognised as a major issue by different groups.

Some companies have perceived the word's advertising potential, and a number have created their own productivity centres : in the USA, the Wastinghouse Productivity Center employs 350 people, being a part of the company's effort for raising its productivity increase annually from 3.8% to 6.1% by 1985; in Europe, the IBM Productivity Centre employs 5 professionals, but has national productivity officers and work through ad hoc groups from its European headquarters in Paris. Elsewhere in Europe it has particularly been in large companies in "advanced traditional" industries which have been leading the productivity thrust. For the "geriatrics", particularly steel and shipbuilding, have tended to place their future in government bailouts. Some chemical and engineering companies are seeking to combine "social innovation" and productivity : making more use of the intelligence of the labour force appears to be making considerable economic sense to Bekaert and Monsanto in Belgium, for instance.

Noting that the rate of growth of their corporate productivity is apparently closely correlated with that of the countries in which they are located, productivity-conscious companies are becoming involved in national initiatives. Inspiration has come from Scandinavia. Norway, for instance, ran a one year national campaign in 1982 with the involvement of all parties, political as well as of the labour market. Joint (employer-union, white as well as blue collared) activities in the Finnish Engineering Industry are referred to later in this article. And in November 1981, President Reagan created a National Productivity Advisory Council. A bi-partite body of "distinguished citizens", the Committee shall "conduct a continuing review and assessment of national productivity ... and advise the President on the Federal Government's role in achieving higher levels of national productivity and economic growth ... and on the potential impact on national productivity of Federal laws and regulations."

Less usual, but more encouraging, are some trade union attitudes: at the Trade Union Study Days organised by the French successor to the national productivity centre, its Working Life Agency (ANACT), the Spanish socialist (UGT) trade unionist emphasised and re-emphasised the need for his union to take the lead in enhancing national productivity in the absence of any significant national employer or management effort, past or present. UGT signed a frame-work agreement (AMT-80) with the Employers' Association

defining productivity as "effective work organisation, adequate technology and proper working conditions".

Not that trade unions elsewhere in Europe are opposed to participating in efforts to raise productivity, seen as the least uncertain way of maintaining employment at reasonable levels into the future. Yet, attitudes diverge. For instance, there is an on-going debate inside the German trade unions about the relationship between actions aimed at "work humanisation" and at "rationlisation". Similarly, some of the most productive companies—GE and Plessey to take two examples—are seriously trying to define their responsibility and possible stance in unloading their "released labour" on society. Productivity increases can often lead to redundancy, particularly where labour is virtually immobile because of the workings of the system, for instance, housing policy; but the unemployment consequences are much harder if productivity is forgotten, as says UGT, Spain's 1.6 million unemployed attest.

Measurement

Revitalised concept or buzz-word? Certainly "productivity" has undergone a broadening, perhaps even a humanisation of its meaning in the past few years.

Basically, it has always expressed a relationship between inputs and outputs. For understandable reasons, particularly of easy measurability, inputs have tended to be expressed in terms of labour. Indeed, productivity growth is usually understood as increased output per man hour. Hence in the eyes of organised labour in some countries, to increase productivity, can only be achieved by "working harder" which in turn needs to be compensated for by increased wages. A causality link is made and where the "fruits" are not "equitably" distributed, then labour trouble is brewing.

Productivity, however, does not equal labour productivity. The Finnish Engineering Industry report stresses "total productivity (which) includes the productivity of the work performed by all persons in the corporate hierarchy and the productivity of all the various capital and other inputs. Thus

$$\text{Productivity} = \frac{\text{MVP}}{\text{L} + \text{M} + \text{C} + \text{X}}$$

where MVP=total output i.e. the market value of production, L=input, M=material input, C=capital input, and X=miscellaneous." Although the measurement of total productivity is extremely complicated, several efforts are currently being undertaken to try to overcome methodological problems : for instance, at the US Bureau of Labor Statistics, the Mecca of productivity measurement, one of the projects to escape the Reagan administration's hatchet is the development of total factor indicators. The problems faced are such as how to estimate quality of labour other than through basic educational inputs? So far, recurrent education is, methodologically, not considered to improve the quality of labour, as strange an assumption as that government productivity increase is nil. Or again: How can capital estimates properly be made, particularly in public administration?

This attempt at total factor productivity measurement is not the sole—in France, the Centre d'Etude des Revenus et des Couts has developed, starting with nationalised enterprises, an analytical approach to ascertaining the sources of productivity increase—which can often be located upstream to the enterprise—and how they should, as objectively as possible, be remunerated.

How to improve productivity

Measuring productivity can be a first step to improving it. The traditional approach is that of inter-firm comparisons. The essence of measurement is not exactitude but orders of magnitude and facility. All sorts of methodological shortcomings can be found with IFCs, but they are successful if they get companies to seriously examine where or how they can change. The Finnish approach stresses measurement, no matter how roughly, at all possible levels and units. Some measurement can be quite refined : that of IBM draws on the company's computerised "common staffing system" to ascertain possible opportunities within functions and countries and, perhaps most important of all, possibilities from taking global and iconoclastic stances.

Involvement of people to the greatest extent possible in the performance of their own work is generally emphasised, getting people to work smarter rather than harder. This is an obvious feature of action learning.

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Identifying Productivity Reserves In Industry

A. Z. SZENDROVITS

Althongh time is an irretrievable resource, planning and controlling other resources takes precedence over managing time both in organisations and in the life of individuals. Improving productivity, a primary prerequisite for econamic development, is a central objective for every level of industrial management. In meeting this challenge, the main task is to establish productivity measures which provide an appropriate basis for comparing performance and for identifying the potential for improvements. It is easier to determine the contribution to productivity of capital investments for new technologies than the contribution of the industrial labour force. This paper focuses on practical issues in establishing productivity measures and methods of analysing productivity reserves in industrial plants and is based on a study funded by National Sciences and Engineering Research Council of Canada.

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An Overview of Productivity

The importance of economie growth has become more evident than ever in the last decade. Improving the standard of living of the population is a central goal of every nation's economy and it is well argued by Frank[1] that a major source of this is labour productivity. Improving labour productivity affects positively real per capita income which ultimately translates to real economic growth. The recent slow-down of economic growth both puzzled and alerted economists, business executives, politicians and the population at large throughout the world. The shadow of the economic depression of the 1930's shifted from memory to reality. The problems and the search for remedies are discussed and analysed by Denison[2] regarding the U.S.A. and by Zohar[3] with respect to Canada. Their studies are representative samples of the rich international literature on the topic.

The meaning of productivity is often misconceived and improperly conceptualized. It is frequently mistaken for the output from the production process; the result of which is either a tangible product or some service. In general economic terms, production converts some form of input to a different form of output. Production output could be increased by using proportionally more of the necessary input factors. However, such an increase does not represent productivity improvement. Productivity is a relative indicator, a ratio which compares a certain measure of output to a required input. Its primary purpose is to measure

factured in a separate shop, the number of products per capita can be expressed for each shop. However, to compare the productivity of the shops or to measure the productivity of the plant, one must establish some equivalence among the products. Equivalence based on price or cost would be biased because one product may have more purchased components than the other. Also, a comparison based on the actual average work time for each product would be biased because one shop may use less time for comparable work than another. The problem is even more complicated when each shop contributes to each of the products. The standard time content of each product is a common denominator in establishing equivalence between the products. For this reason and, as will be seen later, for other reasons, time standards are an invaluable help in measuring labour productivity as presented in the following general form :

$$\text{Productivity} = \frac{\text{Staadard Time}}{\text{Actual Time}}$$

Thus, productivity is the ratio of the standard time allotted to the actual time used for the completion of one work unit. The smaller the work unit, the more accurate the standards that can be expected. Usually, time standards are calculated for operations which are seen as the smallest independent parts of the production process. The overwhelming importance of time standards becomes evident when one wants to analyze the utilization of time in work situations.

Need for Time Management

Time is a unique resource. While it appears to be free, time is not retrievable. Thus, it is paradoxical that the planning and controlling of other resources takes precedence over managing time, both in organizations and in the life of individuals. A primary prerequisite for time management is to define the various components of the working hours of individuals or groups who are expected to perform certain tasks in an organization. Shift time, usually consisting of eight hours, represents a work day. The components of shift time in manufacturing industries as defined by Szendrovits[11] are illustrated in Figure 1.

It is recognized that absenteeism and sick-leave have negative effects on productivity. However, the degree of their influence can be determined easily, provided that a productivity measure is established for the shift time. Thus, it is evident that we should focus our attention on shift time. Nevertheless, management must bear in mind that job satisfaction plays a fundamental role in motivating people to reduce absenteeism and even sick-leave.

Interruptions of work for predetermined time periods, usually regulated by collective agreement (e.g. lunch time, coffee break, pause of assembly lines), are necessary reductions in the shift time. However, it is expected that the remainder of the shift time will be utilized for work. On the other hand experience shows that certain portions of the work time are often wasted, due to the worker (e.g. lateness for work, unwarranted breaks) and due to technical causes (e.g. break down of machines, failure in energy supply) or organizational causes (e.g. material shortage) which are under the control of the company. Reducing wasted time is an "open reserve" for increasing utilized work time and thereby improving productivity.

Although setting standards is beyond the scope and purpose of our discussion, it is vitally important to understand the structure of the utilized work time which is embodied in time standards. First, we must distinguish between the unit standard time and the preparation time (e.g. setting-up a machine; studying a blueprint or work instruction) which occurs only once for several work units. Secondly, we must realize that the unit standard time includes the so-called allowances as well as the basic time. The basic time consists of main elements which influence directly the change of form or characteristics of the work unit (e.g. machining), and supplementary elements which contribute indirectly to this change (e.g. measuring). While the basic time is related to and needed for each work unit, allowances include those time which are work-related activities scattered throughout the whole shift and which are not used exclusively for a particular work unit.

Allowances for rest or fatigue, for personal delays and for servicing work during the shift are incorporated in the unit standard time a a percentage of the basic time. Consequently, the utilization of time

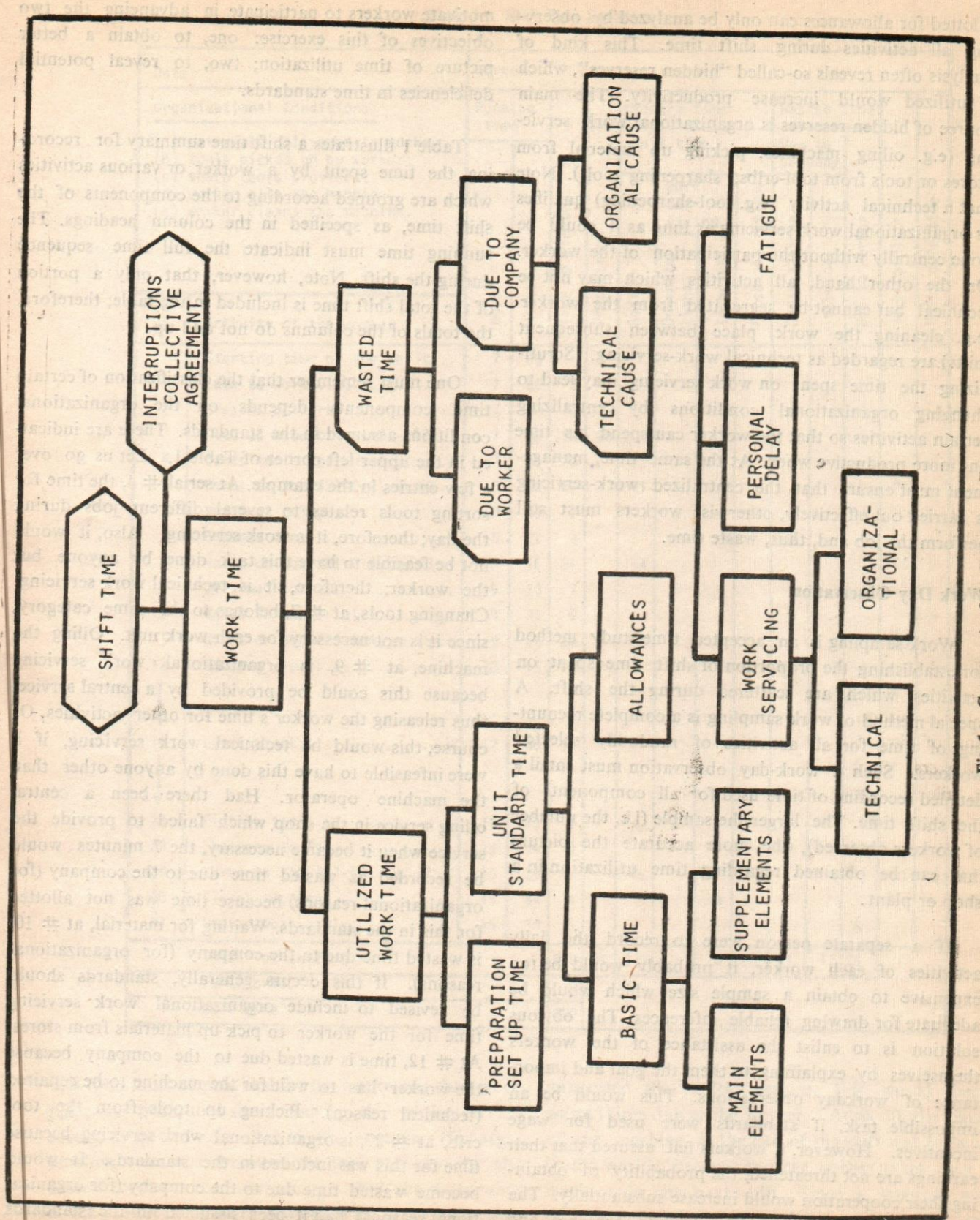

Fig. 1 : Components of the Shift Time

gating the cleaning activity would be infeasible; therefore, it is technical work servicing. Had the company considered the possibility of assigning a cleaning staff to do this job, if there was sufficient time between shifts, this activity could be labelled organizational instead of technical work servicing.

Personal delay and fatigue are special categories. While the time allotted for these in the standards could be based on anthropometric data, personal delay and fatigue times are usualy established by collective agreement as a percentage of the basic time. Although our example states the time used for personal delay and fatigue, it is difficult to distinguish between these and wasted time due to the worker. Therefore, all these times can be registered simply as wasted time due to the worker. When the data are analysed, the times for personal delay and fatigue could be accepted as stated in the standards and the rest could be counted as the net wasted time due to the worker.

The number of completed work units, designated by the job and operation number is also recorded in the shift time summary, along with the number of defective units. This may be done at a later stage, after quality control. From the relevant standards, the time allotted for the various components can be reconstructed for the number of units which were accepted by quality control. By comparing the standard and actual times, the degree of time utilization, as well as the validity and quality of the time standards, can be evaluated.

Identifying Productivity Reserves

The greater the number of workers and the more frequently they submit shiftime summaries, the more representative the sampling results that are obtained. A proper analysis of the data could lead to important and reliable generalizations concerning productivity and productivity reserves. Table 2 illustrates a typical shift time analysis focusing on utilization ratios of the shift time, productivity reserves and the attainable productivity level if the reserves were utilized.

Part A of the table is a comparison of standard and actual times by components. Actual times correspond to the total in the shift time summary in Table 1. Standard times are derived from the number of units and the time standards for the relevant job and operation numbers. For the purposes of our analysis, it is assumed that the data in Table 1 are averages of several observations. Of course, in practice these data would be the pooled results from several shift time summaries. The productivity ratios for each component give valuable information as to which part of the job is done productively and at which component the workers did not meet the anticipated standards. The cause for any discrepancy between the standards and actual data may be that either the workers are not performing at the expected level, or that the standards are not realistic. The actual time distribution shows the percentage of the shift time spent on the various components.

In part B, the time utilization ratios indicate that 85% of the shift time was used for work, 10% was wasted due to the company and 5% due to workers.

The productivity ratios in part C show that the productivity of workers for the basic time is 135% which is quite high and reinforces the supposition that people perform best when they are working on a specific job. For the unit standard time the productivity is 125% which is lower because the workers do not meet the standards regarding allowances. A somewhat lower productivity of 123% occurs for utilized work time due to the excessive preparation time. It is noteworthy that the wasted time reduces considerably the productivity for the shift time to a mere 104%. Awareness of the various productivity ratios is very important for realistic production scheduling and capacity calculations. For instance, using the productivity ratio related to the utilized work time for work schedules will result in recurring delays in meeting production targets, unless wasted time is completely eliminated. Using the productivity ratio related to the basic time would result in even more dramatic discrepancies, unless the standards set for allowances and preparation time are also fully met.

Part D illustrates the calculation of productivity, reserves, in the form of ratios from which factors can be derived to establish the attainable productivity. There are three distinct productivity reserve ratios.

Table 2 : Shift Time Analysis

A. Comparison of Standard and Actual Time

Times in minutes	Standard Time	Actual Time	Productivity	Actual Time Percentage
Basic time	446	330	1.35	68.7
Work servicing (technical)	12	20	0.60	4.2
Work servicing (organizational)	10	13	0.76	2.7
Personal delay and fatigue	18	25	0.72	5.2
Unit standard time	486	388	1.25	80.8
Preparation time	14	20	0.70	4.2
Utilized work time	500	408	1.23	85.0
Wasted time due to company	—	48	—	10.0
Wasted time due to worker	—	24	—	5.0
Work time	500	480	1.04	100.0
Lunch break	—	30	—	—
Shift time	500	510	—	—

B. Time Utilisation Ratios

Utilized work time	85.0%
Wasted time due to company	10.0%
Wasted time due to worker	5.0%

C. Productivity Percentages

For basic time	135%
For unit standard time	125%
For utilized work time	123%
For shift (work) time	104%

D. Productivity Reserves

$$\text{Open Reserve Ratio} = \frac{48+24}{408} = 0.176 \text{ or } 17.6\%$$

$$\text{Hidden Reserve Ratio} = \frac{(20-12)+(13-10)+(25-18)+(20-14)}{408-24} = \frac{24}{384} = 0.063 \text{ or } 6.3\%$$

$$\text{Total Reserve Ratio} = \frac{480}{408-24} = \frac{480}{384} = 1.25 \text{ or } 25.0\%$$

E. Attainable Shift Productivity for Work Time

$$\text{Maximum Attainable Productivity} = \frac{500}{408-24} = 1.30 \text{ or } 130\%$$

Separate Calculation for each reserve :

Reserve	Shift Productivity	Reserve Factor	Attainable Productivity
Open Reserve	1.04	1.176	1.23
Hidden Reserve	1.04	1.063	1.10
Total Reserve	1.04	1.250	1.30

Open reserve is that which can be utilized by eliminating wasted time and is expressed as follows :

$$\text{Open reserve ratio} = \frac{\text{Actual wasted time}}{\text{Actual utilized work time}}$$

Hidden reserve is that which can be utilized if workers meet the standards for allowances, including the preparation time. The expression for this is :

Hidden reserve ratio

$$= \frac{\text{Allowance discrepancies (between actual and standards time)}}{\text{Actual utilized work time—Allowance discrepancies}}$$

The numerator includes the algebraic difference between the actual and standard time for each of the allowances and for the preparation time. This is an aggregate term, which means that if workers perform better than standard at a certain allowance, the difference occurs with a negative sign and thereby decreases the overall total. A negative ratio would indicate that there is no hidden reserve, the effect of which would be reflected in an increased productivity ratio for the utilized work time over that for the basic time.

Total reserve is that which includes both open and hidden reserve and is expressed as follows :

Total reserve ratio

$$= \frac{\text{Actual work time}}{\text{Actual utilized work time—Allowance discrepacies}}$$

Adding one to the reserve ratios shown in part D, corresponding reserve factors can be obtained :

	Percentage	Ratio	Factor
Open reserve	17.6%	0.176	1.176
Hidden reserve	6.3%	0.063	1.063
Total reserve	25.0%	0.250	1.250

Note that the total reserve factor can also be obtained from the product of the open and hidden reserve factors :

Total reserve factor = (1.176) (1.063) = 1.250

By multiplying the shift productivity ratio, 1.04, with this reserve factor, the attainable productivity can be determined as shown in part E. The effect of fully utilizing total reserves can be expressed directly as follows :

Maximum attainable productivity

$$= \frac{\text{Standard time accomplished during work time}}{\text{Actual utilized work time—Allowance discrepancies}}$$

The meaning of the maximum attainable productivity, which is 130% in the example, is that the productivity during the basic time was maintained as it occurred, wasted time was fully eliminated and the allowances (including the preparation time) were used exactly at the level that they were assumed to be by the standards.

A word for caution is in order regarding the attainable productivity ratios. They express maximum possibilities. Most likely only a portion of the open and hidden reserves can be utilized. For instance, the standard for preparation time is not met in the example. It may not be prudent to insist that workers use less time preparing for the job properly, because this could backfire by causing more defective units. Each component of the reserves must be scrutinized separately, After a realistic reassessment of the reserves, the attainable productivity must be recalculated accordingly. Nevertheless, the maximum attainable productivity ratio can be a very useful tool for production managers in overcoming the pressure to accept unrealistic scheduling requests.

Conclusion

The purpose of this paper is to revive the formulation and application of work standards for their legitimate purpose, which is to improve labour productivity without alienating and possibly even motivating workers. Although many important aspects of productivity (e.g. satisfaction on the job, quality of life, management styles) were not discussed, it is hoped that this paper gives valuable insight into the analysis of activities during the time when production is expected to take place. No other method of time study gives a more complete picture of time utilization than the work day observation described. It offers an opportunity to workers for self-evalution, for a critical view of the

quality of production standards, and for active participation in management. Work day observations can be used as a motivational device. Admittedly, some missionary work is needed for enlisting the majority of the work force to cooperate with management. The secret to success lies with the workers' confidence which can be gained if mangement is able to demonstrate that the results of this exercise are used just as much for the benefit of the work force as for the organization.

REFERENCES

1. Frank, J.G., "The Route to Higher Living Standards", *Canadian Business Review*, 6, 1 (Spring 1979).
2. Denison, E. G., *Accounting for Slower Economic Growth: The United States in the 1970's.* Brocking Institution, Washington, D.C., 1979.
3. Zohar, U., *Canadian Manufacturing—A Study in Productivity and Technological Change*, Vol. I and II, The Canadian Institute for Economic Policy Series, James Lorimer and Company, Toronto, Ontario, Canada, 1982.
4. Kendrick, J.W., ed. *New Development in Productivity and Measurement Analysis*, National Bureau of Economic Research, University of Chicago Press, Chicago, 1980.
5. Thurow, L.C., "Survey of Factors Contributing to the Decline in U.S. Productivity Growth", in *The Decline in Productivity Growth*, Federal Reserve Bank of Boston Conference Series No. 22 (June 1980) pp. 22-25.
6. Ross, J.E., *Managing Productivity*, Reston Publishing Company Inc. (Prentice-Hall), Reston, Virginia, U.S.A., 1977.
7. Katzel, E., Productivity; *The Measure and the Myth.* Amacom., New York, 1975.
8. Chen, G.K.C. and McGarrah, R.E., *Productivity Management*—Text and Cases, CBS College Publishing, New York, 1982.
9. Taylor, F.W., *Scientific Management*, Harper, New York, 1911.
10. Whyte, W.F., *Money and Motivation: An Analysis of Incentives in Industry*, Harper and Row, New York, 1970.
11. Szendrovits, A. Z., *Introduction to Production Management —Technical Notes.* McMaster University, Hamilton, Ontario, Canada, 1981.

tant errors; constant reduction of output; poor performance; excessive machine downtime; high labour turnover; poor attendance record at work, i.e. absenteeism, reporting for work late or leaving the office early; excessive overtime; drug addiction, etc.

Worker boredom is a global problem today. This generation of young people is less tolerant of work that is fractionated, boring and programmed in pace and method, than their parents were. Therefore, productivity is affected.

In the United States of America, there is a move towards a four-day work week, because four days on a dull job sounds more attractive than 5 days on a dull job. The rationale for this move is that it hopes to reduce absenteeism, while at the same time raises productivity.

Does Job Satisfaction Lead to Productivity Improvement?

With about 14 years experience on problems affecting productivity of light, medium and heavy industries in Malaysia, one can say that the satisfaction and productivity relationship seems to be modest. Occasionally, high satisfaction and low productivity seem to go together. Hence, innovative ideas are needed to improve job satisfaction and to maximise productivity.

How to Improve Job Satisfaction and Maximise Productivity?

There is no magic formula for the situation, but based on the facts of my study, humanisation of work and carefully structured education seem to hold the the solution to productivity problems. Before I begin to define what I mean by humanisation of work, it is fitting at this juncture to ask ourselves why do we need to work. The question could easily be answered in three sentences i.e. we have to work because we have : to meet our basic needs; to satisfy the need for meaningful activity; and for the production of goods and services as productivity gains resulting from work are credited with reduced costs for goods and services to customers, and concurrently, increasing rewards to people producing the goods and services.

Humanisation of Work

The term humanisation of work simply means making work more appropriate and fitting for an adult to perform. By this definition, therefore, humanised work should : not damage, degrade, humiliate, exhaust or bore the worker; be interesting and satisfying; utilise many of the valued skills the worker has, and provide him an opportunity to acquire other skills; enhance or at least leave unimpaired, the worker's ability to perform other life roles, such as being a spouse, parent, citizen and friend.

The need to humanise work has been acknowledged for generations. There has been too much talk about the subject. We must now test and evaluate on the assumptions. Since we are living in an experimental society, we must try to humanise work by replacing myths with facts through continued research.

How to Humanise Work

How can one humanise work without any loss in quality and quantity of product. Workers are happier when they have a say in constructing their jobs and these jobs are high in intrinsic job satisfaction. Take for instance, professors, research scientists and farmers who are free to work independently, and also the top executives and self-employed proprietors who have greater freedom of choice. One way of making a job more satisfying, therefore, is to give more freedom to workers, to have a say in the way they should do their jobs.

Work Design

Learning how to redesign work and then actually installing the new design requires hard, vigorous efforts. We have to demonstrate to employees that management is willing to alter work design to enhance job satisfaction. The logical approach in rearranging the work flow is to : analyse job description and categorise the job functionally; place the functions according to levels of importance; and withdraw boss's prerogative in the individual's job functions; introduce new functions from within the organisation.

By increasing the scope for initiative and involve-

ment in the job, we get more commitment from people on the job. The end result is that they may even find better ways of doing their jobs. This brings us to the subject of the Q.C. Circle.

Q.C. Circle

According to Peter Drucker, a Professor of Social Science at the Claremont Graduate School, the Quality Circle concept now being practised in American industry was brought to Japan in the fifties and sixties by three Americans—Edwar Deming and Joseph M. Juran, of New York University and A.V. Feigenbaum of General Electric.

A Quality Circle programme usually comprises about ten people who will meet to look regularly into the various manufacturing problems. The subjects discussed are centred around product quality, industrial safety, use of raw materials, capital, productivity, and all other areas affecting their work. The group elects its own leader and meets regularly to determine areas of improvement. Once a particular problem is determined and a solution offered, it is channelled to the foreman who will evaluate the proposal, and then submit it for consideration to the divisional manager. At this level, decision to implement the proposal is made, and once it is made, the Q.C. group goes all out to ensure that the implementation goes through. The divisional manager usually accepts most proposals even though the financial return may be marginal in some cases.

Competition for the best proposals by Q.C. groups are held at departmental, divisional and in-house levels.

The Q.C. Circle makes employees interested in the development of company. The benefits of a successful Q.C. Circle programme are : it contributes to the growth of the enterprise; it respects humanity and ensures a happy working relationship, and it encourages the development of a worker's potential.

Measurement of Humanised Work

In order to assess the effectiveness of a humanised work programme, we must : measure the extent to which work situations are human; isolate the factors that make work satisfying; and determine whether the factors that make a job satisfying.

Satisfaction

It is very subjective and yields only soft data. It relies on the person's response, and one man's satisfaction may be another man's misery.

Person-Environment Fit

It can be measured by adopting the basic concept of goodness-of-fit between the characteristics of the person and the properties of his environment. These characteristics and properties can be measured as the person sees them (subjectively and objectively).

Objective Measure of Goodness-of-Fit: A typist and a copy-typing job. To keep up with the work requires a typing speed of 50 words a minute; this is an objective characteristic of the job. The typist, however, can type only 30 words a minute; this is an objective measure of her ability. The difference between the two objective scores is 50 minus 30, or 20 words per minute, and this is an objective measure of the Goodness-of-Fit between person and job.

Subjective Measure of Goodness-of-Fit: A typist may over estimate her ability, in the self-comforting way that persons often do; suppose she believes that she can type 40 words a minute. She may also underestimate the demands of the job, perhaps as a defence against feeling overloaded, and report that the job requires a typing speed of only 40 words a minute. Thus, the subjective goodness-of-fit (40 minus 40) would be perfect, but the objective goodness-of-fit (50 minus 30) would be poor.

Goodness-of-Fit

Has been measured along such dimensions as : independence, affiliation, achievement, responsibility, self-utilisation and self-development.

Examples of Goodness-of-Fit

A goondess-of-fit to student is related to self-esteem

he is properly trained in the work and knows what to do; the desired end results of whatever he is asked to do have been defined; guidelines or limits in terms of policy, expenditures, and time have been established; he is left alone to do the job; he knows he can go to his boss at any time for guidance or support when he reaches an impasse; he knows he would not be berated

tion of technology, capital investment and most important of all, people. Productivity, like love, is a many splendoured thing; it is an attitude of mind, defying constricted definitions, and its scope is unlimited.

The labour unions' participation in management may become an issue in this decade. Authorities of

of the student, the emotional state (depression, anxiety, resentment, etc) and to the student's reported probability of dropping out of school.

A goodness-of-fit to employees to Government department is related to such psychological factors as job satisfaction and such physiological outcome as cholesterol level

will create willingness on the part of the employees to accept the changes in technology and production processes. This conviction also makes employees believe that increasing productivity is good for everybody in the organisation.

The Q.C. Circle activities will never work unless there is psychological conviction. It is important also

management science have defined this decade as the 'Age of Uncertainty' or of discontinuity. The required qualities of management should be its determination to find and set its own course and a good heart to understand other people's problems, for, without it, no management plan, however sophisticated, will ever work.

BIBLIOGRAPHY

1. *Organisation Behaviour* by Fred Luthans, Professor of Management, University of Nebraska—1972.
2. *Organisation Psychology*, second edition by Edgar H. Schein, Professor of Sloan School of Management, Massachusetts Institute of Technology.
3. *General Psychology* by William N. Dember, University of Cincinnati and James J. Jenkins, University of Minnesota.
4. *Management by Uncertainty* by Brien Jameson, a management tutor at the Birklands Management Center, Hatfield Polytechnic.
5. *Self-Renewal, the Individual and the Innavative Society* by John Gardnar, author of Excellence.
6. *Human Factors Enginering* by Earnest J. McCormic, Professor of Psychology Occupational Research Center, Purdue University.
7. *The International Environment by the National Bank of Malaysia*—1979 Annual Report.
8. University of Pennsylvania's Wharton Econometric Forecasting Associates Report—November 76.

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Appropriate Technology Action Project— A Case Study of Blue Potteries

C. S. RAO

Technology upgradation in the traditional industries sector is a deeply felt need, in the Indian context. Appropriate Technology unit of Department of Industrial Development, Govt. of India, with the assistance of National Productivity Council launched some pilot action projects. This article focusses on action project: Blue Art Potteries of Jaipur, the success of which has been laudable.

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While reviewing the performance of the village and small industries sector in the preceding plan, it was stated in the Sixth Plan document that "low levels of technology resulting in poor productivity and inadequate returns have continued to characterise the traditional industries sector". Besides, some other problems of procuring raw materials, credit and marketing were stated to have deprived the artisans of a good part of the earnings which should have accrued to them. This situation, which has been continuing for over many years since the planned development has started, is certainly not desirable. The traditional industries, which are described, as decentralised/unorganised sector provide larger employment opportunities in rural and semi-urban areas next only to agriculture. The traditional industries which include, handlooms, khadi and village industries, handicrafts, coir and sericulture together account for a total employment of about 15 million persons including those working on part-time basis as against 22.6 million persons employed in the entire village and small industries sector. The total exports from this sector have been steadily growing. During the first three years of the Sixth Plan Period the value of foreign exchange earned by the export of these products, has gone up from Rs. 1,359 crores in 1980-81 to Rs. 1,736 crores in 1982-83. Production has also been registering an upward trend. The estimated value of production has gone up to Rs. 5,878 crores in 1982-83 from the base line value of Rs. 5,077 crores in

artisans by training and widely dissiminate the same among the production units; and finally to apprise the buyers of the new product.

6. It was envisaged that these two projects would be completed by the end of March, 1983. However, while the blue potteries project could be implemented as per the schedule, the locksmithy project is still continuing. The major reason is that the lock making technology involves several problems of designing of tools and equipment and development of prototypes. The results achieved in the blue potteries project are striking and encouraging. At the same time, the experience has offered several useful lessons for devising a strategy for replication of similar projects in other traditional industries like leather, wood-working, wool processing and spinning, handloom weaving, grain processing, energy conservation etc.

Traditional Technology

7. The oriental designs, colour combinations and stony character of blue pottery products make it a distinguishable product, very much different from the glazzed potteries of Khurja, Gwalior and Chunar in many ways. The process of manufacture is entirely manual and laborious and requires tremendous amount of patience and dexterity. Coarse and fine quartz, green glass and white glass, multani mitti etc. are ground by hand into fine powder and made into a thick paste out of which the body of the article is made either by hand or on the potter's wheel. Thereafter, the required design is drawn and colours painted on the surface and dried. The dried and painted body is dipped into lead oxide emulsion for glaze. The raw pots are baked in the indigenously built improvised kiln.

The Problems

8. In the traditional technology which is being employed for ever 600 years, a few defects like porocity, lead poisoning, iron defect, smoke effect and heavy breakage during firing, have been found to be persisting. Porocity in the body causes leakage of water when used as flower vases and spoils the place. The use of lead oxide (Sindhur) in the glaze mix makes it poisonous when it comes into contact with food articles. The European countries have, therefore, banned this item for utilityware. Both these defects disqualify blue potteries for utilityware. Due to contamination of quartz powder with iron particles, black spots are left on the surface of the articles after firing. Apart from these defects caused due to improper inputs, there are other major problems which affected the growth of the craft. During the period of firing, smoke gets deposited on the surface of the bodies leaving black patches. Secondly, due to uncontrolled firing, about 50 per cent of the articles loaded in the furnace at one time get damaged. The traditional kiln is most unsuitable for firing such expensive artware.

9. Presently, oxide colours are used in the glaze. These are formulated by each individual production unit in their own way and obtained by laborious manual process. Besides, some of these colours are also very expensive and their availability is limited. Presently dry grass is used as packing material which increases the weight of the consignment. The present packaging is so poor as to cause breakage in transit.

New Process Technology

10. The main elements of new technology and organizational strategy, successfully tried and adopted are briefly described below :

11. *Porocity* : The problem of porocity has been solved by modification of the body composition in which a combination of a coarse and fine quartz instead of quartz of one mesh was used; green glass was replaced by white glass; Multani Mitti was substituted by china clay; and talc was introduced. The final picture that emerged is as follows :

Body Composition	Existing	Ratio	New	%
Quartz Coarse / Fine	40 parts	0.833	50 parts	38.20
Talc	Nil	0.0	30 parts	22.90
White Glass	Nil	0.0	25 parts	19.00
Green Glass	5 parts	0.104	Nil	0.00
Gum Katire	1 part	0.02	2.5 parts	1.90
Sajji	1 part	0.02	1.5 parts	1.10
Ball clay/china clay	Nil	0.00	2 parts	1.53
Multani Metti	1 part	0.02	Nil	0.00
		0.997		99.90

12. The combination of coarse and fine quartz may give resistence power and prevent cracks; and small quantity of talc will give falling, bending and smoothening effect. Ball-clay/china clay will help in filling up pores. White glass is cheaper than green glass and is also available in plenty. Pounding of mixture after mixing helps in giving compactness to the body; and reduces breakage rate. As a result of the changes introduced in the inputs and their proportion in the body composition, the problem of porocity has been completely controlled.

13. *Lead-poisoning* : Poisonas (Poisonous) lead oxide glaze has been replaced by borosilicate glaze in the following manner :

Chemical Composition	Existing	New
(a) Lead Oxide	1 part	Nil
(b) Borax	1 part	40 parts
(c) Boric acid	Nil	10 parts
(d) Feldspar	Nil	10 parts
(e) Fine Quartz	Nil	20 parts
(f) Glass Powder	2 parts	20 parts

14. The advantages of borosilicate glaze are that it gives clear shining to the body and does not cause cracking. It may, however, be pointed out that it is somewhat opaque, and, therefore, further research is to be carried out to achieve satisfactory results.

15. *New Colour Stains*: As stated earlier, the present oxide colours are not only expensive, for instance, cobalt oxide sells at Rs. 1,500/- Kg., but also their availability is limited. Therefore, serious attempts were made to make available cheap colours which are readily available and also different shades in each colour. This has eliminated the drudgery and delay involved in the preparation of their (entrepreneurs) own colours.

16. *Firing Problems* : As stated earlier, due to defective heating systems there were twin-problems of smoke effect and heavy breakage which are inter-related as both of them occur during final firing only. These defects are caused because the artisans operate the kiln without any measuring instruments and exercise little control over the firing rates. An analysis of the firing defects showed that the bigger pieces were prone to heavy damage. Some of the specific ideas to control these problems were identified as follows :

(a) use of thermo-couple during the firing of the kiln,

(b) uniform inspection of holes with proper fittings,

(c) Peripherical opening between side wall and the hearth should be made uniform,

(d) the fireman should try to maintain the fires at both the ends, and

(e) The fire wood used for firing these kiln, varied in size and length. Sizes from 3" thickness to logs of 12" thickness were commonly used. This variation effects the firing rate. It is recommended to use firewood of 3-4" thickness as far as possible with the length of the wood at 1-2 feet. This also helps in controlling burning rate.

17. Based on these observations and assumptions, a new kiln was designed with double the capacity of the existing ones which can be fired with wood or coal and can be fabricated by the local masons at a cost ranging from Rs. 25,000/- to Rs. 30,000/-. Based on series of trials conducted at different temperatures it is found the heating rate in the region of 570°-650°C is the critical range. In order to regulate the heating system, a thermo-couple should be used to measure the temperature every half an hour and every 15 minutes in the critical range.

Achievements

18. As a result of sustained, determined and joint efforts of the experts of NPC, Regional Design and Technical Development Centre of All India Handicrafts Board etc. there has been a significant breakthrough in the technology upgradation of blue potteries craft, the most notable gain being a substantial reduction in the breakage rate from 50% to 5% of one furnace load of final product during firing. The other gains include reduction in the cost of raw materials by 10%, 25% reduction in the over-all cost one furnace load, 20%

increase in the incomes of artisans and finally profitability of the units had gone up by 50%. The reduction in the breakage rate and economy in the use of raw materials, rationalisation of processes has also resulted in 65% increase in the over-all production. A modified low-cost fuel-efficient new kiln with double the capacity of the existing one which can be fabricated at an estimated cost of Rs. 25,000/- can serve as a common facility to a group of production units, thereby further reducing the cost of production. The new kiln offers flexibility to fire with coal or wood depending upon their availability and its economics. Fuel consumption will be less. The controlled heating system can totally eliminate the problem of smoke effect.

Lessons of Experience

19. The Pilot Action Project for technology upgradation first of its kind to be initiated by the Appropriate Technology Unit, has many useful lessons to offer for future guidance.

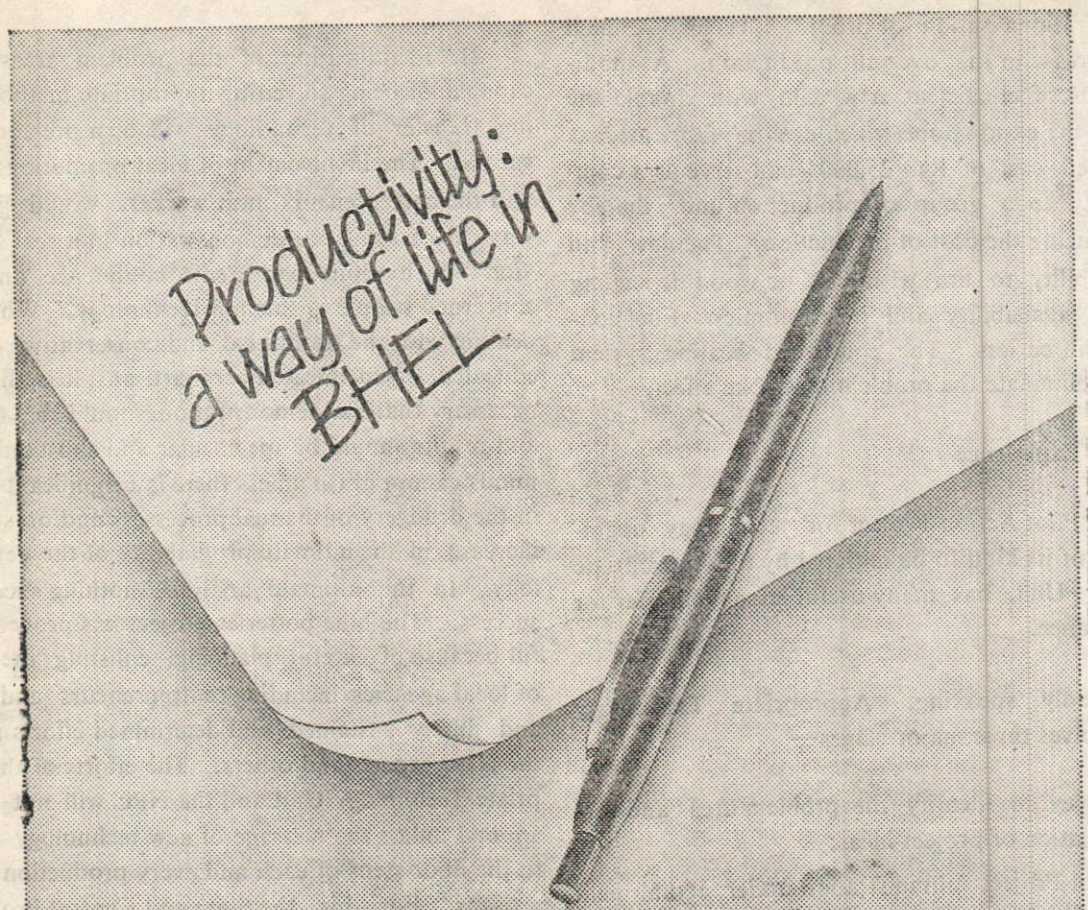
20. Broadly speaking, Appropriate Technology project involves three major stages—

(i) Survey to identify the problem areas and formulation of project ideas;

(ii) Pilot Project Administration under actual field conditions;

(iii) Identification of delivery system for dissemination of appropriate proven technology which would include training, and appraisal of improvements in the quality of the final product, and consequent increase in the profitability to the buyers.

21. Identification of the problem areas which are capable of being solved by appropriate methods including transfer of technology will be a pre-condition for success. The involvement of local promotional agencies and the entrepreneurs and workers would go a long way in carrying out demonstration in a real field situation which alone can create confidence among the concerned people in the new technology. When we are dealing with the traditional and conservative and semi-educated or uneducated rural artisans, it is all the more necessary that the demonstration should be fool-proof and results should be spectacular and substantial. Their minds cannot grasp unless there is a significant reduction in the drudgery of manual processess and/or substantial increase in the ultimate profitability of the new technology. In the ultimate analysis, nothing succeeds like success. The blue potteries project has proved successful because of careful planning, enlisting the support of local agencies including entrepreneurs and artisans and finally sustained and determined efforts put in by the NPC experts and others. The efforts of the Appropriate Technology Unit and the NPC will not come to an end unless the message of new technology is carried to the door-steps of each and every production unit and artisans. For this, the State and Central Promotional Agencies, such as, the Rajasthan Small Industries Corporation, the All India Handicrafts Board, the Handloom and Handicrafts Export Corporation etc. will have to play a major role.



The Prime Minister declared 1982 as the Year of Productivity. BHEL's efforts at productivity have yielded results, which has drawn the attention of experts within the country and abroad.

Dr. A.N. Saxena, Director General, National Productivity Council, in a letter dated 8th April 1983 says "I am particularly struck by the motivational approach which has been made permissive and which has generated a psychology in favour of productivity in the entire BHEL system with specific productivity improvements in areas like energy and fuel, materials consumption, process improvement and other related fields."

An ILO expert, Mr. P.A. Neck, in a communication has invited BHEL to join an international network on productivity. In his letter of 14th March 1983 he says, "May I take this opportunity to congratulate you on the obvious success being achieved by BHEL in the field of productivity improvement".

Such observations have enthused BHEL to further gear up productivity efforts, and have opened vistas for extended cooperation within the nation and abroad.

Bharat Heavy Electricals Limited

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ASP BHEL

Productivity
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Productivity and Job Redesign

RAVINDER NANDA

Twenty-two groups of workers (n=242) in seven different industrial plants from the public and private sectors in India responded to items from the 'Job Diagnostic Survey'. The study covered job design, work environment, internal work motivation, growth-need strength and general satisfaction. The results suggest that job redesign is an important component in improving productivity and quality of work life.

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पुस्तकालय

Introduction

Job design is one of the keys to increased productivity. Productivity will not always be simply improved by monetary policy of more investment in research and development. Efforts will have to focus on organizing and managing people at work and building teams that work cooperatively and effectively with a long-range view.

Katzell and Yankelovich consider the strategy for improving the quality of work life to include: giving employees work that more completely utilizes their aptitude and skills, affording opportunities for upward and lateral mobility, giving workers a voice in decisions that affect them and creating an environment with which the worker can form a positive identification.

Two explicitly articulated theories exploring the relationship between jobs design and worker motivation are those of Herzberg and Hackman & Oldham. Herzberg's view is that jobs are motivation producing if they afford opportunities for greater responsibility, challenge, and self-fulfillment. Factors such as working conditions and pay do not create job satisfaction, but their absence may cause dissatisfaction. Hackman and Oldham postulate five "core job characteristics," which they believe must be present to motivate and satisfy workers : (1) skill variety, (2) task identity, (3) task significance, (4) autonomy, and (5) feedback from job.

There is a growing body of research suggesting a relationship between productivity and the quality of work life. Traditionally, work design emphasized only

the physical aspects of work; this was later enhanced by incorporating physiological (human) factors. Today, the bases for work design are being further enhanced by input of psychological factors. The conventional industrial engineer's approach was that of a cost reduction or a work measurement expert who sets standards to increase productivity. The employee was required to adapt to the job that had been designed for efficiency. Today there is a need to recognize that increased productivity comes from competent supervision and meaningful jobs. Modern job design combines technical requirements, organizational goals, and human motivation. The industrial engineer's role of an expert and decision maker is now shared by others, such that the industrial engineer serves as an advisor or consultant and the managers and workers become decision makers. The Japanese success with quality control circles is a case in point.

The study reported here explores the opportunities for work redesign in the Indian industrial environment. Dialog with top and middle managers and observations on the shop floor raised a series of general questions pertaining to worker motivation, satisfaction, and effectiveness. Through the use of the 'Job Diagnostic Survey' the relationship between job design and issues relevant to improving productivity were analyzed.

The Job Diagnostic Survey (JDS)

The JDS instrument is documented in great detail by its developers, Hackman and Oldham, in their book *Work Redesign*. For the purpose of this article, a brief summary is abstracted from it. The job characteristics model of JDS is shown in Figure 1. It proposes that positive personal and on-the-job outcomes are obtained when three "critical psychological states" are present for a given employee. These, in turn, are created by the presence of five "core job characteristics." A summary score reflecting the overall "motivating potential" of a job is computed as follows:

Motivating Potential Score (MPS)

$$= \left\{ \frac{\text{Skill Variety} + \text{Task Identity} + \text{Task Significance}}{3} \right\} \times (\text{Autonomy}) \times (\text{Feedback})$$

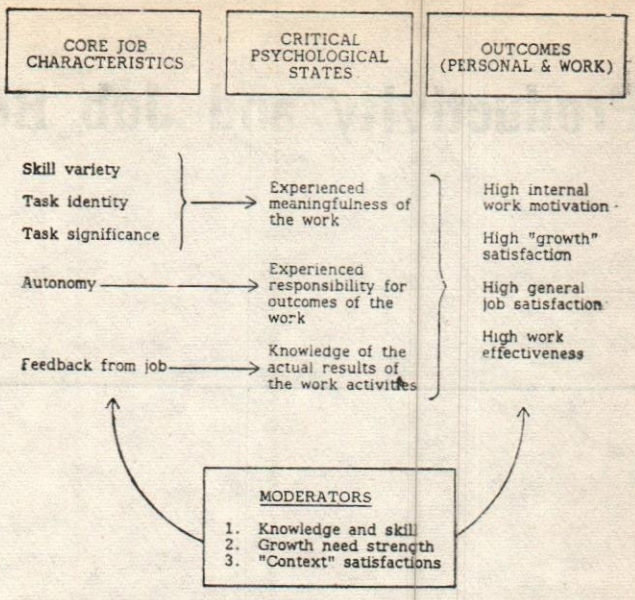

Fig. 1 : The Complete Job Characteristics Model

The JDS instrument uses a seven-point response scale (1=low, 7=high). The individual differences among people play an important role in how they respond to their work. Thus "moderators" are identified in the model, comprising of factors which explain relationships between job characteristics and outcomes.

The five core job characteristics, the three critical psychological states and the affective reactions to the job and other terms measured by the JDS instrument are defined as follows :

Core Job Characteristics

Skill Variety. The degree to which a job requires a variety of different activities in carrying out the work, involving the use of a number of different skills and talents of the person.

Task Identity. The degree to which a job requires completion of the "whole" and identifiable piece of work, that is, doing a job from beginning to end with a visible outcome.

Task Significance. The degree to which the job has a substantial impact on the lives of other people, whether those people are in the immediate organization or in the world at large.

Autonomy. The degree to which the job provides substantial freedom, independence, and discretion to the individual in scheduling the work and in determining the procedures to be used in carrying it out.

Feedback from Job. The degree to which carrying out the work activities required by the job provides the individual with direct and clear information about the effectiveness of his or her performance.

Critical Psychological States

Experienced Meaningfulness. The degree to which the employee experiences the job as one which is generally meaningful, valuable, and worthwhile.

Experienced Responsibility. The degree to which the employee feels personally accountable and responsible for the results of the work he or she does.

Knowledge of Results. The degree to which the employee knows and understands, on a continuous basis, how effectively he or she is performing the job.

Outcomes (Personal and Work)

General Satisfaction. An overall measure of the degree to which the employee is satisfied and happy with the job.

Internal Motivation. The degree to which the employee is self-motivated to perform effectively on the job—that is, the employee experience positive internal feelings when working effectively on the job, and negative internal feelings when doing poorly.

Growth Satisfaction. The degree to which the employee feels there are opportunities for personal learning and growth at work.

Moderators

Context Satisfaction. This includes satisfaction measures for responses to items of pay, security, social (co-workers), and supervision.

Growth Need Strength (GNS). Two separate measures are obtained. In the "would like" format, respondents indicate directly how much they would like to have a number of specified conditions present in their jobs, some of which focus on growth-relevant aspects of the work. In the "job choice" format, the respondents indicate their relevant preferences for pairs of hypothetical jobs. In each item, a job with characteristics relevant to growth need satisfaction is paired with a job which has the potential for satisfying one of a variety of other needs. The total GNS is the average of the "would like" and "job choice" scores.

Additional Measures

JDS also scores two additional variables, which have been helpful in understanding jobs and employee reactions to jobs.

Feedback from Agents. The degree to which the employee receives clear information about his or her performance from supervisors or from co-workers. (This dimension is not, strictly speaking, a characteristic of the job itself. It is included to provide information to supplement that provided by the dimension "feedback from the job itself.)"

Dealing with Others. The degree to which the job requires the employee to work closely with other people in carrying out the work activities (including dealings with other organization members and with external organizational "clients").

"Work Effective" outcomes, which include quality and quantity, absenteeism, and turnover, could be measured by a before-and after study of job redesign. The moderators, knowledge and skill of the individual, are obtained from the participants biographical data and from information gathered by the researcher about that job. The JDS questionnaire is divided into seven sections, requiring responses for some 83 questions. The 21 variables listed in Figure 1 are scored by consolidating responses to questions in different sections.

The JDS instrument was field tested by its developers in 56 organizations, consolidating some 876 job families from an employee sample of 6930. From this data, normative measures for each of the 21 variables were calculated in each job family to form a data base.

Other researchers have also used the JDS questionnaire in industrial and service environments. The JDS, which has been translated into six languages,[1] is thus being adapted to different international environments. A review of the task design literature by Pierce and Dunham revealed that JDS is the most commonly used instrument to assess perceived task design.

Sample

The JDS model was presented to the management of nine mannfacturing organizations in Bangalore, India. Most of these organizations had multiple facilities. The manufacturing sites were in and around Bangalore, as well as in other parts of India. In most cases, a given location exclusively manufactured one specific product. In all organizations, the initial technical know-how had been a foreign collaborative effort. Today, these organizations have adapted the original product designs and operational procedures to suit indigenous needs. Thus the manufacturing organizations approached were mature in areas of technological and managerial competence.

After the preliminary discussions, seven organizations agreed to participate in this pilot study. The management selected the participant groups and location for conducting the survey. Wherever possible, the work groups from each organization which had either identical job titles or work responsiblity were later pooled together to form job families for the purpose of data analysis. The summaries of participants from each organization are shown in Table I. Table II shows the same participants re-arranged in job families. Included in these tables are some related statistics gathered from their biographical data.

With a few exceptions, all participants had a high school education. A majority had a technical trade diploma or a degree. This advanced training is equivalent to a minimum of three to four years of education and work experience. In most instances, the participants had undergone technical training in schools run by the organizations themselves. Thus the participants had a fairly diversified competence and a high level of training in basic skills. The participants were mostly in their 20s (40%) and 30s (50%).

Data Collection

Initial presentations explaining the purpose of the study were repeated for middle managers, supervisors, and labor union representatives. All concerned were assured that their participation was voluntary, that the study was of an exploratory nature, and that no change in work rules of environment would automatically result as a consequence of their participation.

During the preliminary discussions copies of the questionnaire were made available to supervisors of participating groups. The primary purpose here was to pretest the questions for clarity and applicability to the organization. Secondly, it gave the supervisors an opportunity to gauge the level of English comprehension required and thus enabled them to identify and select the pariticipants.

In one instance, the supervisor had the questionnaire translated in the local language. During its administration, this translation was available to those who wished to consult it for further clarification. In three cases, a research assistant fluent in the local language was present to help clarify any terms for the participants. There was little difficulty with the use of JDS in the English language.

The employees completed the questionnaire during their regular working hours in a separate room away from their workplace. No management personnel from the organization were present during the administration of the JDS. Each group was given a briefing on the response scales, before they began writing their answers.

Results

The average response for each of the 21 variables measured by JDS are summarized in Table III by organizations, and in Table IV by job family. The job families are arranged in the increasing values of their MPS scores.

1. Personal communication with Hackman.

Table I: Summary of Participants by Organization

Sector	Public				Public Sector Totals	Private			Private Sector Totals	Total of Study
Organization	A	B	C	D	4	E	F	G	3	7
Sample Size	25	32	53	18	128	33	43	38	114	242
Numbers of Groups in Each Organization†	3	3	3	2	11	3	3	5	11	22
Male/Female Ratio	24/1	32/0	53/0	6/12	115/13	13/20	43/0	38/0	94/20	209/33
Salary* Range (Rupees)	950-1370	700-1800	800-1600	780-1150	700-1800	850-1750	900-2200	750-2100	750-2200	700-2200
Average Salary* (Rupees)	1155	1291	1185	911	1167	1144	1350	1065	1195	1180
Avetage Years at Job**	12.4	11	4.2	1.9	7.2	8.9	10.9	11.5	10.5	8.8
Location	Urban (n=57)		Rural (n=71)				Urban			

† Range 5 to 27
* Including all allowances
** Range 1-20 years

Table II: Summary of Participant by Job Family

Job Family	Inspectors/ Quality Control	Coil Winders	Machinist	Clerical Workers	Calibrators/ Testers	Draftsmen	Machine Setters	Engineers	Total System Certifiers
Sample Size	32	10	71	20	31	25	16	31	6
Numbers of Groups in Job Family	3	1	4	2	3	3	2	3	1
Male/Female Ratio	22/10	10/0	71/0	19/1	12/19	25/0	16/0	31/0	3/3
Salary Range (Rupees)	825-2100	730-950	800-2200	950-1160	800-1375	700-1500	825-2100	950-2100	900-1150
Average Salary (Rupees)	1360	844	1172	1052	100	1125	1360	1473	1053
Average Years at Job	10.9	15	7.3	9.1	6.8	11.4	10.9	6.1	3

Job Design & Motivation

For all job families, the scores for the four variables under "context satisfaction" are higher than the scores for the remaining 17 variables measured by JDS. According to Maslow, there are five hierarchies of human needs to which people can be motivated. The first two (primary) needs of physiological (pay) and security seem to have been met for all job families. This in part has been made possible in India as well as in most of the industrialized modern societies by the political environment and support of organized labor.

The next higher need of "affiliation" is also being satisfied for most job families as measured by the social satisfaction score. Thus, the environment exists to motivate the employees for their next higher need of "self esteem." From the responses of the participants,

this need has not been met satisfactorily at the workplace. The score for internal motivation for all job families is the lowest among all factors measured (2.8).

According to Herzberg, the variables under context satisfaction are "hygiene" factors and not motivators. Factors of responsibility, recognition, advancement, achievement, and work itself are sources of job satisfaction and motivation. Furthermore, his studies suggest that positive job attitudes are favorable to increased productivity. In the job families studied, the score for experienced responsibility (3.1) is the next to lowest score. Thus the employees who have several years of experience and training are working in an environment which does not enhance their full capabilities.

Researeh in the United States shows that experienced responsibility for outcomes of the work contributes most significantly to internal work motivation.[2] Data gathered here indicates very little autonomy in the task of the first five job families listed in Table IV. The work organization was characterized by measurement of work loads in terms of equipment and facilities to ensure a strict routinized sequential pattern.

Other high intercorrelations exist between feedback from job and knoweldge of results.[3] Both variables had low scores in this study. The outcome of general satisfaction has high intercorrelations with experienced meaningfuless and responsibility.[4] The former significantly intercorrelates with skill variety.[5] Feedback is an important step toward creating a climate receptive to participation by employees in job redesign and team building. Thus there is a strong indication that job redesign is an opportunity that could contribute to improving worker satisfaction and organizational productivity.

Growth Need and Development

All job families indicate a strong desire to have growth relevant conditions present in their jobs as indicated by the GNS scores for "would like" choice (4.8). At present, there is not a clear career path defined by management in most job families. Furthermore, there are no organized programs of job design which build in motivators. Job promotion in most instances is based only on seniority to supervisory positions and at times acts as a demotivator.

The inspectors/quality control is a case in point. This job family has the lowest MPS score. Most of the employees in this position are promoted from the ranks of machinists and calibrator/testers, both of which have higher MPS scores. This job family offers individuals little skill variety and the task is low in autonomy and job feedback.

Another job family in which the participants do not experience job satisfaction and could benefit from career development is coil winders. This job family had the longest time on the job (average of 15 years). The job is highly mechanized, and requires a simple monitoring of the coil winding machine by the operator. From their biographical data only one out of the ten coil winders had any education beyond the high school equivalency. This job family had the lowest score for 9 of the 21 variables measured among the 9 job families in this study. This is a low skill job, high in autonomy, but poor in feedback, and lowest in task significance.

The growth need strength (GNS) scores of JDS can also be helpful in estimating whether people are likely to prosper on enriched jobs. Given the training, skill, and knowledge of the participants, if those aspects of the job that contain the motivating potential (for example, in our job families, skill variety and autonomy) are in fact changed, it is possible that workers will respond positively as discussed in the next section.

Job redesign is not the only answer to organizational problems, many of which are rooted in economic, social, political and cultural factors of the work environment. Although the general outcomes of work satisfaction indicated in this study are relatively low, the participants do feel a strong growth satisfaction and task significance in their jobs. Thus the participants see a challenge and opportunity in their work environ-

2. An intercorrelation coefficient of .59 (n=6930). Oldham, Hackman, and Stepina.
3. 49, *Ibid.*
4. 66 and 49, *Ibid.*
5. 45, *Ibid.*

ment, yet do not feel a strong internal work motivation. All of these variables diagnose the need to improve job design by building recognition, achievement, and responsibility into their tasks.

Job Design and Positive Outcomes

Positive outcomes of job satisfaction are reflected in the scores of job families with built-in motivators. Job families in which recognition and responsibility are designed as part of the task have higher MPS scores.

Total system certifiers have the highest scores for the four out of five core job characteristic and for all the critical psychological states. They also have the lowest average years of experience on the job. From personal observation and information gathered about this job family, the job design has many of the features desired in an ideal enriched job. This job family tests the total system through its burn-in period, and the system is shipped under each individual's signature of approval. This responsibility is reflected in the fact that this job family also has the highest score for "feedback from agents." Similar characteristics were also true for draftsmen, machine setters, and engineers, who also show the highest scores for growth need strength. All these job families are high on skill level, and the individuals experience a good deal of autonomy in their task assignments.

Another point of interest is to recognize that inspectors/quality control and machine setters (both of which need high skill levels) are two job families promoted from within the same job families (machinists and calibrators/testers). Both these groups have the same average years on the job (10.9 years, Table II). However, in case of machine setters, the built-in motivators of feedback from the job (and agents-machinist), skill variety, growth satisfaction, recognition (dealing with others) have resulted in positive outcomes for the individuals. Thus in the Indian industrial environment, the presence of critical psychological states did result in higher MPS scores and a positive identification with the job design.

Private and Public Sectors

The organizations were separated into the public and the private sector (see Table III). A comparison of the weighted averages of the responses in each sector reveals that, generally the public sector scores are higher than those for private sector, except for pay and supervision satisfaction and knowledge of results. Although the overall MPS score for the public sector is somewhat higher than for private sector the general patterns of work organization in both cases followed the Tayloristic system, namely specialization of skills, minimization of skill requirement, and reduction of learning time. In both sectors, there were smaller select groups participating in experimental job redesign projects of group technology, job rotation, and quality control circles.

Urban *vs.* Rural Location

In the four organizations of the public sector, two were in rural locations and two were in urban locations. Generally the scores for rural locations are higher than for urban locations. The two rural locations have higher MPS scores than all urban locations in both sectors. In addition, the two rural locations share the highest scores for 10 to 21 variables measured among the seven organizations in this study. This limited data further indicate the high growth satisfaction and growth need strength of rural industrial manpower. This suggests that the public sector investment policy and the national guidelines of industrial development in rural areas offers a unique opportunity to align job design, human resource development and appropriate technology.

In summary, both Maslow's and Herzberg's theories appear relevant in the Indian environment. The workers generally do experience high context satisfaction in their work environment, The MPS scores correlate highly with knowledge and skill level of job families. In cases where good core job characteristics were present, the employees responded positively to enriched and challenging jobs. The lack of clearly defined growth opportunities coupled with job design appears to act as a demotivator. All participants exhibit a high motivation to advance themselves.

There is a critical need to align the ability requirement of the jobs with the abilities possessed by the employees in each job family. This is especially

Table III : JDS Measurement by Organisations

KEY Range for Each Variable X.Y = lowest value [X.Y] = highest value	PUBLIC SECTOR				Weighted Average Public Sector	PRIVATE SECTOR			Weighted Average Private Sector
	A	B	C	D		E	F	G	
Skill Variety	3.5	[4.0]	3.9	3.6	3.8	3 7	3.1	3.9	3.6
Task Identity	3.7	[3.9]	[3.9]	3 7	3.8	3.5	3.6	3.8	3.7
Task Significance	[4.4]	4.3	[4.4]	4.2	4.3	3.9	3.9	4.2	4.0
Autonomy	3.7	4.1	4.0	[4.3]	4.0	3.4	3.9	4.0	3:8
Feedback from Job	3.7	3.7	3.9	[4.2]	3.9	3.8	3.8	3.7	3.7
MPS	54.8	55.9	64.1	[72.5]	61.4	46.5	55.6	57.5	53.8
Experienced Meaningfulness	[4.3]	4.2	4.0	4.2	4.2	4.2	4.2	3.9	4.1
Experienced Responsibility	3.1	[3.4]	3.1	3.3	3.2	3.1	2.8	2.9	2.9
Knowledge of Results	3.8	3.3	3.5	[3.9]	3.6	3.8	3.8	3.5	3.6
Internal Motivation	2.6	[3.3]	2.7	3.2	2.8	2.7	2.7	2.6	2.7
General Satisfaction	[3.7]	[3.7]	[3.7]	[3.7]	[3.7]	3.4	3.5	3.6	3.5
Growth Satisfaction	4.8	4.8	[5.2]	5.0	4.9	5.0	4.8	5.1	5.0
Pay	5.0	4.4	5.3	4.8	4.9	[5.4]	[5.4]	4.9	5.3
Security	5.0	4.9	5.4	[5.5]	5.2	5.3	4.6	4.7	4.9
Social	[5.4]	4.8	5.1	5.3	5.1	4.5	4.6	5.1	4.8
Supervision	5.1	4.7	5.1	5.3	5.0	5.4	[5.5]	5.0	5.3
GNS Would Like	[5.1]	4.9	5.0	4.6	5.0	4.9	4.2	4.5	4.5
GNS Job Choice	4.4	4.4	4.5	4.2	4.4	4.0	4.1	[4.7]	4.1
GNS Total	[4.8]	4.7	4.7	4.4	4.7	4.4	4.2	4.6	4.3
Feedback from Agents	3.8	[4.4]	4.2	4.1	4.1	3.8	3.6	4.3	3.8
Dealing with Others	3.5	[4.2]	[4.2]	3.2	3.9	3.9	3.6	3.9	3.8

significant for core job characteristics of skill variety, autonomy, and feedback. This study indicates that the JDS questionnaire has a logical internal consistency for use in the Indian industrial environment. This conclusion was shared by the organizations and participants when they reviewed a preliminary feedback of the tabulated data.

Conclusions

The purpose of this study was to assess whether job redesign and related activities are an opportunity to improve worker satisfaction and motivation. The results presented above do indicate the need to develop programs and to align the design of jobs and the skills needed to perform them with the capabilities, potentials, and needs of employees.

The management of organizations in India should look upon job redesign as a challenging opportunity toward enhancing democracy in the workplace. This participative style of management and its yield in higher productivity and a higher quality of work life is already a focus in many industrialized societies. Conclusions of earlier studies done in India[6] as well as the research described here strongly suggest that there is a need to motivate workers by involving them more actively in decisions relating to the workplace.

Instruments such as JDS offers an opportunity to build a national data base for a cross section of job families in the manufacturing and service areas in India. Such a data base, indigenously developed, could become the standard against which individual organizations could diagnose the motivational properties of jobs prior to redesign. The normative scales of JDS developed elsewhere would be of little value for developing job design or redesign programs in the Indian environment.

6. Rice and Kanawatty & Thorsud

TABLE IV. JDS MEASURED BY JOB FAMILIES

KEY
Range for Each Variable
X.Y = lowest value
[X.Y] = highest value

	Inspectors/ Quality Control	Coil Winders	Machinist	Clerical Workers	Calibrators/ Testers	Draftsmen	Machine Setters	Engineers	Total System Certifiers	TOTAL AVERAGE
Skill Variety	3.5	3.9	3.5	3.4	3.6	4.1	3 9	[4.2]	[4.2]	3.7
Task Identity	3.4	3.5	3.8	3.7	3.5	4.0	3 7	4.1	[4.5]	3.8
Task Significance	4.2	3.7	4.1	4.3	4.0	4.5	4.0	4.5	[4.7]	4.2
Autonomy	3.6	4.2	3 7	3.8	3.9	3.9	3.9	[4.6]	4.0	3.9
Feedback from Job	3.5	3.4	3.7	3.8	3.9	3.7	4.2	3.9	[4.5]	3.8
MPS	49.3	50 7	52.5	54.2	55.1	57.2	65.2	75.3	[99.9]	58.0
Experienced Meaningfulness	4.2	3.6	4.1	4.3	4.2	4.1	4.1	4.1	[4.4]	4 1
Experienced Responsibility	2.9	3.1	3.0	3.2	3.0	3.3	3.0	3.1	[3.4]	3 1
Knowledge of Results	3.9	3.3	3.5	3.5	3.7	3 5	3 7	3.6	[4.1]	3.6
Internal Work Motivation	2.8	2.8	2.5	[3.2]	2.9	2.7	2.7	2 8	3.1	2.8
General Satisfaction	3.5	3.4	3.6	[3.9]	3.7	3.5	3.4	3.7	3.8	3 6
Growth Satisfaction	4.9	[5.3]	5.0	4.0	5.1	5.0	5.2	5.1	4.7	4.
Pay	4.9	[5.8]	5.4	4.9	5.0	4.9	5.5	4.8	5.2	5.1
Security	4.7	5.3	5.1	4.9	[5.4]	4.9	4.8	5.3	5.0	5.1
Social	4.8	4.8	4.7	4.8	4.9	4.9	5.4	[5.5]	5 1	4 9
Supervision	[5.6]	5.5	5.1	4.6	5.1	4.8	5.2	5.2	5.4	5.1
GNS Would Like	4.5	3.9	4.6	5.0	4 8	4.6	5.1	[5.4]	4.5	4.8
GNS Job Choice	4.3	4.2	4.1	4.4	4.2	[4.5]	4.3	4.5	3.9	4.2
GNS Total	4.5	4.0	4.4	4.7	4 5	4.5	4.7	[5.0]	4.2	4.5
Feedback from Agents	3.7	3.7	3.9	4.1	3.7	4.4	4.1	4.4	[4.7]	4 0
Dealing with Others	3.7	3.3	3.9	3.4	3 4	4.2	4.0	[4.5]	3 7	3.9

There is a growing body of research on job redesign suggesting ways to create an environment in which workers experience the five "core job characteristics."[7] This calls for a long-range commitment by industrial organizations, and it has to be pursued with aggressive support of top management. Management has to be willing to be innovative, patient, and believers in the process of humanizing the workplace. Such programs must include diagnosis, subordinate involvement, job design, training, a performance appraisal system, and an external (unbiased) evaluation. In the competitive international market, there is a strong need to pursue ways of increasing industrial productivity. This study indicates that job diagnostic, leading to a national data base would be an essential first step in this change process.

7. Nanda and Browne

REFERENCES

Dunham, R.B., "The Measurement and Dimensionality of Job Characteristics", *Journal of Applied Psychology*, Vol. 61, 1976, pp. 404-409.

Dunham, R.B., Aldag, R.J. and Brief, A.P. "Dimensionality of Task Design as Measured by JDS", *Academy of Management Journal*, Vol. 20, 1977, pp. 209-223.

Hackman, J.R. and Oldham, G.R. "*Work Redesign*", Addison-Wesley, Reading. Massachusetts, 1980.

Herzberg, F. "One More Time : How to Motivate Employees", *Harvard Business Review*, Vol. 46, 1968, pp. 53-62.

Katzell, R.A. and Yankelovich, D. "Work Productivity and Job Satisfaction", *The Psychological Corporation*, New York, 1975.

Kanawatty, G. and Thorsud, E. "Field Experiences with New Forms of Work Organization", *International Labor Review*, Vol. 120, No. 3, 1981, pp. 263-277.

Maslow, A.H. "*Motivation and Personality*" Harper and Row, New York, 1954.

Nanda, R. and Browne, J.J. "Hours of Work, Job Satisfaction and Productivity", *Public Productivity Review*, Vol. 2, No. 3, 1977, pp. 46-56.

Oldham, G.R., Hackman, J.R. and Stepina, J.L. "*Norms for the Job Diagnostic Survey*", Technical Report No. 16, School of Organization and Management, Yale University, July 1978.

Pierce, J.L. and Dunham, R.B. "Task Design: A Literature Review", *Academy of Management Review*, Vol. 1, 1976, pp. 83-97.

Rice, A. K. "*Productivity and Social Organization. The Ahemdabad Experiment*", Tavistock Publication, London, 958.

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Banking's Efficiency Paradox—An Insight in Global Perspective

BIMALENDU MUK HER

While Indian banking's achievements over the past couple of decades are spectacular in many dimensians and its discerned growth unprecedented anywhere in the world; in today's milieu of banking certainly not everything is eurhythmic. The stagnating operational efficiency, in fact, has been becoming a very trivial concern of all those connected with this vital sector in the economy. Undoubtedly, this is an important issue in the context of the banking sector's rapid expansion, swift transformation, and gradual entry into the volatile and complicated arena of international financial markets.

Mr Bimalendu Mukherji is an Associate Member of Institute of Bankers, London and Life Associate Member of Institute of Bankers, Bombay.

Global View

The criteria of efficiency in a service-oriented industry like banking can hardly be codified precisely. But whatever vexed the issue may appear to be, it can nevertheless be dealt with by some rough approximations of significant operating parameters in coherence with a global perspective and the relevant antecedents of importance to industry as a whole.

Important financial indicators of world's major banking institutions as on 31st December, 1981 are placed in Tables 1 & 2. Table 1 displays basic operating data of the largest bank of several countries, ranked in terms of assets-holding. The key efficiency indicators, viz., per employee assets. deposits, loans and income as well as stockholders' return on equity are shown in Table 2. The comparison data gives some fascinating exposures. Ranked in terms of assets per employee, Japan comes first ($ 3942,000), closely followed by Sweden ($ 3591,000) and Switzerland ($ 3174,000); Brazil ($ 663,000), Britain ($ 708,000) and India ($ 104,000) are relatively low scorers. While India is at the lowest ebb in all the respects, in terms of per employee deposits Japan's is the highest again, though Switzerland shows the highest out-turn in loans per employee. Brazil is the top income earner—both per employee and in relation to stockholders' equity, though its per employee assets, deposits and loans are

can we do this miracle with our existing resources, system and style?

A change in our approach towards the use of advanced technology is clearly indicated. Computerization and mechanisation in banking is, after all, a very sensitive issue. It remains a vexed question, as well, in the context of the country's massive unemployment problem. In the midst of conflicting needs, prudence demands, perhaps, a safer course. While a total switch on to computerisation is neither warranted nor practicable, a modest support of sophisticated aids to human endeavours at least in certain areas—such as, management of funds, flow of management information for decision-making, submission of data to statutory authorities, maintenance of personnel inventory skills and handling of house-keeping functions—may reasonably be propounded for ensuring the minimum standard of efficiency in the industry. The recent installation of a mini-computer in Bankers' Clearing House at Bombay and the Indian banks' urge to come under the fold of SWIFT network are positive indications that the computerization of our banking is in the offing. The real handicap in the process of introducing modern technology seems to be the industry's inability to reach mutual agreement with its work-force over the sensitive issue. The sooner this understanding gap is wiped out, the better for the industry's future appetite,[3] needless to mention.

Managing Behaviour

The most formidable dimension of problems circumventing the course of our banking's efficient functioning would be conspicuous, however, in a vicious circle stemming out of the bathos in behaviour of employees and a declivity in the responsiveness of the higher echelons responsible for managing the subordinates. The problem of behaviour may be seen to find its origin through the coherence of a number of avoidable reasons, such as :

First, the slow process of grievance handling often stands as a direct cause of discontentment—the occurrences, in fact, are very frequent even in mundane matters at the branch level; the reasons being inadequate delegation of authority, or lack of information and/or poor perception.

Second is the absence of proper communication link in the organizational hierarchy. What happens quite often is that the employees at the grass-root levels are led to rely on their union leaders, who happen to maintain contact with the management for negotiations. Perceptions and understanding of employees tend easily to get concocted under such a design.

Third, historically and by background, the bankers had been to busy in harbouring around 'business'; but in the process, imposing excessive controls and directions to the utter dilution of human aspects of management; this drifted the management's net far apart from its basic resource—the employees, whose loyalty did tend to swing eventually in favour of unions.

Fourth, the banking industry adulates highly individualistic operations and dispels the virtues of the people working as a team—absence of team work 'Sans' group goals is a stumbling block to organisational vitality in that this condition stifles loyalty, degenerates involvement and causes frustration. Upheavals of employees' alienated attitudes find their ways as a natural corollary, causing finally to obstructive and/or destructive activities.

To imbibe the sense of responsibility and ensure involvement and batter performance, a participatory style of management is often propounded in banking industry.[4] In 1972, such a design was formally adopted in essence. Under this arrangement, participation of employees' representative was allowed at the Board Level of individual banks, aiming to foster the behavioural needs. The experiment, however, has not produced any discernible result. The obvious reason is that the work force at large did not sense the 'feel' of being involved through this constrictive participatory process.[5]

A facile climate micro-points for integration of people with the organisation should, on the contrary, produce better results. This suggests a participatory style of leadership at the branches. But, in the process, at least two hindrances may appear : first, the multiplicity of unions may not facilitate amicable solution to problems, particularly when cross-interests between the groups clash; and the second, the managers themselves

may hold thwarting attitude towards employees' participation for fear of dilution of managerial authority.

About the first one, a workable suggestion may be that the very common and simple issues which lead to the least of conflicts may be tried as a first step to inculcate the spirit of involvement, after which, attempts for resolving the delicate ones may be made in stages. Managers, however, often tend to complain of complications and impracticability inherent with participatory approach. But a little zeal and optimistic pragmatism would have proved that it is not 'a useless theory developed by some one looking for a new behavioural idea'.[6]

Contextually, reference may be made to a recent kind of Japanese experiments that resulted in excellent results. The approach is what has been dubbed as "A/T" or "Achievement Targets" programme which, basically, 'requires employees to set personal goals or targets within a specific time frame, make specific progress reports and announce the results when the time period is over.[7] This course of approach improved productivity so tremendously that its usage became very popular soon. A similar kind of development is taking place in some of the European countries with positive results.[8]

It is not, in fact, an Utopian dream that a manager who provides encouragements and gives due appreciation, discusses problems and seeks suggestion, offers counselling and renders help—shows invariably, in turn better rapport with employees, builds strong morale and, in the process, accelerates productivity—he succeeds in managing his affairs better and at the same time, produces better potential supervisors, the most valuable of all resources, a service organisation like banking can afford to usher in.[9]

Rsource Development

There is nothing platitudinal in that 'the assets which towers above all others in business is not buildings, not land, but men'—and hence, the greatest stress needs to be given on the training of men and the giving of service. It has been observed that 'man to man coaching on the job ... meets specific needs of an individual. It presents a nearly perfect learning situation, in as much as the understudy, who has a problem can talk it over with his supervisor and can put what he has learned into practice on a live problem of the moment.[10] Reviewing the Indian position one observer finds that although, 'most of the banks agree in principle for job rotation at clerical and junior officer level and transfers to different departments/locations at higher levels of management is desirable both from an individual's and organisational point of view', the fact remains that 'for reasons of expediency, immediate gains and conveniences of certain persons, job rotation is not strictly followed.[11] Evidently, this shows a vital leakage in the commitments for human resource development needs of banks.

In the other dimenson, i.e. institutional training by colleges and centres, most banks have by now developed adequate infrastructural facilities to meet the needs of their exisiting manpower, but here again, the system has been found to suffer from several limitations as under.[12]

(a) 'It is still rather isolated from other sub-systems of human resources development, e.g. transfer, promotion and such other aspects of career path planning'.

(b) 'The line management does not feel involved—does not feel responsible to utilize the training given or to help a trainee learn further, and to guide or counsel him to improve his performance'.

(c) 'The most important defect in the system is that'—there is a vague idea of what it is to be accomplished and the currently pressing problems decide the nature of immediate task. But it is dangerous to allow this state of affairs to continue, If it is allowed to continue the institutes will become soon moribund, in the sense that they will not die, but they will continue to exist remaining mortally sick. The signs of this sickness can be seen in the ritualistic nature of the training exercise'.

This suggests that pragmatism, zeal and determination are needed to make objective utilization of training

emphasizes on effectiveness and the achievement outputs. It integrates the individual with the organisation and recommends all the activity in an organisation to be objective-oriented through the effective utilisation of the resources such as materials, machines and manpower etc. It is essentially a performance oriented process.

In practising MBO, performance objectives are clearly quantified and made available for the use of the functional managers[5]. All the activities get co-ordinated, directed and monitored to achieve the performance objectives. The performances are measured and evaluated against the performance objectives. The authors have considered these important aspects of MBO technique and have taken into account the same in their methodology of productivity measurement, in the following respects[6] :

(a) MBO lays stress on the performance. In the terminology of productivity, performance is synonymous with output. MBO does start with quantification or measurement of inputs. It consideres inputs as means to achieve performance. Outputs co-related to constraints of inputs become the desired objectives.

If applied to productivity measurement it amounts to first laying down the Performance Objectives. Obviously these have got to be in line with the goals of the Organisation. The Performance Objectives as related to input resources shall provide Objectivated Productivity (say).

(b) MBO lays specific emphasis on quantification of objectives. This is also the requirement of the productivity measurement. All the outputs must be taken into account to represent the effectiveness or performance of all input resources.

3.2 *Systems Approach*

Plant Organisation is basically a system. It gets effected by the external environment and internal enviroment. Within the plant considered as system there are sub-systems which interact. No sub-system can be seen as a purely isolated sub-system with clearcut boundary. These sub-systems interact and effect the productivity of each other. The resultant productivity of a system is therefore the sum total of productivities of its sub-systems suitably arrived at by assigning weightage factors depending upon the importance and priorities accorded to the sub-systems. The productivity so arrived has also to be corrected by a factor to account for the effect to external environmet[7].

4. Performance Objectives—Productivity (POP) Approach

The methodology suggested as under basically takes into account that Productivity Index to be arrived at should be related to the Performance Objectives. It differs essentially from the other known methods of productivity measurement in the following respects :

(a) Emphasis is more on performance, outputs and achievements and comparing the same with the desired goals or Performance Objectives of the plant.

(b) The use of units as measures of productivity are avoided. This does away with the cumbersome exercise of conversion of all inputs and outputs to a common base.

(c) Weak areas, where improvements are required, are immediately identified for remedial actions.

(d) The systems concept is utilised in identiftying sub-systems and effectiveness areas. Emphasis is more on measuring effectiveness of functional areas considered as sub-systems. This is in line with the general Organisational pattern in industry where the work division or responsibilities are divided on functional lines rather than on the lines of inputs such as Labour, Capital, Materials etc.

5. Terminologies in the Proposed Approach

The following terminology has been used extensively in the proposed POP System.

(a) *Performance Objectives*

These are the objectives or results or the goals decided upon as required to be reached by the Plant. The analogy can also be extended down the line at

department or section level. These are arrived at in clearly defined terms and not left as vague.

(b) *Key Effectiveness Areas*

Within a sub-system, there shall be several areas where activities take place. Some of these areas may be performing well while others may need attention. As a part of the exercise of determining Performance Objectives such areas which require close monitoring of results shall be identified. These are referred to as Key Effectiveness Areas.

(c) *Objectivated Productivity*

This essentially is the productivity arrived at by considering output as the Performance Objectives and inputs as the inputs required to achieve the performance objectives. Or in other words :

$$\text{Objectivated Productivity} = \frac{\text{Performance Objectives}}{\text{Budgeted inputs}}$$

This also represents the upper bound of productivity achievable.

6. Proposed Methodology

The exercise of productivity measurement is to be restructured to incorporate the following salient features :

(a) *Identification of sub-systems*

There is no one best way to define a sub-system at plant level organisation. However, any definition to be adopted must consider that the sub-systems represent a major or a major group of activities which have a similarity. The sub-systems should contribute to the plant and together should form one congruent organic organisation.

No sub-system can be seen as a pure isolated sub-system with clear cut boundary. There will be overlaps and interactions. There will be interdependence on other sub-systems for its own survival and existence. Yet, for the sake of evaluation as well as systematic work, it would be necessary to create boundaries which make the sub-systems as independent as possible.

Fig. 1 depicts a classification of sub-systems. The authors however, are of the opinion that for the type of exercise under study, that classification is not very meaningful and does not represent the objectives in mind.

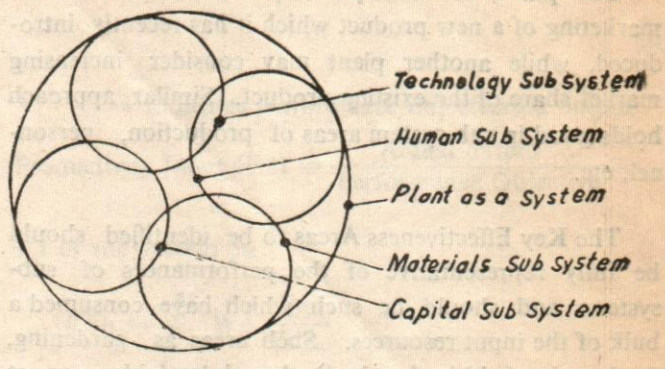

Fig. 1

An engineering plant, in general, working on the concept of profit center, has its activities organised on functional lines such as, Production, Marketing, Materials, Finance and Accounts, Personnel, etc.

These functional areas are more or less well defined. The authors suggest that these functional areas can be considered as sub-systems (Fig. 2). Additional sub-systems can be added depending upon the requirements of a particular plant. For example if a plant has "Erection and Commissioning" as a major activity, it could well consider it also as a sub-system.

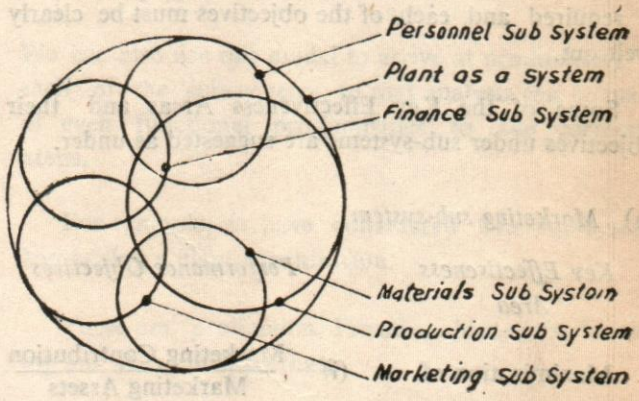

Fig. 2

(b) *Identification of Key Effectiveness Areas*

In line with MBO approach, it is first necessary to identify Key Effectivess Areas against each of the identified sub-systems.

$(P.I)_L$ = Productivity Index of Personnel sub-system

$$(P.I)_L = \sum_{j=1}^{m} W_{j5} \frac{O_{j5t}}{O^*_{j5t}}$$

The Key Effective Areas would vary from plant to plant depending upon the overall objectives of the organisation as well as long-term planning.

Accounts receivables	(iv)	$\frac{\text{Amount outstandings}}{\text{Total sales}}$

and as $(P.I)_T = \sum_{j=1}^{n} W_i (P.I)_i$

$$(P.I)_T = W_1 (P.I)_P + W_2 (P.I)_F + W_3 (P.I)_M + W_4 (P.I)_K + W_5 (P.I)_L$$

$$= W_1 \sum_{j=1}^{m} W_{j1} \frac{O_{j1t}}{O^*_{j1t}} + W_2 \sum_{j=1}^{m} W_{j2} \frac{O_{j2t}}{O_{j2t}} + W_3 \sum_{j=1}^{m} W_{j3} \frac{O_{j3t}}{O_{j3t}} + W_4 \sum_{j=1}^{m} W_{j4} \frac{O_{j4t}}{O_{j4t}} + W_5 \sum_{j=1}^{m} W_{j5} \frac{O_{j5t}}{O_{j5t}}.$$

8. Illustrative Example

We shall now take up Production sub-function to illustrate as to how POP can be applied to measure an index of Productivity. The data used is only representative to emphasize the use of the methodology.

Production Sub-function Defined

Plants define the production function depending upon their needs and other organisational equations. Some of them have been seen to club together shop-floor activity, production planning, materials planning and procurement. However a large number of organisations have recognised the separate identity of materials management and have considered production function mainly comprising of various manufacturing shops with the manufacturing plant, machines, tools and similar other facilities alongwith direct and indirect labour. Together with the same are clubbed the production planning, maintenance and tool room activities. We shall adopt this demarcation in this example.

Key Effectiveness Area and Performance Objectives

The organisation under this example has considered the following Key Effectiveness Areas. The performance objectives are noted alongside :

Key Effectiveness Areas	*Performance Objectives*
1. Labour Utilisation	Labour Performance Index = $\frac{\text{Achieved Std. Hours}}{\text{Direct Attendance Hrs.}}$
2. Capacity Utilisation	Capacity Utilisation Index $\frac{\text{Total Hrs. worked}}{\text{Total Hrs. available}}$
3. Indirect Expenditure	Index of Indirect Expenditure $\frac{\text{Indirect cost per Std. hour produced}}{\text{Direct Cost per Std. hour produced}}$
4. Quality	Quality Index $\frac{\text{Cost of Accepted Production}}{\text{Cost of Rejection (including rework)}}$

Weightage Factors

The organisation has decided the following weightage factors for the performance objectives :

Labour Performance Index	=	0.4
Capacity Utilization Index	=	0.3
Index of Indirect Expenditure	=	0.1
Quality Index	=	0.2
		1.0

Data	*Performance Objectives*	*Actual Output*
Labour Performance Index	109	90
Plant Performance Index	85	79
Index of Indirect Expenditure	0.38	0.35
Quality Index	20	19

Productivity Index of Production sub-system, therefore,

$$(P.I)_p = \sum_{j=1}^{m} W_{jl} \frac{O_{jlt}}{O_{jlt}}$$

$$= 0.4 \times \frac{90}{109} + 0.3 \times \frac{79}{85} + 0.1 \times \frac{0.35}{0.38} + 0.2 \times \frac{19}{20}$$

$$= 0.4 \times 0.83 + 0.3 \times 0.93 + 0.1 \times 0.92 + 0.2 \times 0.95$$

$$= 0.332 + 0.279 + 0.092 + 0.19$$

$$= 0.893$$

9. Conclusions

In this paper the methodology of Performance Objectives Productivity (POP) has been explained through an illustrative example as applicable to production sub-system. The methodology can be extended to cover measurement of plant productivity or departmental productivities.

The methodology proposed considers organisation as a system and therefore, does not propose to identify inputs in conventional forms of labour, materials, capital, etc. On the other hand, it considers functional areas as sub-system and therefore, proceeds to arrive at productivity indices of sub-systems and then for the whole organisation as a system.

POP system does away with the cumbersome process of conversion of inputs and outputs to a common unit as this problem is eliminated through ratios.

POP lays stress, as in MBO, on the outputs and considers inputs as means to achieve outputs.

In these respects, the authors opine that the proposed POP system can be a better way of measuring productivity.

REFERENCES

1. Fabricant, Solomon, "A Primer on Productivity", Prentice Hall of India Pvt. Ltd.,—1973.
2. SARDANA GD, "Plant Level Productivity Measurement as Applicable to Engineering Industry", Proceedings, All India Productivity Seminar, Haridwar 1982.
3. Faraday, J.E., "The Management of Productivity" Management Publications Ltd., London 1971.
4. Gold Bela, Practical Productivity Analysis for Management : Part 1, Analystic Framework, IIE Transactions, December 1982.
5. Reddin, W.J. "Effective Management by Objectives", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1971.
6. SARDANA GD, PREM VRAT, "An MBO Based Mathematical Model for Measuring Plant Productivity" Proceedings, All India Seminar on Productivity Maximization in Industries, Organised by Institution of Engineers (India), April 1983.
7. SARDANA GD, PREM VRAT, "Impact of External Environment on Productivity and Productivity Measurement"—A Contingency Approach. Proceedings, International Productivity Congress, Bombay, 1983.

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Productivity
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Managing for Productivity in the Indian Context

M.V.V. RAMAN

The ultimate aim of all human endeavour is the welfare of the individual. The national plans drawn up for economic development and growth of the country have this as their objective. Productivity, as is well known, is the effective utilisation of resources. Productivity is not an end by itself, but a means for achieving higher standards of living for the people; it is the production of goods and services required by the community at large at prices it can afford and continue to do so in an effort to improve the standard of living continuously. How can we do this effectively ?

Mr M.V.V. Raman, Regional Director, National Productivity Council, Calcutta.

Introduction

Government(s) can create conditions of favourable atmosphere in the economy which stimulate the efforts of employers and workers to raise productivity by well defined and balanced programmes of economic development, and other measures to tackle the challenges associated with increased productivity, namely, redundancy, shifts in employment and similar problems. Raising the level of productivity within a unit is the responsibility of management to be achieved with the cooperation of workers, ably supported by research, educational and training institutions. This visualisation of accumulation of economic activities emphasising micro approach to achieve results at macro level and the interdependencies of the economic system is to be appreciated in recognising the meaning and implication of productivity.

Productivity is defined in various ways, the most popular one being the ratio of output of goods and services to the input of factors responsible for it. Though the classical economists classified factors of production into land, labour and capital, it would be useful to recognize them as men, machines, materials, energy, work, technology, management and organisation; productivity could be defined in terms of one or more or all of them. While it is thus necessary to stress on the efficient use of all resources (or factors) to improve productivity, a tendency is noted to stress on

labour productivity alone, consciously or unconsciously, possibly due to the commonly used and easily measurable measures of productivity, namely, output per employee, manhours per unit of output, labour cost, etc., If any one factor is to be picked up for emphasising in the Indian context, it should be managerial productivity.

The European Productivity Agency (EPA) defined productivity in these terms ; "Above all else, productivity is an attitude of mind. It is mentality of progress, of the constant improvement of that which exists. It is the certainty of being able to do better today than yesterday and continuously. It is the continual effort to apply new techniques and new methods; it is the faith in human progress."

Studies have revealed that research and its application (technology) can bring about spectacular results in increasing productivity in terms of new and better products, outputs, quality and reduction in costs. To appreciate this, one has only to scan the improvements that have taken place in various fields—agricultural production, transportation, newer life-saving drugs, communications etc., over the last century. A definite correlation exists between expenditure on research and development and the per capita GNP. Countries with low levels of living standards (and hence lower per capita income) and countries with higher standards of living are at different levels of technology. While the benefit achieved at different levels of technology are different, effective utilisation of resources at any given level of technology is of great importance, bringing to the fore the need for management as a pace-setting factor. For eg. in transportation, from ox-cart to supersonic transport, improvements achieved are significant.

Productivity concept helps in understanding effectiveness and efficiency by providing a basis for doing right things, setting objectives, measurement and control; the significance of technology and management in productivity improvements and role of individual managers, get clarified, leading to managerial effectiveness. In this sense, management gets a dimension encompassing activities in the total economic system, and managerial effectiveness, it's content.

Though managerial effectiveness is applied to individual managers at various levels in organisations, it has to be viewed cumulatively as well, since managerial effectiveness may be meaningless without organisational effectiveness. In the economic system, an organisation is but an entity, and the effectiveness of all organisations leads to the needed impact at the national level.

The Indian Context

A brief review of the Indian scene with regard to some specific aspects and issues would be helpful in crystallising the thoughts on managing for productivity in the Indian context.

Economic and Industrial Development

When India attained freedom in 1947, the economy was characterised by weak infrastructure and elemental handicaps, without any base for progress in any sector of the economy. Considering that there was no technical know-how for industrialisation and there was lack of capital and entrepreneurship, it was obvious that only planned development could bring some sense amidst prevailing chaos to usher the country into economic development and progress.

The post-independence period is characterised by economic growth and development. This calls for a rapid social and economic transformation through democratic processes. The objectives of the plans call for initiative, imagination, enthusiasm and above all dynamism and leadership in all spheres of economic activity, which in turn require policy making, planning, decision-making, problem-solving and creation of an atmosphere where individuals can work harmoniously and contribute to the achievement of national goals. Productivity approaches discussed earlier have a major role to play in these processes.

Management Development

The earlier discussion has pointed out the close relationship between management and productivity improvements. If managers are not effective, implying inefficient utilisation of resources or water resources, it is the total economy that suffers. Society at large is benefitted if the managers are effective, this is parti-

cularly important in a planned economy where inter-relationships and dependencies of economic activities in both inter and Intra Sectors are very strong.

The managerial environment in India has its own peculiarities and problems. Indian managers have to face problems of shortages, prolonged deliveries, poor quality and similar problems as opposed to the efficient conditions under which western managers work characterised by easy availability of right quality of materials at right prices and on time, and technology. This calls for a new approach which should include consolidation of technology and modification of managerial practices and methods to suit Indian conditions, and developing our own, if necessary.

Management development implies an organised effort towards human resource development, as a part of improving organisational performance for constant upgradation in managerial effectiveness of individual managers achieving organisational effectiveness through synergism. While management development activities have increased over the last three decades, it may not be wrong to say that one does not see the desired impact in organisations. The reasons for this are many, including lack of faith and interest in training, lack of clarity in objectives, lack of evaluation of training effectiveness and the low status of training functions in most organisations. It may be observed here that training in most organisations is built around apprentice training schemes, which is not the choice of the concerned organisation, but implemented as a directive by the Government. This type of training is conceptually easy to implement and evaluate. It is now recognised that individual skills in themselves will not necessarily improve group and organisational performance, and the need therefore is towards developing interventions which work at organisational problems; the emphasis is on solving organisational problem as well as developing individual skills.

It is interesting to analyse the reactions of participants, to the various management training and development programmes. It is common to hear "It was alright, but cannot be applied in my place"; "there was nothing new"; "it is all theoretical"; "this should be told to our senior managers" and the like. It appears that most participants expect "spoon feeding" in these programmes. In some cases people attend programmes (internal or external) because they are nominated. These are all symptoms of a much deeper malady, namely, that there is no practice of measuring or evaluating the performance of managerial personnel. This aspect requires a great deal of attention and if this could be done, which in many situations is possible to do, managerial effectiveness assumes significance and management development becomes meaningful.

Research and Development

Views have been expressed that Research and Development efforts in the direction of meaningful consolidation, absorption and improvement of imported technology have been inadequate in India. The Hindu dated 24th January 1981, in the absence of any other indicators, has taken the ratio of R & D expenditures to technical fee remittances, called Absorptive Effort (AE) as a measure and points out that the value of AE in Japan during 1950-1960 was consistently well above 4, and has been increasing steadily over since, being about 14.0 in 1978. While comparison may not be proper as circumstances differ from country to country, it would be informative to know the value of AE in the Indian context, which has always been less than 1.0. It was even below 0.5 during early 1960s, but increased during the late 1960s, reaching 0.94 in 1969-70 and has fluctuated since then, but remaining below the value of 1.0.

Product Quality and Related Aspects

In the quest for improving productivity for achieving higher standards of living, product quality assumes great significance; product quality is also important for economic development, because of the need to export products, services and technologies of Indian origin. While the productivity movement in the country has gathered momentum during the last 25 years, the approaches and methods employed have emphasised on output aspects, taking for granted the quality aspect. In the long run quality products are always cheap in price. The loss to individuals in terms of money and inconvenience caused and to the industry and other sectors and to the community at large due to poor

quality, does not seem to have been focussed at all in the Indian context. The productivity movement must now turn its attention towards upgradation of the quality of Indian products and services.

As governmental policy, Indian products enjoy protection from competition from abroad. But the entrepreneurship in India has more often not taken this oppprtunity as an instrument to develop and improve the product and its quality, but has fallen prey to easy and quick profits and thus a state of 'stagnation' has been reached with reference to technology and quality in those cases.

Product development, production and distribution and after-sales service are all limited in character. Only those products which have been developed and used in industrially advanced countries and where technical know-how is obtainable, have been manufactured. No attempt at product development to suit the needs and pockets of the common people, most of whom live in villages has ever been made.

If customer is the king at it is generally said, the king has lost his crown in India—that is how a T. V. presentation at Madras said in a broadcast (1981). Product quality, service, and customer satisfaction are all far from satisfactory in the Indian context. Shortages, lack of competitive spirit and will to produce superior things, limited product development, lack of coordination and cooperation amongst business cummunity, government and research organisations have all contributed to this sad state of affairs.

Analysis of the Indian scene in depth, reveals many inhibitions particularly amongst the senior management personnel regarding quality, quality control, quality-cost-productivity relationships. Further their belief is that all most all quality problems are operator oriented. However, world-wide experience suggests that 80 per cent quality variations and problems are traced to management deficiencies and the remaining to others including workers. If genuine attempts are made to identify and eliminate management oriented deficiencies, this would certainly improve the morale of the worker and help him concentrate on those errors attributable to him.

Quality control programme should be emphasised as a consolidator of technology, by a fuller development of specifications and better understanding of processes and products through effective documentation of internal experience by application of known quality control approaches, techniques and experience. The information system to be documented comes from the application of the programme in the areas of incoming Materials Control, Process Control and Product Control, through the coordination of information in various aspects like quality of design, of conformance and performance and by the choice of appropriate technologies in the fields of engineering, statistical and managerial including quality costs, quality motivation, organisational and internal and external coordination.

Labour-Management Relations

Productivity improvement on a continuing basis can take place only in an atmosphere of good labour-management relations. 'Management' is the skill with its own discipline and fields of knowledge' which achieve results working through people. A responsible union, is one that understands workings of organisations, role of workers and can negotiate with confidence on issues that affect workers as a group. Enlightened management and union, with mutual understanding of each others' role in an organisation, can create atmosphere conductive to increasing productivity. It is a pity that we are not in sight of such an atmosphere in most of the organisations and it is time that both realised the productivity implications not only in their own self interest, but also in the interest of society at large, where they themselves form a part of it.

The crux of the matter rests on sharing the gains of productivity equitably not only amongst labour and management, but also with society (consumers) at large; without this no material progress can take place.

Any discussion on the Indian context cannot be completed without reference to public sector and some of the current infrastructural problems which have hindered our attempts to improve productivity. The public sector is supplier of raw materials and products to other industries and services, and therefore their con-

tribution has a direct bearing on the output, quality, delivery and costs of the users. This is a structural aspect of the economy which places greater responsibilities on the managers in the public sector. At present the country is facing problems of infrastructure management which has to be given priroty from the point of view of individual units as well as national productivity. Forces in Steel, Electricity, Transportation, Coal, Water etc.

Productivity at the Unit Level

At the unit level, stability and growth are vital for their own survival and contribution to the economic system. This implies continuous evaluation of organisations and making changes as needed. One should look at organisations both from short-range and long-range points of view. Stability refers to the short and possibly medium range point of view of consolidating its capabilities, by effective utilisation of resources and growth refers to the strategic planning and changes to move an organisation in new direction to keep it viable in the changing environment.

Enhancing productivity and quality should be the key to achieve stability and growth of organisations. One may ask are quality aspects not included in productivity considerations? Quality considerations require a different orientation, tools and techniques than hither to applied in Indian industries and organisations for improving productivity. Further, quality control approaches, tools and techniques can be utilised to consolidate the technology in any organisation and pave way for its improvement; if planned properly it may help product development, indigenisation and import substitution efforts.

There is a need to examine the present systems of evaluation of organisational performance. The present indicators generally used, profits, costs, output, and some financial ratios will not yield information on productivity improvements which is vital for achieving stability and growth. What is required is a measure of the effective utilisation of resources, which in a sense measures managerial productivity as well. It has become necessary to devise techniques that measure total factor productivity change (i.e. change in labour, materials, capital, and energy productivity) taken together (and or individually) on corresponding change in profitability. In this sense monitoring productivity performance, measuring how profits were affected by productivity growth or decline, is of value.

Keeping these in view, a summary, as a broad indication of the basis for a plan of action for managing for productivity at the unit level can be given as follows :

(i) Deriving objectives of organisation and role of managers and workers in fulfilling these objectives with an understanding of productivity concepts.

(ii) Recognising "growth" as an essential ingrediant in the survival of organisations and to develop means of achieving growth in the working of organisations corporate planning.

(iii) Recognising the role of Productivity techniques in determining the "capability" of organisations and pave the way towards achieving stability; leading to development of MIS including the use of computers.

(iv) Understanding the means by which labour-management relations can be directed towards common goal, the role managements have to play in the years to come to put the labour-management relations on an even keel to achieve improvements in productivity on a continuing basis for mutual benefit Industrial Relations.

(v) Recognising methods and approaches in measuring productivity from the point of view of over all Organisations Productivity Measurement.

(vi) Understanding quality implications and efforts needed to consolidate the technology in organisations not only for improving quality but also to assisting in : new product development, indigenisation and cost reduction (Quality Control).

(vii) Improving the attitude and analytical skills of managers both in management and technology continuously through education and training (Management Development).

of business—Republicans, professional managers, college graduates and the affluent—are increasingly disenchanted with the social conduct of corporations and have declined by over 50%. In 1979 alone, public interest groups have put before 112 corporations 130 shareholder resolutions. These resolutions address the major questions of social responsibility by corporations.

(viii) Developing a style of management based on goal setting and rewarding as a means of motivating managerial personnel (Managing for Results).

(ix) Recognising managerial productivity as a crux

Working

They dealt with the old problems of nuclear power plants and weapons, labor relations and employee motivations, political contributions, equal employment opportunities, price fixing, military, and lobbying. New questions were also brought up like South Africa, television advertising directed at children, trading with repressive governments, redlining and community reinvestment, foreign payments and media policies.[3] The American public is demanding that these issues be dealt with rather than put in a corner and forgotten.

The distrust the public has generated toward big business is the result of corporate price increases and inflation, unemployment and recession, the amount of pollution and deterioration of the environment caused by corporations, company practices when dealing with customers, and overall poor decision making on the part of management. The public knows all it needs to about inflation and how it affects them but it also knows how corporations are a major cause of inflation through their pricing policies. It is no wonder that the American public wants the Congress to set price ceilings when they know that corporate price increases are the major causes of inflation. To generate more public distrust towards corporations is the fact that the public is realizing that corporate profit on every dollar of sales is not 4 cents as business states but 28 cents. This is at a time when the public believes a fair profit on every dollar of sales should be 10 cents.[4] Recent recessions have increased the rate of unemployment which is another fact generating public distrust. However, now even white collar workers who are not accustomed to this joblessness are finding themselves without jobs. Engineers, Ph.D's, executives, security analysts, brokers and advertisers have for the first time joined the blue collar workers on the unemployment lines and are blaming business and government who in turn blame business. The public particularly those who are without jobs believe that there are plenty of jobs if companies were not so into maximizing their profits by sacrificing social objectives.

Hostility towards corporations also arises from socialists, politicians and intellectuals, These groups direct their anti-corporate sentiment towards the entire role of business and free enterprise in our society. The intellectual class according to Robert Bork provides "the indispensable theoretical apparatus with which the institution of capitalism is attacked.[5] Socialists and intellectuals are increasingly disenchanted with big business with respect to their social conduct. This trend is most likely to continue unless corporations take effective counter action. "There can be no doubt that increasingly during the future, business will be subjected to mounting pressures to abandon the single-minded pursuit of profit and to take on purposes linked with broad public responsibility."[6]

The criticism makes itself particularly more evident in an election year. Most political analysts agree that though Senator McGovern and Governor Wallace appeal to different groups of people, a common reason for their successes in the 1972 Democratic primaries and the following national election is their criticism of the attitudes and policies of big business and the power they have over other institutions. Big business very often face lifts itself during election years to encounter the criticism of politicians. If big business wants to put an end to political criticism of its policies, it should constantly improve its public image, not just during election years.[7]

What Should Business Do?

Business must respond to these critics by consistent better performance, effectively communicated. Most executives subscribe to the view that business values are closely intertwined with societal values. The concept of a corporation's social responsibilities has received much attention from management scholars in recent years; we can agree that an effective answer to the recent criticisms would be for business to discharge its social obligations and responsibilities. However this concept is still a fuzzy doctrine. McGuire defines it as a "crude blend of long-run profit making and altruism."[8] What is meant by this statement is that if a company shows concern for the general well being of the public it will result in a positive effect on profit making in the long run. Further, even among many of these scholars, wide discrepancies of opinion exist as to the role of corporate leadership in social activities. "In the face of criticism and doubt concerning the ramifications of the social responsibility doctrine, some hesitancy and resistance to further applications of it appeared in business circles."[9]

The resistance to furthet applications of social responsibility in business circles has to do in part to confusion over the various models of corporate social responsibility. These models are the austere model, household model, vendor model, investment model, civic model, artistic model and eclectic model, which incorporates two or more of the above.[10] Each of these models makes different groups a primary concern of the corporation, in terms of responsibility. For instance, in the austere model, stockholders are a major concern of the company, while in the household and vendor models, employees and customers are a primary concern. The same is true for the investment model where the life of the firm and its long term profits are a major concern while in the artistic and civic models business concern for the arts and community activities are important. For a business to carry out an effective program of social responsibility it must decide which group or groups will receive the most emphasis in the policy making.

According to Opinion Research Corporation Chairman Hugh C. Hoffman, "Whether business likes it or not the public is re-defining corporate responsibilities in general and telling the companies what their social responsibilities must be. One of the studies by the Opinion Research Corporation stated that one out of five people blamed corporations for not doing enough to hire and train Negroes, maintain full employment, help clean up the ghettos, provide rewarding and satisfying jobs, letting community services deteriorate, respond to the needs of the younger generation and provide day care centers for women employees with preschool age childern."[11] The important fact revealed by such studies is not that one of five people blame corporation but that the trend is increasing and unless something is done soon it will be one out of four blaming corporations.

Many experts of the Opinion Research Corporation[12] believe that there will be a re-shaping of the corporation around a system of social cost accounting. This will most likely happen if business can not put an end to public distrust and the possibility of government intervention. A tool of social cost accounting would be block voting of stock owned by colleges, funds and other groups. Such groups or organizations whose main interest is in the social objectives of the company will pressure many companies into realizing that their constituency is no longer simply the consumer for their products, but the total public with which they interact in society.

This report takes the view that for a corporation to effectively discharge its social responsibilities and thus increase its long term profit, top management must initiate a system of "social audit" certified by independent accountants. The social audit is a series of mechanical steps under which the certified public accountant verifies through the appropriate forms that the company is maintaining its goodwill after which it is placed in the audit file for future reference. To substantiate this concept, six steps of the "social audit" have been developed.

1. *Executives Outlook* : Generating the support of corporate executives and middle managers in the drive to make corporations socially responsible is a major achievement for the advocates of the social audit. In a survey of corporate executives 90% feel that they operate in an ethical manner, however 80% of these same executives consider the generally accepted practices of their company as unethical. The major criticism brought forth by these executives is that companies are indifferent to consumers health and safety.[13] Corporate executives are changing their allegiance as a result of the pressure they receive from friends and family. Many a time executives have been questioned by their childeren on why they let their company carry out policies that have negative effects on society. How is a businessman supposed to act around family and friends when he knows that they believe he would do anything possible for a buck? In a representative survey of 2,000 Americans over 50% said that a businessmen would do anything for a buck.[14] While executives are standing up on the issue of social responsibility they are facing problems from people on both sides of the issue.

Businessmen who believe a company's policies are unethical have few options open.[15] If they speak up the top level managers will label these men as lacking corporate loyalty and thus being untrustworthy. Such a label would result in a halt to any further movement up the corporate hierarchy. If these ethically minded

since what may be a practical policy in one case may be completely impractical in another.[23]

Recent trends in business criticism indicate that the public has a tendency to view the corporate contributions to social welfare as a gimmick. A "Social Audit" widely publicized can go a long way in improving this image. "Today society is demanding a greater commitment by business to socio-economic tasks. There is growing and ever more vocal insistence that we in management should commit corporate resources, as well as our personal ones, to the battle against the social and environmental ills that plague us, many of which are alleged to be the inadvertent results of industrial success in the past."[24]

Rodman C. Rockefeller,[25] President of International Basic Economy Corporation (IBEC) states that the success of an operation usually depends on a combination of four guidelines. In an operation the company must identify the human needs in the market and develop new, innovative ways to meet that need after the method of meeting the need is developed it should be analysed with the help of financial criteria to determine if it is economically feasible for the company and if the local managers are qualified to make it succeed. Finally it is important to determine that the policy does not violate the social, cultural and economic values of the people that it is intended to help. After all we are trying to solve problems, not create new ones.

McGuire[26] points out that the modern American views life as a game and a race; he frequently asks "who's ahead?" or "Who's winning?" The rewards of the game are not so important as the attitudes people have of the game which appears in everything we do. This is shown by the growing popularity of polls. When reading the newspaper we are more concerned about which politician is leading the poll than the issue he stands for. By widely publicizing this "social audit", a far-sighted businessman can take the lead over other companies in improving his image and dispel the notion of the public viewing the social responsibility doctrine as a gimmick.

Possible Governmental Controls and Actions

Americans believe that business should bring its huge amounts of resources, skills and clout around to solve social ills. In order to make a broad attack on our social problems business must first change the ideology of the United States. It must come up with a new insight on the community and how it should operate. If this is not done any actions on the part of business to rectify social ills will lead to confusion, anarchy and ultimately failure.[27] According to Lodge[28] an important social responsibility of business and other institutions in American life is to assist in the devoloping of an adequate political structure and authority based on a clearer, more explicit and realistic ideology. This is basically a political task which business must pressure government into carrying out. It involves changing the authority and strength of government at all levels. Business policies that are meant to solve social ills but may very well cause social ills if business attempts to carry out such policies before government is ready.

Government, under pressure from the American public, is beginning to become more involved with business on social issues. One program that government has started—the New Commerce Program suggested by Secretary Juanita Kreps[29]—shows the degree of government concern. This program is designed to provide guidance for corporate activities in the social policy sphere, equal employment, consumerism, resource conservation, environment, relations with host communities. The programs assist business by creating a number of categories that can serve as a management tool or model. The program also offers some limited assistance on how to measure a company's social responsibility policies, in a few spheres of activity. This is only one of many programs government has that concerns business and there are more under development. It is up to business to work with government or these programs if they wish to hold back government from placing limitations on them through regulations.

"Social Audit" will effectively combat governmen action in this respect. It will show government and th public that business is concerned about the issues tha effect society. If the company is working to solve socia ills, the social audit will verify this. It is up to busines to see that all companies have a social audit an work on social issues if they wish to prevent goverr ment intervention.

Due to the growing pressure for greater corporate accountability one can foresee the day when legislature may be passed requiring business to publish such an audit. Hugh C. Hoffman comments : "If, by word and deed, business does not dispel public mistrust further government intervention is certain."[30] It will not be long before price ceilings are instituted to place ceiling on corporate profit. Even stock-holders no longer feel that competition can keep prices at fair levels without government controls. The ability of corporations to govern their undertakings by standards of public rather than private interests is being increasingly questioned.

Business leaders must realize that they live and operate in an open society which is disenchanted with the way they operate. These business leaders must realize that all of their actions and policies can and will come under public scrutiny and the scrutiny of its institutions. "The disenchantment with business shows up not only in reluctance to buy some goods and services but also in a growing anti-business mood which encourages regulatory agencies to get in touch with business and Congressmen to support anti-business legislation."[31] "Business will have to adopt social issues voluntarily or government always sensitive to the public mood will seize the initiative and force changes by regulation."[32]

McGuire[33] points out that the public distrusts big business power because of its influence over other institutions which is a threat to the concept of a pluralistic society. If institutions are small and power centers are widely diffused we need not fear power. When power is diffused like this it can accomplish social goals and at the same time be limited by the organization of society. There are types of power McGuire says we should fear, they are, managarial power and business power. Managerial power refers to the control managers exercise over their subordinate while business power refers to the power which business has over its environment. Some of the proposals advanced by the former Democratic presidential candidate, Senator McGovern, ıre intended to curb the influence and power of big ›usiness. Though curbing the power of any institution ; good for the democratic way of life, one should be ·ary of the fact that in an emotional climate, extreme emedies may be adopted. This is one of the biggest dangers a businessman faces these days. "Corporate size brings political influence but also political vulnerability."[34] Sethi also points out that "in a society which is essentially characterized by large corporations, politics must of necessity be pressure groups politics."[35]

Businessmen can face up to this challenge by making common cause with other reformers—whether in government or elsewhere—to prevent the unwise adoption of drastic and emotional remedies. In incorporating a "social audit" in their year-end figure, they can initiate necessary reforms to convince the legislatures that they are continuing to function as a constructive force in our society. The goal of businessmen should be "nothing less than the deliberate institutionalizing of social change so that violent revolution becomes superfluous."[36]

Generating Employees Motivation

"Social Audit" can help in improving the morale of the company's employees, "A social audit of the current and potential social benefits and costs generated by the company for its employees can identify the steps that would maximize the company's attractiveness within any fixed level of budget. In social audits, this would be accomplished by the following sequence of actions :

1. Questionnaire survey of employees' perceptions of the relative worth of different current and political social benefits and the cost of different social disadvantages associated with company employment.
2. Follow-up interviews to clarify and ambiguities in responses to the survey.
3. Formulation of any employee benefits, preference inventory, with relative perceived worth associated with each item.
4. Inventory of current social benefits supplied by the company to employees.
5. Comparison of employee preference inventory with current programs inventory and identification of "low preference, high cost "components to be eliminated" and "high preference", "pre-

sently unavailable" or "under available" components for possible addition.

6. Re-design of company benefits program to respond maximally to employee preference within some budget and associated reallocation of sub-budgets.
7. Review and analysis of additional, highly valued social benefits requiring additional budget to determine if potential return on additional investment is justified.
8. Consistency check, using a survey of employee responses to the new benefits plan and determination whether significant improvement in perceived worth has been achieved without significant budget expansion.
9. Communication of the resulting changes to employees and stockholders, demonstrating the improved benefits gained with no diminution of return on investment.

If such a social audit of employee benefits and costs is executed annually and followed up with the actions indicated, employee recruiting and retention should improve, with attendant reduction in personnel costs from undesired turnover.[37]

According to Act[38] a company's social audit measures the company's social performance with respect to employees. Such an audit will provide by item, year and company comparison of the social benefits and costs created by the company for its employees. Comparisons of this type can then be used to allocate personnel resources more efficiently and in conformance with employee preferences and perceived valuations, as well as to make them effective with respect to corporate objectives.

The modern American society carries a built in guarantee to its citizens of the basic physiological and security needs. In view of this, more than in any other nation, an American employee looks for more than just economic incentives. A person would take a greater interest and pride in working for a socially responsible organization.

Some companies are giving their employees leave for public service programs. This enables the executive to take time off, usually with pay, to perform socially constructive tasks. IBM is one of the companies that has started this policy.[39] A program of this type gives concrete evidence in a "social audit", will generate a great amount of interest and enthusiasm among the employees. Further, the employees are more likely to talk about it with friends in their social circle, which is naturally beneficial to the organization.

Consumer Behavior

Social Audit is in consonance with the modern marketing concept which emphasizes consumer orientation. The new marketing concept "starts with the firm's existing and potential customers; it seeks profits through the creation of customer satisfaction; and it seeks to achieve this through an integrated corporate-wide marketing program.[40]

"Product quality and advertising decisions can be made incorrectly if based on purely financial conditions. Partly unsafe or misleading advertising of products may maximize profits temporarily but the social costs of these policies will quickly be converted to financial costs by an angry public when awareness spreads of the consumer risks imposed without informed consent of consumers. Social audits can anticipate such social costs and provide a basis for a sounder social investment decision that will also yield better long term financial returns."[41] In one survey, 21% of the public felt they were cheated in a recent purchase of a product or service especially on groceries, meats, autos and appliances. When a consumer purchases a good or service they expect to get what they pay for and if not will apply pressure until the companies deliver what they expect.

"One of the most volatile issues of the dynamic business environment is the issue of consumer welfare. Consumer welfare is the provision of quality products and comprehensive manner to reasonably assure the safety, well being and satisfaction of the customer."[42] There are many characteristics of the market environment that will have an effect on the consumer. These include the relationship between buyers and sellers, the size of the companies, legal rights of the buyers and sellers, rising affluence, consumer sophistication and technological innovations.

When a customer buys a product or service, he looks for some symbolic satisfaction also in addition to the functional use. This is especially true in a country like the U.S.A., where for the vast majority of products the competitive brands are physically undifferentiated. In such a competitive environment, the symbolic value of products can be enhanced by giving wide publicity to the "social audit" figures. In effect, the argument is that "social audit" improves the institutional image and this would lead to greater sales, one of the parameters by which the success of an organization is judged. A company should be able to answer two questions for the social audit on consumer relations. These questions are, "Has the company a thorough consumer policy?"[43] and "Has any appraisal been made of the growing power of Consumerism?"[44]

Social Goals

"Social Audit" helps in reaching the corporate objectives of long term profit, viability, increased growth, increased share of the market and increased sales. It does this by improving the company image in the eyes of the public. The American public appreciates a company that is concerned about the environment and its inhabitants and shows so in its purchase of consumer goods.

This hypothesis is a natural consequence of the argument advanced in favor of the previous hypothesis. As McGuire states, "one goal of the corporation far submerged during prosperous periods is viability—survival of the firm. McGuire also feels that the importance of viability or any of the other corporate objectives has a lot to do with the company's leadership and the nature of the particular situation. The leadership of a company very often determines the personality of that company in how it conducts business.

A goal value that McGuire[46] says has some significance in our modern business system is that of integrity. This means that the enterprise—and in particular the large corporation—behaves in accordance with the laws and ethical precepts of a society. More than this, however, integrity also means that the corporation "does right" by the claimants who seek its assistance. "This is not so easy since very often the claimant groups are also the opposition."

Though a system of "social audit" may mean an acceptance of lesser profits in the short-run, it would definitely be beneficial to the long-term growth of private enterprise. "Scarcely a handful of businesses take advantage of the 5% deduction allowed for contributions. This potentially staggering sum of money could supply more than enough funds to resolve social problems. Such contributions would have to be made with the seriousness, analysis and careful attention which the same management regularly gives to their annual capital budgets. But if that were to happen, these expenditures would clearly turn out to have been profitable ones, for they would all tend to reduce present problems and enhance the log and purchasing power of many individuals."[47] Miller advocates businessmen to take the vangurd in the "war" against our domestic ills.

The long-term perspective demands that the top management pay heed to the circumstances that bring about the current criticism and take effective action to answer critics whose arguments have validity.

The Opposition to Social Audit

"Everybody is talking about social audit, but scarcely anyone agrees with anyone else as to exactly what it is, and no two organizations are doing it quite the same way."[48] There are numerous problems that are incurred with the use of social audits. First, the social problem for which social audits are adopted are usually short run problems and do not require such a far reaching solution. Second, it is impossible to determine an exact measurement. Third, the goals of a social audit and the information it requires are unrealistic and of no use to society. Fourth, the company's financial statements are capable of providing the information society needs without a separate social audit. Finally, there are many administrative problems that will arise with social audits. A better understanding of each of these criticisms will enable us to understand the pros and cons of social audits.

Very often managers do not know what is expected of them since the relative importance of a particular social issue is continually changing. There is a transition period under which the importance of different

issues change causing management to re-adjust its policies. One observer called this transition period a "zone of discretion" or a time span for every social issue before it becomes a matter of social concern and the time when the acceptance of such issues is so wide spread that adherence is an unquestioned part of doing business.[49] The same observer describes the period between the two points as a "period of uncertainty as to the strength and durability of public support for the issue, standards of socially acceptable behavior, timing of desired conformity, and the technologies of resources available for complying."[50] What is being pointed out here is that what public opinion considers to be a major social issue is always changing.

A social audit is supposed to evaluate the total impact of a corporations social policies. "A company's total social impact is far from being understood and is notoriously elusive to define because virtually every decision made by a corporate manager has some social consequences that may not conveniently agree with the company's "impact area" however carefully it may be conceived."[51] This is a problem of measurement, in that it is impossible to determine the effects of a profit oriented or socially oriented decision would have on the environment in the long run.

There are two reasons why the goals of the social audit are unrealistic. "The first reason is that there seems to be an erroneous definition of the users of a social report, and the information that should be required."[52] If a social audit is for the public, then the audit should be formulated as a cost benefit analysis since the public does not care how a company promotes its social goals. What the public is concerned about is what activities business uses to promote social goals. "The second reason that the social audit is unrealistic is because it uses the format of financial statements to show how a company pursues social goals. The problem is that financial statements are not set up in a manner to determine how a company is achieving its goals, even if they are financial goals."[53]

Regular financial statements are better than a social audit for three reasons. The simplest reason is cost. It is cheaper to use a financial statement to find the social responsiveness of a company than to produce a separate social audit. Second is that the credibility of financial statements is as good, if not better than a social audit since they are done by certified public accounts. Finally financial statements can provide its user information on the organizations responsiveness and acceptance of social issues, if they are trained on their use.

Finally a system of social audit, like any other new organizational method will pose administrative problems. The question of assigning priorities can be a major problem. Should the company spend more on pollution control or on training minorities? Should it contribute to a cleaner environment at the cost of higher prices to consumers? The demand from various institutions in our society do and will conflict. How can the businessman satisfy all these demands?

There can be no simple answer to these questions. However, one of the primary tasks of top management to come up with an optimum solution in the face of a variety of problems.

The priority to be assigned to each of the social tasks will have to be flexible. It will change from year to year and also depend on the particular industry the company is a part of.

There are many advocates of the idea that the management is primarily responsible to stockholders and that their objective should be profit maximization. However, the objective should be profit optimization not maximization.[54]

How exactly is the social audit to be conducted? The association of CPA's is already working on social accounting methods and they can be called upon to devise a suitable method.

Conclusion

The concept of social responsibilities of an organization has been much discussed in recent years. Most business-men accept this idea. However, good results are much more valuable than good intentions. "To reverse the disaffection the public has for business will take a lot more than public relation compaigns. It will take management willing to talk candidly about the bad as well as the good. It will take management showing

as much concern for quality of the company's goods and services as it does for the enterprise's profits."[55]

Most management authorities agree that this concept has not been sufficiently translated into action. "In 1970 it has become obvious that the performance of U.S. corporations in the area of social responsibility has generally been trivial, considering the scope of their operations."[56]

The main difficulties seem to be in getting corporations to change their policies and then translating policy into practice. Every important advance in business ethics was achieved through a long and painful process. The process begins, according to Carr[57] when members of society point out the problems with a particular company practice. The problems continue until economic conditions and technological advances make the practice even more undesirable thus resulting in more criticism. Businessmen who profit from practice defend it generating a long period of public controversy until laws are adopted to forbid the practice. Once the social goal is set, it is natural to look for appropriate yardsticks to measure the extent of corporate aid for social purposes. It is suggested that "social audit" will enable the executives to pursue a carefully marked out program to reach their social objectives by providing such a yardstick.

The social audit should be conducted by a team of people who understand the workings of the company and industry. "The social audit should be made by a team of persons who are (1) oriented toward the social point of view, (2) conversant with business practices and problems and (3) technically trained in fields such as law, economics, sociology, psychology, personnel: government, engineering, philosophy and theology." A team of this type would benefit both the corporation as well as the public by giving a true and accurate report.

The social audit would have several advantages : (1) it would provide a recognized method of bringing the social point of view to the attention of management; (2) the appraisal of individual corporations would be made by persons outside the company who would have a more disinterested and detached view of its activities than company employees; (3) the creation of a specialized groups of social auditors would give an impetus to the consideration and development of recognized social standards for corporate practice; (4) the fact that the report on the audit would be made to the company and not to the public would make possible complete frankness and at the same time would make the scheme more acceptable to businessmen."[58]

Another compelling reason for the introduction of this audit is that it is quite likely that before long government will pass laws to make it mandatory. For this reason having a social audit conducted by outsiders will slow down government action and at the same time generate public support.

Admittedly this system will pose new problems. But it is the management's primary responsibility to solve problems. Perhaps, it would be appropriate to conclude this report with a quotation from Henry Ford II, taken from a speech he delivered before the Yale Political Union at Yale University :

> "To translate any set of intentions into results programs have to be developed and built into the structure of the organization and its operating procedures. We need to make changes in our organization, to allocate responsibility and authority, to determine priorities, establish targets, time tables and reporting procedures, make up budgets, provide incentives and do all the numerous things a big organization needs to do to reach any goal."[59]

REFERENCES

1. Purcell, T. V. "Management and the Ethical Investor", *Harvard Business Review*, September-October, 1979 p. 26.
2. "America's Growing Anti-Business Mood", *Business Week*, June 17, 1972, p. 101.
3. Purcell, T. V. *Op cit* p. 24.
4. "America's Growing Anti-Business Mood", *Op cit* p. 101.
5. Bork, Robert "Assault on the Corporation" *Across the Board*, February, 1978 p. 50.
6. Lodge, George Cabot, "Top Priority : Renovating Our Ideology", *Harvard Business Review*. September-October, 1970, p. 55.

7. Lundborg, L.B., "Making Profits is Not Enough", *Across the Board*, February 1977, p. 56.
8. McGuire, Joseph W. *Business and Society*, New York : McGraw Hill Book Company, Inc., 1963 p. 144.
9. Heald, Morrell, *The Social Responsibility of Business* Cleveland, Ohio : Case Western Reserve University Press, 1970, p, 291.
10. Karp, R.E., "Corporate Social Responsibility "Training and Development. Journal (30), November 1976, p. 11.
11. "America's Growing Anti-Business Mood" *Op cit* p. 103.
12. *Ibid.*, p. 103.
13. Carr, A.Z. "Can an Executive Afford a Conscience", *Harvard Business Review*, July 1970, p. 61.
14. *Ibid.*, p. 61.
15. *Ibid.*, p. 60.
16. *Ibid.*, p. 60.
17. Heald, *Op cit* p. 243.
18. Bork, *Op cit* p. 53.
19. Bowen, Howard R., *Social Responsibilities of a Businessman* New York : Harper and Brothers, 1953, p. 154.
20. *Ibid.*, p. 154.
21. Sandberg, Robert A., "New Roles for PR Managers" *Public Relations Journal*, October, 1970, p. 104.
22. Cohen, Stanley E., "Social Responsibility Can Win Friends in Government and the Marketplace" *Advertising Age*, May 31, 1976, p. 6.
23. Rockefeller, Rodman C., "Turn Public Problems to Private Account" *Harvard Business Review*, January-February 1971, p. 132.
24. Rockefeller, *Op cit* p. 132.
25. *Ibid.*, p. 133.
26. McGuire, *Op cit* pp. 175-176.
27. *Op cit* p. 53.
28. *Ibid.*, p. 55.
29. Barovick, R.L., "More Responsibility" *Business and Society Review*, Winter 1977-1978, p. 78.
30. America's Growing Anti-Business Mood" *Op cit.* p. 103.
31. "Why the Public Has Lost Its Faith in Business, "*Business Week*, June 17, 1972, p. 116.
32. *Ibid.*, p. 116.
33. McGuire, *Op cit.*, pp. 133-138.
34. Sethi, Narendra K., *Management Perspectives*, Bombay : Progressive Corporation, p. 254.
35. *Ibid.*, p. 255.
36. Henderson, Hazel, "Towards Managing Social Conflicts" *Harvard Business Review*, May-June 1971, p. 82.
37. Abt, Clark C., "The Social Audit for Management" New York : American Management Association, 1977, p. 77.
38. *Ibid.*, p. 80.
39. "Doing Good Works on Company Time", *Business Week*, May 13, 1972, p. 166.
40. Kotler. Philip, *Marketing Management-Analysis, Planning and Control*, Englewood Cliff, N.J., Prentice-Hall Inc., 1967, p. 6.
41. Abt., *Op cit* p. 72.
42. Sturdivant, Fredrick D., *Business and Society : A Management Approach*, Homewood, Illinois: Richard D. Irwin, 1977, p. 235.
43. Humble, John, *Social Responsibility Audit*, New York : American Management Association, 1973, p. 30.
44. *Ibid.*, p. 30.
45. McGuire *op cit.* p. 275.
46. *Ibid.*, p. 276.
47. Miller, Irving "Business Has a War to Win," *Harvard Business Review*, March-April, 1969, p. 168.
48. Bauer, Raymond A. and Fena, Daniel H. Jr., "What is a Corporate Social Audit ?" *Harvard Business Review*, July-August, 1973, p. 92.
49. Ackerman, Robert W. "How Companies Respond to Social Demands", *Harvard Business Review*, July-August, 1973, p. 92.
50. *Ibid.*, p. 92.
51. Tipgos, M.A. "A Case Against the Social Audit" *Management Accounting*, November, 1976, p. 24.
52. *Ibid.*, p. 25.
53. *Ibid.*, p. 25.
54. Sethi, *Op cit, passim.*
55. "Why the Public has Lost Its Faith in Business" *Op cit.*, p. 116.
56. Carr, *Op cit.*, p. 62.
57. *Ibid.*, p. 63.
58. Bowen, *Op cit.*, p. 156.
59. Ford, 'Henry II, *The Human Environment and Business*, New York : Weybright and Talley, 1970, p. 38.

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Increasing Productivity in Banks

KISHORE C. PADHY

Increasing productivity of banks in India is a recurring theme in the late '70s. A bank is 95% men and 5% money. So labour productivity is the essence of productivity of banks.

Bank employees have to develop marketing skills to retain the present business and to expand it without adding to costs and affecting bank's image at the same time. Job enlargement/enrichment encompassing skill variety, task identity, task significance and autonomy is suggested to transform employees into Managers of services. SBA approach to training (Change the situation—Behaviour changes—Attitude changes) may be adopted. The style of management recommended is a mix of Y theory (self-control and self-direction) and Z theory (compromise and corporate team work.)

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Increasing productivity of banks in India is a recurring theme in the late '70s. Productivity is the relationship to output of each of the three major categories of inputs—namely, men, money, and machine—in a given period. A bank is 95% men and 5% money. So, the measurement of productivity becomes admittedly an intricate problem in a labour intensive service organisation.

Measurement of Productivity—Banks

The yardsticks of measurement usually adopted are :

—Deposits/credit per employee;

—Growth in deposits/credit per employee;

—Total assets per employee;

—Total assets growth per employee;

—Net operating income per employee;

—Net operating income growth per employee;

—Operating profit per employee;

—Operating profit growth per employee;

Average assets per employee and revenue per employee in American Banks is as high as $1.8 million and $2 lakhs respectively, yet American Productivity Centre has singled out banking as a poor productivity performer. Considering the stage of the country's economic development, business potentials and state of technology of the banks' operations, performance of Indian banks measured by anyone of these eight yardsticks cannot be compared with their American or European counterparts.

If the output in banking is seen primarily as deposits and credit, deposits per employee and credits for employee have risen over the last five years for the banking system in India as a whole. But the figures cannot be related directly only to staff effort in a given year as a number of factors such as inflation, deficit financing, branch expansion and credit policy of the Government are relevant in this context. On the other hand, if income, expenses and profitability are used as indices of efficiency, the per employee profit in our public sector banks is Rs. 0.01 lakh only whereas the per employee staff expenses is as high as Rs. 0.12 lakhs. Moreover, the spread of interest has gradually reduced over years and the spread of expenses has perceptibly risen for the public sector banks. However, these indices do not necessarily indicate low productivity because interest rates and cost of living index linked wage structures—the major determinants of income and expenses—are beyond the pale of the banking system. Further, 'area prosperity' and 'people prosperity' approaches reflected in opening of new branches in rural centres and earmarking a portion of lending to the priority sectors also have a considerable impact on profits. To go by the profit criterion, in the present state of Indian economy where social costs and benefits are becoming more important is to live in a make-believe world. To be in tune with the social forces of the time, it is necessary to evaluate the bank's productivity from a social rather than purely quantitative point of view.

Moreover, quantitative estimates do not present a realistic picture in a cost push inflationary situation as ever increasing product price covers up operational inefficiency to a large extent. As such, the bank productivity is to be measured in qualitative terms, namely, (a) the state of maintenance of books and accounts and security of assets like cash and investment, (b) quality of lending, and (c) customer service. Fraud, forgery and bank robbery have become daily occurences. Without production of statistical evidence, it suffices to say, on the basis of empirical studies that the quality of lending and services to customers leave much to be desired. Thus, on the basis of qualitative, besides quantitative, determinants of efficiency, the conclusion is inescapable that there is substantial scope for improvement of productivity in banks.

Factors effecting productivity

Facilitators

(i) Awareness of social obligations
(ii) Emergence of managerial philosophy
(iii) Young and enterprising middle management
(iv) Well paid and highly educated staff
(v) Accelerated training activities
(vi) Changing outlook of union
(vii) Emphasis on excellent customer service.

Restraining factors

(i) Industrial relations
(ii) Absenteeism
(iii) Work norm
(iv) System and procedure
(v) State of technology
(vi) Marketing skills and techniques
(vii) Death of a job.

The restraining factors may be examined at length as policy prescriptions for improving productivity are to be based on such a systematic analysis.

Industrial relations

Industrial relations in banking industry is at a low ebb :

(i) Supervisors nurture a feeling of being let down, do not trust management intentions and rely on pressure and direct action than on peaceable representation. The middle level officers aptly described as 'foregotten men' in the industry forge unity to form association. The management feels that the supervisors being part of the management should be disciplined, should behave in a responsible way and should have trust in management goodwill. As their images of each other known only to themselves, remain unrecognised by each other, there is needless exchange of correspondence, conflict and confrontation.

(ii) A survey among the public sector bank employees indicated that the climate of employer-employee relation is not good. The employees' rating of different factors/facilities is given as under :

Monetary benefits Training Recognition	High
Employee welfare Working condition	
Promotion Communications Grievances handling Style of Management	Average
Participation Discipline and control	Low

To quote Federick Herzberg, "The absence of such factors as good supervisor and employee relations and liberal fringe benefits can make a worker unhappy but their presence will not make him to work harder."

(iii) The employees are also highly unionised. Unions share nominally the management objectives of productivity, profitability and growth. They are suspicious of the basic principle that good work should be rewarded. In bank like nature, there are neither reward nor punishments. There are consequences not for the doer alone but for all others.

(iv) The employees for various historical and other reasons consider their rights or convenience more important than work. They are less inclined to accept managerial authority on transfer, job rotation and a host of other related issues. The first line supervisor does not and is not allowed to work as a captain of the team.

(v) There is no procedure to handle problem employees.

Absenteeism

Absenteeism results in loss of productivity, increased cost to the industry, loss in stability of work performance and loss of workers in skill and efficiency.

To apply Kurt Lewin's field theory $B=(P, E)$, the behaviour of absence is a function of personal and environment factors. The causes of absenteeism on macro level are rural origin of employees—behavioural pattern affected by social, cultural and economic background and lack of commitment to the job. At the microlevel, the following organisational, personal and external factors are resposible for absenteeism :

(i) Work environment—Monotony, lack of team work and co-operation in work group, work milieu influenced by lenient policy granting leave and condoning/regularising unauthorised leave.

(ii) External—Climatic conditions, lack of adequate accommodation, insufficient transport, lack of recreational facilities, etc.

Incidence of absenteeism is higher with younger employees enjoying new income, female employees and employees who are relatively aged, saddled with growing family responsibilities. Large banks and large branches of the banks have higher absence rate. It increases as the number of employees reporting to one supervising official increases. It also increases as overtime increases. Frequency of absence is more in places with poor physical working conditions and in less easily accessible or metropolitan areas where the employees have to cover longer distance to join the work situation. The period of absence coincides with days before or after holidays and week-ends.

Work norm

(i) There is no prescribed work norm. Total job of the employee is not fully delineated. Work is neither defined nor described in detail and yet both the management and workmen blame each other for not doing the work. Time motion study of Taylorism is in its infahcy. There is no management by measurement.

(ii) Standardisation is not an accepted norm. So the nature and quantum of work is different from one employee to another.

(iii) Obedience to superiors is not taken as a virtue. The bank employee does not develop ties with his superiors and subordinates on the basis of the vertical principle of work.

(iv) Employee appraisal is subjective. Reporting official does not maintain diary noting significant achievement of the employees. There are no opportunities for the employee's self-rating and rating by his peers. Counselling is not a part of the appraisal system.

System and procedure

The systems and procedures determine effectiveness, efficiency and economy of operations which have a bearing on customer service and productivity, Banking routine operations consist of : registration in forms, vouchers, etc., maintenance of registers and ledgers, classification of transactions into definite categories, doing simple arithmetic and controlling activities through a report return system. The traditional systems and procedure suffer from :

(i) Repetitiveness of work steps;
(ii) Backtracking in work flow;
(iii) Duplication of work to ensure accuracy;
(iv) Checking at multiple points by different persons;
(v) Improper sequence of work steps resulting in increased work flow;
(vi) Proliferation of forms and returns which do not inform.

State of technology

In our country, we witness a paradox of technological progressiveness and banking primitivism. The banking world is on the threshold of cashless and chequeless society. Our banks are engaged in mass banking with a manual system of technology. Collection, processing, storage and retrieval of data are done manually and inefficiently with great inconveniences for both the customers and the bank. In effect we are doing banking for today and tomorrow with yesterday's tools.

Marketing skills and technique

Customer loyalty is a thing of the past. The typical problems are :

(i) how to satisfy the high saver who cares for rate than the safety of funds;
(ii) how to deal with small ones without adding to cost and burning bridges at the same time;
(iii) how to become a nice bank and avoid reputation for being a pushover.

Bank employees are to sharpen their marketing skills and technique to retain the existing business and to expand it.

Death of a job

Our banks face the risk of death of job. The reasons are : job fragmentation, minute specification, excessive monitoring for perfect practice, removal of fund and excitement and deskilling by monotonous repetition of work steps. Death of a job is a demotivating factor sharply reducing work productivity.

Low productivity tackling continuum

The steps taken/to be taken for tackling low productivity are presented as under :

%	*Stage I*	*Stage II*	*Stage III*	*Stage IV*
	Uncertainty	Awakening	Enlightenment	Certainty
Management attitude	No comprehension	Aware but resigned despair	Better awareness Determination	Commitment to tackle positive attitude
Problem handling	No understanding and resolution	Problem is tackled as and where basis	Problem identified and resolved in an orderly fashion	Determined efforts made to forsee problems and prevent them

Increasing productivity

Industrial relations

(i) Unionism—Perhaps the productivity would have been higher if unions are non-existent but unions, intended to preclude exploitation, have come to stay and should not be allowed, in turn, to exploit the management. The principle of participating management is accepted in principle but the bank management negotiating with the unions of clerical staff and first line and middle level supervisors should delineate the zone of indifference whereby subordinates should be indifferent about questioning some aspects of the superior's orders, e.g. transfer from one place to another and from one department to another. They, on their part, should use the law of reversal to get results.

(ii) Fourth P's—Banks should give incentives financial and non-financial to enable some employees to rise little higher than the average. Well-defined good performance rather than age, experience, or seniority in service should be given weightage for promotion. Increments and other benefits should not be given as a matter of routine. 'Peak performance for peak profits—four p's of productivity should be the motto.

(iii) Problem employees—Problem employees have emotional immaturity and/or poor health and suffer from lack of skill in the job, misplacement, inadequate supervision and incompatibility with the supervisor. Bank' recruitment should have clear cut employment specifications and use tests to find out skills and personal characteristics suitable for banking. Those who become problems after joining the institutions are to be apprised where they stand, may be shifted to job where they are suitable and in extreme cases, may have to be disciplined.

(iv) Employee relation programme—Employee relation programme should be organised to streamline grievance procedure and to reduce employees' complaints without intervention of the unions.

(v) Unproductive work force—Banks should minimise proliferation of such categories of workers as messengers, peons, and watchmen by rationalising work and negotiating with the unions for deployment of existing staff to perform more productive work.

Absenteeism

(i) Attendance and leave rules—Banks have to formulate an employee attendance policy and enforce progressive discipline. The following measures introduced during the period of internal emergency e.g. enforcement of punctuality in attendance, introduction of lunch recess/movement register, maintenance of diaries of daily work, regulation of overtime, enforcement of leave rules, allotment of full days' work to union office bearers, etc., may be reinforced with seriousness of purpose and direction.

(ii) Flexi time—Division of time into discretionary time (6 a.m. to 9 a.m. and 3 p.m. to 7 p.m.) and core time (9 a.m. to 3 p.m.) may be made to make employee's presence during the latter period obligatory while allowing him to retain his option to be present during the discretionary time. Flexi time improves employee's handling of fluctuating workload, suits his bodyclock to optimise performance and improves customer service. But the typical problems are : getting the employees when you really want them, appointment of part time employees (with known opposition of the unions) and difficulties of its implementation in certain interdependent tasks.

(iii) *Incentives punishment*—Absenteeism can be discouraged by taking a firm stand on discipline and by using incentives such as bonus and recognition for attendance.

(iv) *Counselling*—Intensive counselling is to be done for habitual absentee to identify the reasons for his withdrawal from the system and to help him to take charge of himself.

Work norm

(i) *Reorganisation of work*—It is high time, banks fix work norms or performance standard in branches classified population groupwise. Branch activity analysis which analyses activities and charts and times various steps could be usefully employed to settle work norm. The basic issues are security, responsibilility and

accuracy. The banks are to take calculated risk commensurate with their resource position to extent share of self-supervision by the clerks and to reallocate the present task between the clerks and officers to ensure greater flow of work.

(ii) *Work philosophy*—'Zero defect service' should be work philosophy of banks signifying Confucian virtue of perfection in one's work. The employee who competes with others or himself to excel should be suitably rewarded. An average employee must also be subject to doctrine of completed staff work. Management at all levels must set examples to personify the work philosophy.

(iii) *Appraisal*—Appraisal of employees (officer and clerk) has to be made on objective considerations, allowing for the employee's self-rating and rating by his peers.

Systems and Procedures

(i) *Routine operations* : Banks have to design functional vouchers and two or three comprehensive returns which are to be periodically updated. They have to implement more 'one step banking' devices to usher in a procedure revolution.

(ii) *Kiss rule* : Banks have to implement Kiss (keep it simple, stupid) rule. New procedures must be simple and easy to learn, implement and monitor.

(iii) *Job enlargement* : Appropriate changes in systems and procedures have to be initiated for facilitating job enlargement/enrichment.

State of technology

(i) *Mechanisation* : Machanisation is a systematic response to problems of mass banking. It rationalises work procedure, facilitates speedier performanace of tasks, reduces cost of operations and improves the employee's productivity. We are in the threshold of cashless and chequeless society with introduction of Electronic Fund Transfer System (EFT) for making payments. Automatic clearing House and Automatic Payroll Deposit developed as alternatives to cheques have ushered in 'Banking without paper'. Automatic Teller Machine has made such concepts as office hours, employee's skill and motivation redundant for limited purpose of accepting deposits/effecting payments/providing balance information. Electronic Mail has assaulted the bastion of manual processing—the office. It distributes message fast and cheap, reduces paper work and increases the productivity of the office staff. With an entirely different factor endowments, the extent of mechanisation and sophistication in our banks will have to be different depending on employee's skill and orientation, volume of transactions and security. For example, Adding/Listing Machines/Calculators may be introduced for listing/totalling transactions. balancing and interest application, Accounting Machines for recording descriptive particulars and Cash Register for effecting cash receipts/payments.

(ii) *Computerisation* : Computerisation is necessary for streamling information system and for processing and storage of data. It can be used at different points of time for different purposes e.g. personnel skill inventory, micro-filming of records and storage for future retrieval, payroll/term deposits management etc. The rising cost and stagnating productivity of the employees makes it necessary. Computer advances and sharp reduction in cost of computerisation makes it attractive. It is not possible in the circumstances of our country to introduce OMAHA i.e. banking by cable TV to give the customers TV access to all accounts carried on in banks customer information file. Banks should have computerisation to the extent necessary to achieve customer-oriented productivity.

Marketing and customer service

(i) *Incomplete service revolution* : Banks have gone a long way from the days when their motto was 'Never do something for the first time'. Yet, the service revolution is incomplete in terms of (a) services offered, (b) customer groups covered. They are yet to offer intensely customer satisfying services i.e. Personnel Advisory Service, Investment Service, Hire Purchase Service, etc. Though they have adopted market segmentation, they have not been serious about an important sub-group of personal segment i.e. women. Poor people, below the povertyline, who constitute more than 50 per cent of our population get a small portion

of the total bank assistance. Bank marketing recognisedly is no substitute for income and employment policy. Nevertheless, there is no real mass banking unless these unpriviledged millions are brought into the fold of the banking system.

(ii) *Customer Service* : Mass banking has made the customer a sovereign in theory but it cannot be said with certainty that he is one in practice. It is often presumed that competition among twenty-one public sector banks ensures the quality of customer service. It is not understood that when banks are free to do as they please them, they imitate one another. It is not known whether a bank retains its present business or acquires much of new business through its competitors vices rather than its own virtues. By aiming at zero defect service, implementing doctrine of completed staff work and developing 5'C's of communication skill among the employees—coordination, cooperation, correlation and correction—banks must render excellent customer service.

(iii) *Complaints* : Complaints can help the banks to compete and to increase per employee productivity. People do not complain because it is not worth it. They do not know how and where to complain. They also do not believe that bank will do anything. Dissatisfying customer tells on an average about 10 other people whereas satisfied one tells only half as many. What banks do not know can hurt them. It is as fatal as it is cowardly to blink at facts because they are not to our taste. It is necessary for banks to seek out complaint rather than to wait for it to come and to settle it without delay.

(iv) *Customer oriented productivity* : The traditional view of productivity in terms of cost reduction and operational efficiency is irrelevant at present. Banks are to promote customer-oriented productivity, In fact, the customers doing something for themselves, more pleasantly and efficiently (e.g. handling mechanical aids) may add to the bank's productivity.

(v) *Public relations* : Marketing is part public relations, part services. Public relations need not be the 'art of making the whole lies out of half truth'. It has to be the 'art of arranging so that people like you'. There are four essential ingredients in effective public relations, namely, 'attention, interest, desire and action'. The basic rule in public relations is that there are no rules. Direct marketing organised through public relations is a 'what' medium not a 'why' medium. It can show what the results are in terms of business and productivity gains.

Creativity

(i) *Job enlargement/enrichment* : Jobs are to be redesigned in banks to make them challenging. It should start at the bottom than at the top and should be implemented with active participation of all employees and consent of unions. It must also be accepted that the core jobs cannot be redesigned. Individuals with complementary specialisations may be associated in mutually supportive and responsible teams and the job should be redesigned to meet as many needs of the employees as possible. It must encompass (i) skill variety, (ii) task identity, (iii) task significance, (iv) autonomy. Variety is the spice of life and harnesses employee's latent talents and abilities. Task identity gives him the whole job so that the employee becomes not merely a clerk or officer but manager of services. Tasks' significance establishes client relationship between the employees and the end users of his service i.e. customers. Autonomy heightens the sense of job ownership. Thus, job enlargement/enrichment promotes productivity of bank employees.

(ii) *Autonomous work team* : Autonomous work teams formed to look after group of customers has worked well in French banks where every member learns to do every job. It is observed that as little as 15 basic skills are required to make every staff know the whole process. The employees are fitted on the basis of work and mutual likes and dislikes and the supervision is conspicuous by its absence. The problems of working it out were : hostility of the unions and executives who perceived it as deprivation of their power and pay differentials based on age and length of services, not on skills and quality of work. With resolution of these basic problems, autonomous work teams can make employees self-supervised entities, which reduces cost of banking operations and improves their productivity.

to be pooled to bring back the needed rhythm in operation. Though the position has considerably improved, the industry is still passing through anxious moments on account of power shortage in parts of the country. Our men and machines are in a position to attain higher productivity levels, if the major inputs are available un-interruptedly in the required quantity and quality.

Key Areas

The key areas directly affecting the achievements of our output plans and lying within the control of the industry are keeping the equipment in good condition, healthy management practices in industrial relations and adequate motivation of managers and workers. Although the availability of major raw materials and power has to come largely from external agencies, our efforts are to minimise the effects of the shortages in supply by optimising production of the major inputs, wherever possible, from our captive sources.

Equipment Condition and Availability

As the health of the equipment has necessarily to be maintained in good condition, implementation of the Preventive Maintenance Schedules as well as Planned Capital Repairs have been receiving a major thrust for the last three years. Carrying out of major capital repairs and preventive maintenance jobs have resulted in the availability of equipment for operation at a high level.

Other measures in this direction include drive for strict adherence to technical regimes and improving the quality of repairs, ensuring timely supply of all critical spare parts and maximising the production of all the engineering shops and foundries.

For ensuring increased productivity from the available facilities, we have planned the following steps to be taken :

(ii) Adherence to casting schedules in the blast furnaces;

(ii) To attain the specified average heat size and duration in the steel melting shops through proper charging and technological control;

(iii) To minimise the track time of heats in order to reduce the heat delays in Blooming/Slabbing Mills;

(iv) To have optimum rolling programmes in the Rolling Mills consistent with market demand; and

(v) To make determined efforts to improve the technological and human discipline.

Captive Power Generation

As we all know, the industry has been facing even now intermittent restrictions in the supply of power from Public Utilities. The captive generation units at the Steel Plants are provided to only supplement the external availability in order to prevent damage to equipment in times of crises. Besides, the captive generation is dependent upon the steam availability for the power units after meeting the primary requirements of processed steam in the plant.

Another measure taken in this area is to plan for economising electrical energy in terms of consumption per tonne of saleable steel.

Techno-economic Norms

Norms have been fixed in respect of vital techno-economic indices having direct impact on productivity and profitability. These norms are being monitored meticulously at the plant level as well as at the Corporate level.

Substantial reduction has been planned in "coke rate" by improved burden preparation, higher use of sinter, and improved blast temperature and other technological parameters of Blast Furnace.

Key result areas for effecting energy savings both on short term and long term basis are being worked out by SAIL's R & D Centre. The objective is to draw an Energy Conservation Programme for 5 years for the steel industry.

Savings in Petro-fuel Consumption

Even with the higher levels of output planned generally, economising on the consumption of furnace oil/naptha at the main steel plants is being emphasised.

Norms of Productivity

A committee has been constituted at the Corporate Office for monitoring the fulfilment of Production and Productivity norms through regular feed back from the steel plants. The Committee has already been functioning with full vigour. In addition to overall Productivity Norms for the plants, shopwise norms are also being worked out in order to motivate the employee in each shop to attain higher levels of production and produtivity. Efforts are also on to eliminate wasteful and restrictive practices to the extent possible. These areas include the technological regimes as also the human aspects, each of which is coalescing on the other.

Personnel

We propose to contain the manpower at almost the present level for the existing activities. With increased output, this will help in attaining higher labour productivity.

A close watch is being kept on the IR developments in the Plants. Measures have also been taken to improve the grievance machinery for expediting the redressal of the grievances and a drive initiated to reduce the pending grievances of the employees by quicker disposal to avoid frustration to the employees otherwise. Other measures include strengthening employee communication, developing better understanding, stepping up decision-making at all levels and intensifying manpower planning and training schemes.

Long Term Measures to Improve Productivity and Profitability

Some of the measures taken for improving productivity and profitability on a long term basis include removing obsolescence, upgrading technologies, diversifying with high value products etc. These measures may involve changes in the equipment, modifications in the structures, provision of balancing facilities, revamping, peripheral expansion and the like. While the R & D Centre takes care of the technological areas and development of new products and processes, a Centre for Engineering and Technology has been recently organised to step up the designing and project work in SAIL Plants. This new organisation will play a significant role in the development of steel industry in the public sectors. Similarly, a Centre for Raw Materials and Mining is also being set up to develop strategies for exploration and exploitation of our non-replenishable raw materials in a scientific and efficient manner. As a long term measure to minimise the severity of the effect of power shortage from Public Utilities, the captive power generation capacity at the steel plants at Bokaro, Durgapur, Rourkela and Bhilai is being augmented by installing new units.

Concept of Productivity & its Measurement

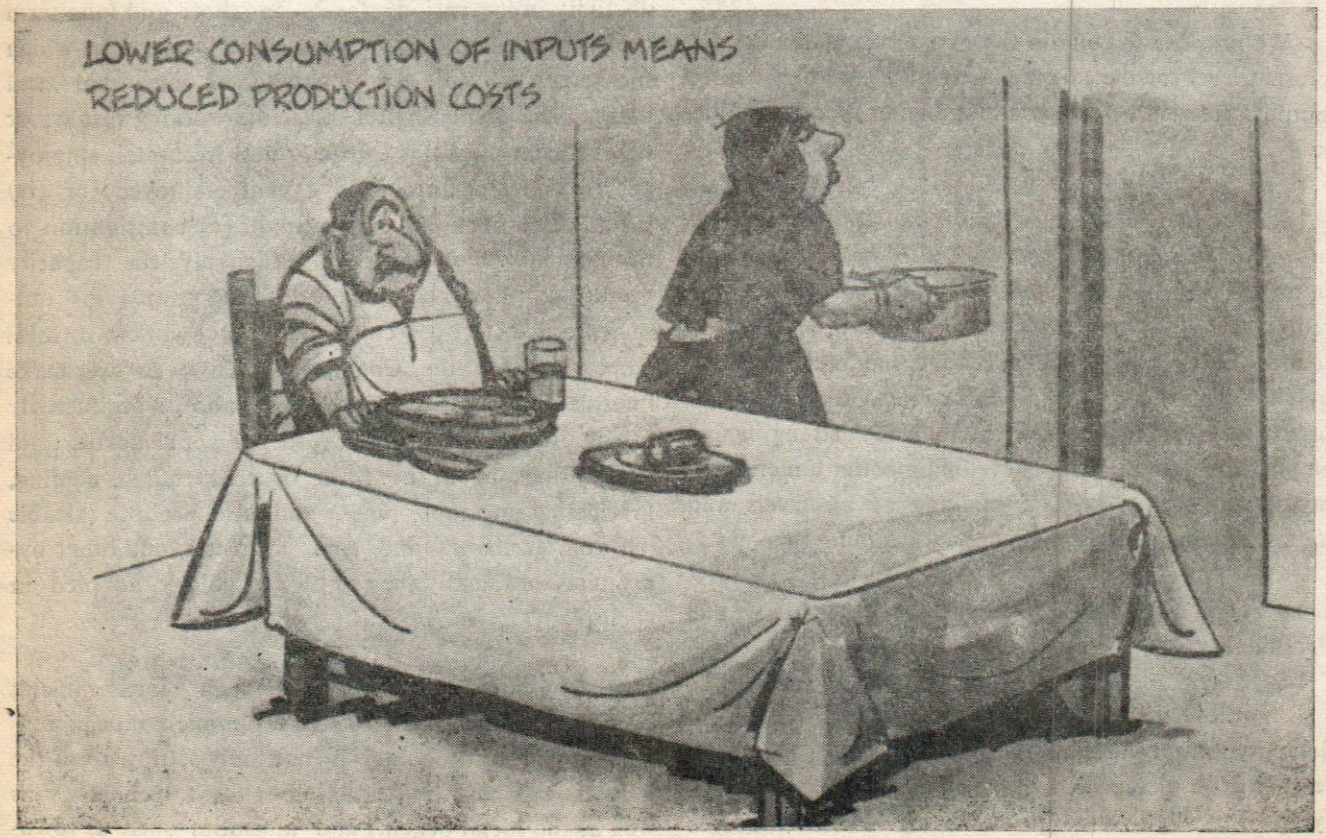
Having outlined the various measures and strategies taken, or being initiated, for improving productivity in its various facets on short and long term basis, the questions are : What is the yard-stick which measures the total productivity of integrated steel plants like ours? Shall it be (i) the working results; or (ii) the ratio of profits (gross or net) to capital employed; or (iii) sales turnover to capital employed; or (iv) value added to capital employed; or (v) contribution to the national economy; or (vi) simply the capacity utilisation; or (vii) equipment utilisation; or (viii) output of crude steel per employee (only works or total employment in the Company) ? How do we make interplant comparison of even labour productivity taking into account the degree of sophistication and further finishing in the form of cold rolling, coating, fabricating into tubes/pipes, and also produce saleable pig iron, fertilisers and coal chemicals and other by-products and finally the age of technology adopted in each plant?

International comparison is much more difficult because of the peculiar socio-economic political compulsions in our country is not only setting up of the industry but also in capital investment, technology as well as the social benefits and amenities such as town-

ship, education etc., captive raw material and other input sources forming the assembly cost, captive design engineering, construction and maintenance organisations, and finally the size of total employment in each steel plant.

In the late sixties, a study was undertaken by the U.N. Economic Commission for Europe to study the various measures of labour productivity in the steel industries in thirteen different countries with the sole objective of standardising the definition of "Total Labour Productivity in the Steel Industry" enabling international comparisons really meaningful. The study report suggested an index of labour productivity in which the output took into account the various factors mentioned above and particularly the degree of sophistication and finishing of the steel products as well as the various coal chemicals, fertilisers, by-products, pig iron, slag and the like.

SAIL, had been following the conventional method of measurement of Labour Productivity for a number of years. As per this method, the labour productivity was measured in terms of Ingot Tonnes per man-year (including 25% credit for Saleable Pig Iron Production). In view of the shortcomings of this method listed in above paras, the matter had been engaging our attention for quite some time. Consequently, SAIL have been able to evolve an alternative method of productivity measurement for Inter-Plant Comparison of Labour Productivity. As per this method, which is quite similar to the method suggested in the study report of the U.N. Economic Commission for Europe, weightages are assigned to various products, viz., Coke, By-Products, Sinter, Hot Metal, Intermediate & Finished Products of Rolling Mills etc. for their conversion into equivalent Ingot Steel Tonnes. Labour Productivity is then computed in terms of equivalent Ingot Steel Tonnes per man-year. These weightages (equivalent factors) are common for various Steel Plants of SAIL (including IISCO). This method is being followed on experimental basis by us at present in addition to the conventional method of measurement of Labour Productivity.



Productivity
1983, XXIV, 3, 339-343

Total Productivity Measurement for Manufacturing Organisations with A Constantly Changing Product Mix[1]

MARVIN E. MUNDEL

An attempt is made to work out a model for measuring total productivity in manufacturing organisations with a constantly changing product mix as a partial measure in these circumstances will be delusive. The model takes care to aggregate outputs in a way that reflects their contribution to the effectiveness of the organisation.

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Assumptions

1. To "improve" productivity we must first measure it so as to have a datum from which to measure change.

2. With a constantly changing mix of output a partial measure may be delusive; steel output measured in tons may show false labor productivity readings reflecting the average size of steel sections, or show increased labor productivity from slower rolling speeds, and so forth. A total measure of all costs and values is needed.

Purpose of this Paper

1. In this paper, the discussion will center on an algorithm for computing and manipulating :

   a. Sum AO=Aggregated outputs (any period)

   b. Sum RI=Resource inputs (any period)

2. Care will be taken to "aggregate outputs in a way that reflects their contribution to the effectiveness of the organization." (*Improving Productivity and Effectiveness*, M.E. Mundel, Prentice-Hall and APO, 1983, p. 16).

1. This paper is adapted from a 1982 working paper of the "Firm Level Productivity Project" of the Asian Productivity Organization.

NOTE : Base period output values and measured period output values should be only of product of acceptable quality.

3. *Notes* The method requires the establishment of :

   a. Fixed hourly rates for all units of facility.

   b. Standard times for all steps in processing all products.

   c. Base year hourly energy cost for operating each facility, where energy is an important and *alterable* component, as in iron and steel; to some extent in machining; probably not in pharmaceutics. (If tool costs are important as energy, then may be handled as energy will be handled later).

4. Computing APO (AO partial) : (Management and other non-direct costs will be added later; see 5).

Let m = measured period; b=base year

Q = Quantity of each product, 1 thru i

(a) $AOP_m = Q1_m\ [ST_1 1(\$_{1L} + \$_{1EB}) + ST_2 1\ (\$_{2L} + \$_{2EB}) \cdots + ST_N 1\ (\$_{NL} + \$_{NEB})] \cdots + Qi_m\ [ST_1 i\ (\$_{1L} + \$_{EB}) \cdots + ST_N i\ (\$_{NL} + \$_{NEB})]$

(b) AOP_b = Same as AOP_m, except Q1...Qi are base period values and are counts of only acceptable quality products.

5. Computing RIP (RI partial) : (Management and other non-direct costs will be added later; see 6.)

(a) Let X_1 be the hours available on facility 1 for the measured or base period; X_2 the hours available on facility 2, etc. It is presumed that, in most cases, all values of X will be equal except for those pieces of equipment with unusual maintenance cycles, or those added during the measured period.

(b) Further, let :

$\$_{Eb}$ = Total energy cost and tooling, base period

$\$_{Em}$ = Total energy cost and tooling, measured period, computed from energy and tool quantities *and base year $ rates for energy and tools* to avoid dependence on external inflation or deflation rates.

H_b = Base year labor hours

H_m = Measured year labor hours

$\$_{Lb}$ = Base year labour cost in dollars

(c) Computations :

(1) $RIP\ (RI\ partial)_{common} = X_1\ \$_1 + X_2\ \$_2 \ldots X_N\ \$_N$

(2) $RIP_m = RIP_{common} + \frac{(adjustment\ for)}{(any\ new\ equipment)} + \$_{Em} + \$_{Lb} \times \frac{H_m}{H_b}$

(*Note*: Last term in (2) avoids labor rate adjustments.)

(3) $RIP_b = RIP_{common} + \$_{Eb} + \$_{Lb}$

Note : If plant utilization decreased in the measured year productivity will decrease; if utilization increases (without other offsetting costs) productivity will increase. I believe this is correct.

6. Adding management and other overhead costs (e.g. material handling, maintenance, etc.) :

   (a) Compute total for base period as a money value; designate as $\$_{ob}$.

   (b) Sum $RI_b = RIP_b + \$_{ob}$

   (c) Determine, to compute RI_m :

   (1) HR_{MB} = Average hourly rate, management, base year (M)

   (2) HR_{SB} = Same as (1), supervisors (S)

   (3) HR_{RB} = Same as (1), maintenance (R)

(4) HR_{HB} = Same as (1), material-handlers (H)

(5) HR_{CB} = Same as (1), clericals (C)

(6) HR_{OB} = Same as (1), all other (O)

(d) Let HA = Actual hours worked; each group of c supra, groups, using subscripts of 6c, for measured period.

(e) Computation of Sum RI_m appears in f, following :

(f) Compute Sum RI_m as :

$$\text{Sum } RI_m = RIP_m \text{ (see 5c)} + HA_{Mm} \times HR_{MB} + HA_{Rm} \times HR_{RB} \cdots + HA_{Om} \times HR_{OB}$$

(Note : This equation avoids the assumption that all wages change equally.)

(g) Compute Sum AO_b as :

$$\text{Sum } AO_b = AOP_b \text{ (see 5c)} + \$_{ob} \text{ (see 6a)}$$

(h) Compute Sum AO_m as :

$$\text{Sum } AO_m = AOP_m \text{ (see 5c)} + \frac{AOP_m}{AOP_b} \$_{ob}$$

7. Computing productivity :

(a) $$\text{Productivity} = \frac{\frac{\text{Sum } AO_m}{\text{Sum } RI_m}}{\frac{\text{Sum } AO_b}{\text{Sum } RI_b}}$$

(b) For detailed computations of terms, see previous sections.

(c) Correcting for quality :

Compute AO_{md} where :

AO_{md} = Value of defective product computed per equation 4c but using Q values for defects.

$$\text{Corrected} = \frac{\frac{\text{Sum } AO_m}{\text{Sum } RI_m}}{\frac{\text{Sum } AO_b}{\text{Sum } RI_b}} \times \frac{AO_m - AO_{md}}{AO_m}$$

Summary to this point :

1. Data needed :

(a) Unit facility hourly rates (in monetary terms including labor) and without labor on each piece of facility.

(b) Standard time for each product on each piece of facility used.

(c) Quantity of each product, base measured year or period.

(d) Time per period (base or measured) available on each piece of facility.

(e) Management, materials handling, maintenance and other non-direct costs, base period.

(f) Energy and tool costs, base year, per piece of facility, per hour.

(g) Energy cost total plant, base year.

(h) Energy cost total plant, measured year or period, using measured year (or period) quantities but base year prices.

(i) Average hourly pay rate, management and overhead labor, base year, or period for :

(1) Managers

(2) Supervisors

(3) Maintenance workers

(4) Material handlers

(5) Clericals

(6) All others

2. Effects of various changes as reflected by this productivity equation :

(a) If management (and other overhead) costs increase faster than the value of the outputs, after correcting for inflation-deflation, productivity will appear to fall.

(b) If new equipment is installed, the return (increment to partial AO) should exceed the cost (increment to partial RI), unless it was a bad investment.

(c) Selling price changes will not be reflected in the productivity equation. This is correct in that selling price affects "effectiveness", not productivity.

(d) The method will reflect actual productivity,

compensating for differences in the mix of outputs.

(e) Deflation or inflation of costs is not tied to a price index; all costs do not alter in a similar manner; fixed equipment has similar fixed costs for considerable periods of time.

Notes :

1. *General* : It is expected that this general method may be applied to machining, pharmaceutical manufacturing and iron and steel, etc., with minor modifications.

2. *Modifications*

(a) Machining and pharmaceutical manufacturing may find the energy related terms to be minor and not use them.

(b) Machining may find a new item, tool costs, to be important, and treat these in a manner similar to the method used, in this paper, for energy, and add this factor to the productivity equation.



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Productivity
1983 XXIV, 3, 345-348

Productivity Trends of Key Industries in the Public Sector

C. VENKATARAMAN

The productivity levels of basic industries influence the productivity levels of other industries. The performance of the enterprises in the basic industries, is, therefore, a matter of great importance to the national economy. The already huge investment of about Rs. 15,000 crores in these industry groups, is likely to increase further progressively. In this paper, productive efficiencies in terms of capacity utilisation and profitability ratios are focussed and broad conclusions drawn.

Mr C. Venkataraman, Special Secretary to Government of India & Director General, Bureau of Public Enterprises.

Introduction

Basis industries which include steel, non-ferrous metals such as aluminium, copper and zinc, coal, petroleum and fertilizers provide the sinews for economic growth. The share of public sector in these basic raw material category of industries is almost 100% in coal & lignite, copper, lead and petroleum, 78% in steel, 81% in zinc and 52% in fertilizers in relation to the country's total production in each of these industries. An analysis of the total investment, which is of the order of Rs. 25,000 crores in the Central Private Sector, would show that the above groups of activities account for almost 60% of the total investment. By their very nature, these products provide linkages to a host of other industries both in the public and private sector. The productivity levels of basic industries influence the productivity levels of other industries. The performance of the enterprises in the basic industries, is, therefore, a matter of great importance to the national economy. The already huge investment of about Rs. 15,000 crores in these industry groups, is likely to increase further progressively. In this paper, productive efficiencies in terms of capacity utilisation and profitability ratios are focussed and broad conclusions drawn.

Productivity Trends

Steel : Steel industry in the public sector as a group shows phenomenal growth in terms of investment. Over two decades ago, the investment in this sector was

Rs. 724 crores which rose to Rs. 3120 crores in 1972-73 and Rs. 4908 crores at the end of 1981-82. About 20% of the total investment today in the public sector is in the steel sector.

A good indicator of performance level of any industry which manufactures/produces goods is the level of capacity utilisation. Steel industry, in terms of production of steel ingot shows capacity utilisation of —

71% in 1982-83
71% in 1981-82
58% in 1980-81
65% in 1979-80
67% in 1978-79

The performance trends indicate an upward movement in terms of utilisation of the installed capacities over the five year period; though there is still considerable gap between the potential and actual levels.

Another useful indicator of efficiency of the invested resources is the ratio of gross profit to capital employed. Here, the steel group shows a declining trend. The table below indicates the position for 5 years.

1982-83 — 2.2%
1981-82 — 4.5%
1980-81 — 4.0%
1979-80 — 3.5%
1978-79 — 6.2%

Minerals & Metals : Capacity utilisation picture under the broad homogeneous group of Minerals & Metals presents a mixed pattern. Aluminium, copper, zinc and lead are important metalliferrous industries in this group. In a table below, the extent of capacity utilisation of these industries over the last 5 years is shown.

	1982-83	1981-82	1980-81	1979-80	1978-79
Aluminium	44%	36%	59%	60%	67%
Copper	73%	58%	53%	47%	46%
Zinc	58%	62%	59%	59%	68%
Lead	82%	80%	83%	63%	58%

The performance over the years presents a mixed pattern. Capacity utilisation of copper shows upward trend. High levels of capacity utilisation are noticed in respect of lead production (above 75%); other groups operated at low levels.

Two other important groups under the cognate classification of Minerals & Metals are coal & lignite. One has to exercise caution in trying to interpret capacity utilisation of this extractive industry; as the problem of determining capacity and interpreting the production with reference to installed plant and equipment is acute. First, the resources are of depleting nature. As the old mines get exhausted, development of new mines takes place. Second, at the time of nationalisation of coking coal mines in May 1972 and non-coking coal mines in May 1973, with a good number in the unorganised sector, determination of the capacities of those mines was found to be difficult. Nevertheless, broad indication is available to show that the extent of utilisation ranges from 60% to over 75% in a span of 5 years.

The profitability ratio of minerals & metals as a group shows a declining trend over the last 5 years.

1982-83 — Negative
1981-82 — Negative
1980-81 — 3.4%
1979-80 — 4.7%
1978-79 — 5.1%

The performance of coal also shows a declining trend. The profitability picture which was negative in 1978-79 & 79-80, registered 10.3% in 1980:81, 7.27% in 1981-82 and 5.7% in 1982-83. In other words, the profitability position of coal as a sub-group, shows deterioration.

Petroleum : In the petroleum industry, there are three types of activities—(a) extracting crude, (b) refining crude, and (c) marketing petroleum products. There has been phenomenal growth in the production of crude in the country over the years. In the activity of extraction of crude, the concept of capacity is not applicable. One could, however, gauge the high order

of growth in the matter of extraction of crude from the following table.

1982-83	—	18.2	million tonnes
1981-82	—	13.18	,,
1980-81	—	9.2	,,
1979-80	—	9.5	,,
1978-79	—	8.9	,,

There was more than 100% improvement in the production of crude within the country in a time span of 5 years. One more enterprise (Oil India Ltd.), which is now fully owned by the Government, contributes another about 3 million tonnes per annum.

Petroleum refining is an activity presently carried entirely in the public sector. The refining capacity during 1982-83, in respect of 11 refineries in the public sector was 37.8 million tonnes per annum during 1982-83. Capacity utilisation of petroleum refineries as a group indicates a very high level of utilisation above 90% over the years.

The activities of petroleum group, viz., extraction, refining, and marketing display high levels of capital/output efficiencies. The profitability ratio over the last 5 years is presented in the table below.

1982-83	—	48.6%
1981-82	—	38.1%
1980-81	—	14.3%
1979-80	—	20.5%
1978-79	—	21.8%

There was steep increase in the profits of petroleum group in 1981-82, when price revisions of petroleum crude was made on the basis of international prices. Nevertheless, one has to recognise that the production, both in terms of crude and refined products, has also registered considerable improvement in the year 1981-82 and 1982-83. This, coupled with the fact that refineries as a group operate at a very high level of capacity utilisation, account for the profitability buoyancy.

Fertilizer : The capacity utilisation in the public sector in terms of Nitrogen and 'P_2O_5' generally shows a low level over the years. The extent of utilisation in the last 5 years is shown in a table below.

	N_2	P_2O_5
1982-83	53	44
1981-82	56	45
1980-81	39	45
1979-80	44	40
1978-79	55	35

It would however be appropriate to record that 2 out of 6 enterprises in the public sector usually operate at very high levels, above 80%.

The profitability picture shows that while among the fertilizer companies 2 present a negative picture in terms of profitability in all the 5 years, 2 other companies show a range from negative point to 16% and the remaining 2 display a range of 6% to 30% over the span of 5 years. The point that merits attention is that only two enterprises in this group operate their plants at high levels of capacity utilisation as reflected in the positive results with regard to their profitability. Chemicals, as a group which includes fertilizers as major segment of activity shows low profitability ratio of 6% in 82-83, 5% in 1981-82 and less than 1% in 1980-81 & 1979-80 and 3% in 1978-79. The group operates at below average level.

Conclusions

While in all other groups a certain correlation could be discerned between capacity utilisation and profitability, our steel industry does not seem to lend one to draw this inference. Two conclusions which may follow are (i) whatever may have been produced may not have been sold. In other words, a heavy finished goods inventory would adversely affect the profitability; (ii) if the product-mix does not reflect production of high value items sustainable by market demand, the realisable income drops low, adversely affecting the profitability. These observations could be empirically tested and proved.

The productivity trend analysis in terms of capacity utilisation establishes, by and large, a direct correlation to profitability in our industries covered in this survey—

petroleum sector with high profitability and others of a varying pattern. It is commonly held that the optimum utilisation of productive assets, leads to generation of surpluses. Conversely, one could also hold it as an axiom that if there is under utilisation of productive assets, this would lead to lower production and, as a logical extension, lesser profit or no profit at all. The lower the levels of production, the higher would be the operating cost leading to lower profits or higher losses. In this scenario, it is the assumption that there is a ready market for the products.

The process of economic development envelops several sectors. The enterprises in basic industries largely operate in a demand oriented situation whether it is steel, coal, fertilizer, non-ferrous metal or petroleum products. Some pockets of low demand are, however, seen, more as a result of fluctuating demand pattern rather than as a long standing problem. In a planned economy when demand projections are made in a perspective of inter-linkages, some imbalances do arise giving rise to recession at certain points of time. This has to be interpreted as a passing phenomenon in a dynamic environment. In such a situation, reorientation of marketing strategies, with emphasis on product-mix of high saleability could be an answer.

The very success of public sector operations greatly hinges on the operation of enterprises in the basic industry groups which account for lumpy investment. The recognition that the extent of capacity utilisation is not to the desirable level and also the profitability position is not appreciable, has stirred the public sector management and Government to take a number of steps with the objective of upgrading the performance of identified low performers and revamping of marketing strategy.

The measures contemplated or in the state of implementation also include drawing up of corporate recovery plans for improving physical and financial performance, evolving strategies in terms of short and long term plans for rehabilitation of the companies with the objective of improving the returns on investment and also identification of potentialities for improving the earning in a long range perspective.

REFERENCES

1. Public Enterprises Survey 1978-79.
2. Public Enterprises Survey 1979-80.
3. Public Enterprises Survey 1980-81.
4. Public Enterprises Survey 1981-82.
5. 'Lok Udyog' Special Number, April 1983—Monthly Journa of Bureau of Public Enterprises.
6. 'Performance Aims and Financial Targets of Central Government Public Enterprises', BPE's document of March, 1983.
7. 'Emerging Blueprint for Productivity Management', BHEL Monogram, February, 1983.
8. Annual Report of Department of Petroleum 1982-83, Page 15.
9. 'Role of the Public Industrial Enteprises in India', UNIDO monogram—UNIDO/IS 367 January, 1983.
10. Report of the Committee on Economies in the Cost of Production of Coal, Department of Coal, May 1978.
11. 'National Objectives and Pattern of Investment in Public Enterprises'—paper presented by BPE at the seminar on 'Prices, Profits and Pattern of Investment in Public Enterprises' held in August, 1983 at New Delhi.

Productivity
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Participative Management For Higher Productivity

DR. SUBRATESH GHOSH

This paper studies the lessons drawn from the experiments in participative management for improving productivity in different countries including India and suggests measures for its success in India.

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The significance of proper human resources management in improving the productivity in an economic organisation needs no special emphasis. The total productivity of an organisation in general depends greatly on motivation to work. The precise role of human resources management in this context lies in improving the motivation and in maintaining it at that higher level to develop and utilise the potentials of the human factor in the best possible manner. This may be attempted through various approaches of management which have been tried out in the past in different organisations in different countries under different contexts. Participative management, which by itself represents a distinct style of management with its own philosophy and goals, has been considered in recent years as a highly effective instrument for motivating the workers to contribute the improvement of productivity of the organisation and in particular that of its human resources. Apart from its role in improving the motivation to work, the participative schemes can also smoothen the path of technological innovations and switch over to more effective technology for raising the level of productivity.

In this paper an attempt is made to study the lessons drawn from the experiments in participative management for improving productivity in different countries including India. In the light of these experiments, the problem areas would be identified and the role of the participative management in the productivity improvement would be assessed.

Participative Schemes in Productivity Management Abroad

In the advanced countries, participative schemes for improvement of labour productivity relied on different approaches and assumed different forms. In France, West Germany, U.K. and U.S.A., workers' participation in various forms have been sought in bringing about technological changes proposed or initiated by management. Such participation at times was in the form of collective bargaining[1]—both conventional and that of the productivity bargaining type. At times, the workers participated in a more direct way in planning and deciding the details of such technological changes through joint consultative forums of different types. On the other hand, in recent years, in some countries notably in Japan, the U.S.A. and also in some of the Scandinavian countries, different types of autonomous work groups formed by workers participated in interesting ways in redesigning work, improving quality of the working life, raising the quality of output and production processes.

West Germany

In West Germany, co-determination system, as well as the rationalisation agreements emerging out of collective bargaining have played a significant role in bringing about technological changes without workers' resistance and that, in turn, resulted in higher productivity. Co-determination has provided for smooth industrial changes.[2] Numerous technological innovations had been introduced in coal and steel industries and the improvement in production was significant.[3] In fact, the elected representatives of workers have been given right to be consulted in all management proposals for technical changes. The rationalisation agreements which followed intense collective bargaining in West Germany and helped to introduce significant technological changes accompanied by mutually agreed safeguards for workers, were first initiated in the textile industry in the mid-sixties. Thereafter it quickly spread to several other industries.[4] In most of these cases, the initiative for the rationalisation agreements were taken by the Unions, but in the course of actual bargaining, the management and the Unions significantly participated in joint-decision making in respect of the nature of the rationalisation to be introduced, mode of implementation and also in providing adequate compensation to the workers adversely affected by the technological changes. They also provided for retaining of the redundant workers and, in effect, attempted to create some sort of small-scale employment policy for each enterprise.[5]

France

In France, the elected staff representatives in the Works Councils have been given the right of consultation under the law of the country.[6] But apart from joint consultation the workers have also participated in the decision making regarding the technological changes in industry through collective agreements. There had been several industry wide collective agreements (particularly in the textiles and metal industries) providing compensations for workers rendered redundant for technological change, allowances for workers transferred for the same reason and retraining of the workforce affected. Usually such agreements provide for detailed information to be supplied by the employers in respect of the technological changes resulting in redundancies and notices to be given by them.[7]

United Kingdom

In U.K., a different type of collective bargaining, styled "productivity bargaining" developed on account of the urge of the organised labour in participating in the decision-making regarding the technological change. Unlike the rationalisation agreements in West Germany or Collective agreements signed in India on account of trade union resistance to rationalisation or automation, the initiative in productivity bargaining in U.K. mostly came from the management side. In fact under this type of collective bargaining, management and labour confront each other with their "demands". Management seek the smooth and conflict-less introduction of technological changes or new work-processes for improvement of productivity and the unions seek to ensure that labour is not adversely affected (or the adverse effect is minimised) due to such changes and at the same time the gains of productivity improvement are shared by the workers. This approach to bargaining first attracted notice in U.K. in the sixties with the

signing of a collective agreement in Fawley unit of ESSO Ltd. (U.K.) following intense bargaining between the management and the Union. It then rapidly spread throughout the country, partly because of its novelty and partly due to its consistency with the policy of productivity—based wage change advocated by the Labour Government in power at that time. With the subsequent political changes in the seventies, the initial popularity of productivity bargaining has substantially declined in U.K., but it has come to stay as an approach different from the conventional approach to collective bargaining. In most of the agreements signed under productivity bargaining approach in U.K., as well as in other countries, the agreements gave joint sanction to changes in work practices which were needed for productivity or other technological reasons. In recent years due to the intensification of the technological change mainly under the impact of new technology based on accelerated use of micro-processors in the industry and various services and with the increased technological rationalisation and automated control of industrial production, clerical work and administrative processes, the management and the organised labour in U.K. are trying to affect the nature of the changes to save their own interests through accelerated bargaining on technological changes. The Trade Union Congress developed a set of uniform policy guidelines based on 3 principles, viz., (i) new technology should not be introduced without the full support of the employees and their union, (ii) there should be no overall fall in employment due to the change in technology and (iii) the new technology should not be used simply as a labour saving strategy and should be able to improve and extend public services in the public sector and, in the case of the private sector, should mean trade union involvement in planning improved productivity and new products. It is interesting to note in this connection the distinct emphasis on the trade union involvement with the introduction of new technology as a precondition for its introduction both in the private sector and the public sector.

However, on the basis of case-studies of some recent technology agreements signed in U.K. and the rationalisation and modernisation of mechinery introduced in textiles industry in the West Yorkshire region, T Woodhouse reported that despite the issue of comprehensive guidelines on the union participation in introduction of new technology supported by the issue of model collective agreements to be followed by the trade union side, the extension of labour control over the new technology has not been significant and remained quite uneven.[8] In fact, is has been noted that in the recent technology agreements the unions demanded in general, better pay and conditions of service as a consequnce of new technology, but they did not propose a permanent extension of union/employee influence in the strategic management decisions, except for the transitory phase when new tcchnology was being monitored.[9] Woodhouse explained this trend, which ran contrary to a difinite guideline issued by the Trade Union Congress, to the general recessionary climate in the country in the early eighties, which appeared to have reduced the trade union movement's power to claim wider influence on decision-making in the field of technological changes.

Apart from collective bargaining, the workers in Britain also have some opportunity to participate in decision-making in the field of productivity management through the consultative committees operating at various levels, both in the public sector and the private sector. However, the role of joint consultation in the field, although not a dismal failure, has not been very encouraging. On the success side, examples of introduction of new equipment or production methods in the private industry and the handling of the staff problems arising out of the conversion of the remaining trams to oil buses in the fifties could be cited.[10] In the nationalised electricity industry the productivity tended to increase and that could be partly ascribed to the reasonably good performance of the consultative committees in the industry. On the other hand, Hugh Clegg strongly maintained that successes at joint consultation in improving productivity or industrial peace were not impressive in comparison to the large claims made on its behalf by its supporters.[11]

United States

In the Unites States, apart from collective bargaining on incentive wage schemes and protective measures for labour following technological changes, the Scanlon Plan played an important role in the years following the

Second World War in promoting labour participation in decision-making for cost-saving and efficiency raising measures and sharing the gains resulting therefrom.[12] This plan was first recommended by J. Scanlon, a steel worker who later on became a leader and executive in the United Steel Workers. It is based on (a) extension of labour-management cooperation through joint production committees, and (b) sharing the gains of cost reduction on the basis of union management agreement. In recent years, an important thrust of the participative management has been in the form of autonomous workgroups, mainly the Quality Circles. Success of the Quality Circles in Japan in the early '70s led to their import into the U.S. industry.[13] They are spreading very rapidly in the U.S. industry in view of the high rate of success achieved in the industries which first experimented with them. In 1979, there were about 150 organisations having Quality Circles (Q.C.), while by August 1981, there were over 1000 organisations having Q.C., which appear to be "Catching on like wildfire in American industry".[14]

These Quality Circles are autonomous workgroups, consisting of 5 to 15 workers, which meet voluntarily on a regular basis usually on company time. They identify and analyse worpklace problems including problems of quality of output. An interesting feature of the Quality Circles movement in the U.S. is that, unlike many of their Japanese counterparts, the American Q.C.'s often reward the workers directly in the form of wage increases or production bonuses.[15] A leading example of the combined Q.C.-cum-wage incentive programme is found in General Motors Corporation, The Employee Participation Groups (EPG) of this organisation are modelled on the Quality Circles of Japan. Each EPG consists of 8—12 employees who meet voluntarily on the company time and discuss the work-related problems. It has been reported that EPG's in General Motors contributed to cost savings, improved quality, reduced absenteeism and following the introduction of these Groups, there has been reduction in workers' complaints.

The U.S. industry in recent years also experimented with participative programmes for improvement of the "Quality of Working Life" (QWL). The QWL programmes in the U.S. involve employees at every level of the organisation in decisions about their work and workplaces. They deal with improvements in working conditions and environment, job design and other work-practices and also with general culture of the workplace. The QWL programmes in U.S. usually involve all levels of management as well as the union leadership. The issues dealt with under steering committees and work groups in QWL do not cover the collective bargaining issues, although the dividing line between the two is sometimes blurred.[16] Wages are kept outside QWL discussions. But some of the matters connected with working conditions at times are also negotiated as bargaining issues between the Union and the management. In U.S.A., QWL programmes often successfully deal with reorganisation or redesigning job with a view to job enrichment and other organisational innovations, the areas which do not often come under the collective bargaining process. In many cases such efforts result in significant increase in productivity at the workplace level. In fact, although many work redesign or other job enrichment programmes do not explicitly mention improvement in productivity as an objective, they are necessarily linked to improvement in productivity. Herzberg believes that there can be no organisational innovation which is not tied to productivity. Orthodox job enrichment restructures individual jobs by emphasising client relationship and worker productivity.[17]

The Scandinavian Countries

In the Scandinavian countries the collective ageements on technological changes and the participative programmes for "Enrichment of the Quality of Worklife" have been the main contributions of Workers' participation in the improvement of productivity. In Norway, several successful experiments have been made in improving the quality of worklife in manufacturing organisations, ships and banks. In M/s. Balao, a general purpose carrier ship of Torvald Klaveness Shipping Company a participative work planning and training project was launched in 1973. In the course of the project, in planning which the officers and representatives of crew participated, temporary workgroups were created around particular types of tasks which changed from week to week. Duties and job-assignments were rearranged along new lines as a result of

which qualified members of the crew covered a variety of duties crossing the traditional functional or status divisions (e.g. deck crew and machine crew, or officers and crew). It was reported that as a result of the project, the level of maintenance and operational efficiency improved, the maintenance costs came down and the days lost for repairs were brought down below the average.[18] In one of the branch-offices of Kredit Kassen, a large Norwegian bank, the principle of multi-skill operations through job-rotations had been practiced under a participative work planning arrangement. It is reported that as a result of this, the employees were better integrated and the branch office developed a remarkable capacity to cope with variations in work-loads and task-requirements, which often created problems in banking operations.[19] In Sweden also cases have been reported about the success of the participative job enrichment programmes in improving the productivity and work efficiency.

In Denmark, the technological changes for improving productivity have been brought mainly through technology agreements reached under collective bargaining. It is reported that the unions in Denmark seem to have very little faith in the existing forms of industrial democracy like joint consultations, cooperation councils, labour representation boards etc.[20]

In the recent decades, the rate of growth of productivity in Japan has surpassed all other countries, although in terms of absolute level, her level, might be still lower than some other advanced countries, notably U.S.[21] Much of this productivity growth has been achieved through technological changes and workers' motivated performance brought through different forms of participative management (e.g. collective bargaining, joint consultation, autonomous workgroups), and the built-in mechanisms of personnel management and labour relations, e.g. qualifications system based on performance, "life-time employment system" with its implications for promotion and job security, job-rotations, carrer development. etc.

Japan

In Japan, which is accepted as a leader in the field of industrial robots and which has successfully utilised all modern forms of technological innovations, including the latest of micro-electronic technology, the introduction of new technology was brought through collective agreements, the details having been worked out through joint consultations.

As regards the labour participation in the decisions leading to the introduction of new technology, although the Japanese unions generally do not oppose the introduction of new technology, the unions often try to check any adverse effects of the new technology on jobs security and humanisation of the work process. Such checking by unions is achieved through joint consultation and collective bargaining.[22] In this connection, a group of Japanese trade unions, including Zenkindomei (National Federation of Metal Industry Trade Unions), Jidoshasoren (Confederation of Japan Automobile Workers' Unions), and Denkiroren (All Japan Federation of Electric Machine Workers' Unions), issued "Guidelines for Agreements on Technological Innovations". The document insists on (i) joint consultation as a precondition for the introduction of new technology, (ii) guarantee and improvement of employment opportunities and working conditions of the affected employees, (iii) fair sharing of fruits of increased productivity with employees and (iv) promotion of international cooperetion.[23]

Collective bargaining and the resulting collective agreements in Japan are very much interconnected with the joint consultation at the enterprise level. In fact, collective bargaining system in Japan is not independent of the joint consultation system.[24] Joint consultation, in effect, works at two levels : viz., at the company level between the top management and top representatives of the unions, and (ii) at the workshop level, in which it is usually referred to as the production committee. At the company level, the boundary of the joint consultation often gets blurred in relation to collective bargaining. Usually here it deals with personnel policy matters like retirement, promotion policy, technological innovations and general management matters, like overseas investment, diversification of company's activities, change in management organisation etc.[25] Matters like wages, bonus, discharge, lay-off and other conflict-oriented issues are dealt through collective bargaining between the union and management. At the production committee level, the decisions relating to

production schedule, work-schedules, manning, working hours etc. are discussed.

In addition, there are autonomous work-groups like Quality Circles, Zero-Defect (ZD) groups etc. which discuss in the company time matters relating to quality of output, productivity matters, reduction of costs, working methods etc. These autonomous group activities have spread tremendously in the course of last 15 years. According to a recent report of the Ministry of Labour of Japan, about one-third of all Japanese firms have small autonomous groups and the proportion of large corporation having such groups is 69 p.c. In a survey conducted among 60 large enterprises in the Keihin industrial belt, in 90% of the units having autonomous groups, the employees' morale improved following the commencement of autonomous group activities.[26] According to the data published by Japanese union of Scientists and Engineers and quoted in a publication of Japan Institute of Labour, in 1980, there were 1,15,254 Q.C. circles registered with J.U.S.E. The same report mentioned that Q.C. circle produced favourable effects such as improvements in workers' morale, quality control and safety measure.[27] It was estimated that the economic benefits of the Q.C. circles 42.4 times their financial costs.[28] T. Inagami, Professor of Hosei University and Research Officer of Japan Institute of Labour, emphatically maintained that these circles "Contributed enormously to productivity and product quality and helped to reduce company costs."[29] In general, the Quality circles positively absorbed and utilised the ideas and creativity of employees in the workshop and promoted a sense of identity with the company among the employees. In this way, they contributed to the humanisation of the work process. However, it is interesting to note that apart from improving the quality of working life, their success may be partly ascribed to the financial and other rewards granted for the effectiveness of voluntary group activities. It has been reported that 68.7 p.c. of the Quality Circles subsidized Participants in one way or another and 92.7 p.c. of the companies indicated that they had a recommendation program to reward employees for outstanding service through these autonomous group activities.[30]

Productivity and Participative Management in India

The joint consultation and other forms of participative management that have been introduced in India, had from the very beginning the improvement of productivity as one of the major objectives. Although the Works Committees introduced under the Industrial Disputes Act, 1947, did not explicitly mention rise in productivity as an objective and in general had the duty "to promote measures for securing and preserving amity and good relations between the employer and the workmen, and, to that end, to comment upon matters of their common interest or concern,"[31] many of the matters which were usually dealt in the Works Committees (e.g., safety measures, improvement of conditions of work etc.) had direct impact on the productivity at the shop-floor or the plant level. The matter was made more explicit in the Second Five Year Plan, which categorically recommended increased association of labour with management and "promoting increased productivity" was mentioned as one of the major objectives of this measure.[32] The Joint Management Council scheme which was formulated during the Second Five Year Plan to give effect to this policy and also to implement the joint decision of the tripartite Indian Labour Conference (1957) clearly included improvement of productivity as one of the objectives of the J.M.C. The Draft Model Agreement circulated in this connection provided that the management would consult the Joint Management Council, among other things, in the matter of introduction of new methods of production and manufacture involving re-employment of men and the Council would have responsibility in respect of supervision of safety measures and operation of vocational training, both of which have significance for improvement of productivity. The Scheme for Workers' Participation in Industry at Shop and Plant level circulated by the Government of India in October, 1975, which was more or less followed in another schemes circulated by the Government in 1977, had been more specific and included the improvement of production, productivity and efficiency, as a function at the Shop Council or Unit Council level and matters relating to "optimum production, efficiency and fixation of productivity norms for men and machines" in the list of functions of the Joint Council.[33] However, in actual practice the extent of success achieved by the forums for workers' participation of management in India at different times has been practically negligible. In a very large number of undertakings which required to set up

Works Committees under the I.D. Act, 1947, the Committees were not established. In 1980, out of 1114 undertakings in the Central sphere which required to form Works Committees under the I.D. Act, 1947. only 588 such committees were in existence.[34] In reality however many such works committees only existed in paper and hardly functioned with any effectiveness. The Joint Management Council Scheme was also practically a non-starter. Although introduced with much fanfare in 1958, there were only 80 Joint Management Councils in existence in India in 1967. However, a Report on Working of the Joint Management Council issued by the Ministry of Labour, Government of India, claimed that in majority of the cases where JMC had been established the production and productivity had improved.[34] Although it might indicate the potentiality of the participative management in improving productivity, due to very little spread of the scheme in the organised industrial sector in India, its overall impect on the productiviiy in the country appears to be insignificant. The same may be stated in respect of the later scheme of the Workers' participation in the form of the two tier joint-council and shop council. The two-tier scheme, although appears to be somewhat more successful in terms of its numerical spread, hardly appears to have much impact on raising the productivity and meeting other objectives. Drawing on the deliberations of several seminars and workshops in which important managers and trade unionists had participated and also on the basis of the opinion-surveys conducted among the leaders of trade unions and important executives in Indian organisations, the International Centre for Public Enterprises in Developing Countries in its National Report on the Workers' Self-Management and Participation in India, noted that the schemes for workers' participation of the country was not, in general, successful partly because of the antagonism or indifference to the concept of workers' participation and partly due to other factors like inter-union rivalry, lack of requisite political will on the part of the state to make the scheme a success and jurisdictional confusion in respect of different consultative forums etc.[36]

Although the officially blessed participative schemes like Works Committee, Joint Management Council, or the two-tier machinery of the Joint Council and Shop Council did not make much headway in improving productivity, with the exception of some undertaking, the success stories of the participative approach in productivity management are not unknown in India. It is interesting to note that most of these cases were results of collective bargaining followed by collective agreements, which set up regular machinery for consultation in matters of productivity (including the Joint Productivity Committees, and in some cases, Joint Management Councils or Joint Councils and Shop Councils). One of the earliest of such cases was the "Agreement for Closer Association of Employees with Management" signed on August 4, 1956, by Tata Iron and Steel Company Ltd. and Tata Workers' Union, Jamshedpur. The Agreement established a three-tier machinery consisting of a Joint Consultative Council of Management at the top, the Joint Works Council and the Joint Departmental Councils. Along with other objectives and functions, the matters concerning production, operational results and the production problems, rationalisation of production and improvement of productivity were given special emphasis at all levels of operation of the three-tier consultative machinery created under the Agreemen t.[37] For more than two decades, the scheme worked well in general and helped a lot in improvement of efficiency, prevention of wastes of materials power and equipment and introduced important safety and productivity raising measures.[38] Similar cases of more or less successful operation of the consultative commttees set up under collective agreements in the field of productivity improvement have been reported from some other units in the iron and steel iudustry, enginering industry, · chemical industry and also in some ordinance factories under the Ministry of Defence of the Government of India. Apart from the consultative committees set up under collective agreements, which showed favourable results in creating workers' involvement in productivity management or in improvement of productivity, these have been a few cases of participative autonomous groups functioning in India, which showed positive impact on productivity. In Bharat Heavy Electricals Ltd., Hardwar, and also in New Delhi Divisional office of Life Insurance Corporation of India, workers' autonomous groups were formed with the support of management mainly for redesign of work-processes in selected sections. The groups worked successfully and improvements in productivity and also in quality of working life were reported in both the

cases.[39] However, on the basis of later enquiries made by the author of this paper, it was learnt from some responsible executive of B.H.E.L. Hardwar, that after the initial success for about two years, the scheme failled to maintain the gains achieved and the groups died down within three to four years after their inception mainly due to the lack of financial rewards for the participating workers and antipathy of some trade unions, which did not favour the scheme. Very recently, another unit of Bharat Heavy Electricals Ltd. (Hyderabad) has seen interesting beginning of Quality Circle activities and it has been reported that they achieved good results, including improvement of productivity.[40] In Rourkela Steel Plant also small autonomous work-groups entitled "Shop Improvement Groups" have been formed in the early part of 1983.

There have been also cases of collective agreements in India, which although directly did not improve productivity, but contributed to the same indirectly, by removing workers' fear and resistance in the context of management's measures for introduction of technological changes, on the basis of agreed decisions incorporated about the job-security, workers' training and other matters to protect their interests in connection with such changes.

Problems and Prospects

Experience of participative management's role in the improvement of productivity and management of technological change for that purpose in the advanced countries as well as in India clearly indicates that, in spite of major limitations and problems, the appraach has definite possibilities in removing workers' resistance to technological changes and also in raising productivity. Workers' positive motivation to work being an indispensable condition for improvement of productivity and technological changes being at times essential for this improvement, the positive results experienced in this matter are definitely indicative of the merits and possibility of this approach. The Japanese, Norwegian and the U.S. experiments clearly have shown the extent to which workers' participation may help in cost reduction, improvement of quality of output, better work-design and the overall increases in workers' performance and motivation. The British and the West German cases indicated the role of the participative systems including collective bargaining in removing workers' resistance to technological change and in minimising or removing its adverse effects from the workers' points of view. In spite of somewhat unencouraging record of the schemes of workers participation in management in India as a whole, individual cases of success of this approach in raising the productivity clearly show that even in the developing countries, the experiment may be worthwhile provided it is conducted under favourable conditions.

However, when we accept the potentials and prospects of participative decision-making the level of productivity through technological change or without it, we should not forget the problems and limitations of workers' participation in this process.

Great problems appear to emerge from attitudinal barriers. The experience in India and also in other developing countries often indicate the hidden antagonism or reluctance of the management to seriously involve labour in decision-making affecting change of technology or to give them effective say in this respect. A group of trade unionists from private and public sector undertakings complained in a Seminar on Workers' Participation in Management that in respect of matters connected with production and productivity, the management only "put forward plans for acceptance by workers' representatives without associating them in the process of planning.... In view of the said conditions, the Shop Councils and Plant Councils have become forums for dissemination of information only."[41] An Officer of the Union Ministry of Labour was quoted to have said that the main problem is that of attitudes and prejudices of employers.[42] In South Korea, where the consultative Labour-Management Councils have been given a major responsibility by law, among other things, to function as an organ to promote increased productivity, it has been observed that "the attitude of the management towards the labour-management council system has been extremely passive and even negative."[33] But if the management does not intend to involve the workers in any real sense in decision-making, or in planning the change in productivity and adopts a negative or apathetic stand in respect of this matter, it is unlikely that the workers

would ever feel enthusiastic about the schemes of workers' participation in raising productivity.

The attitudinal problem poses difficulty from the trade union side as well. Although in advanced countries like Japan or West Germany, trade unions without ever being formally associated with certain participative schemes for productivity management (e.g., autonomous workgroups in Japan or works councils in West Germany) never interfered with their operations and permitted their representatives or union-members to effectively participate in these schemes, in India and in other developing countries, there are many instances where individual trade unions either refused to cooperate or director opposed the schemes evolved through joint-consultation committees or autonomous work groups. In fact, one of the leading trade unionists and an important office bearer of a leftist All-India Trade Union Organisation categorically maintained that in view of the class conflict, workers' participation in a capitalist country in effect "turns out to be exploiting the workers more", i.e., make him produce more in the name of participation.[44] Recognising that in the public sector undertakings it could have worked to some extent, there also he expressed his doubt about its success in view of what he termed as the influence of the big business on the public sector management.[45] An office-bearer of another important All-India Trade Union Organisation was, in principle, in favour of the concept of workers' participation in management, but he underlined the need of attitudinal change of both management and labour in this respect. He predicted that the scheme would definitely fail if the employer thought the worker as a servant and did not recognise him as a partner in the work.

To some extent the problem of an agreed solution regarding the sharing of gains of productivity with the workers is very much connected with the attitude of the management. If the latter wants the workers' cooperation only for the improvement of productivity, without being ready to permit the workers to share its gains, an attitude which is often found in some private sector undertakings (but not only there), it is unlikely that the workers would be permanently motivated to cooperate for the improvement. For a while, other considerations may encourage them to participate in the scheme, but in a developing economy like India, where the workers' physiological and security needs are still largely unsatisfied, the scheme is not likely to show lasting results. The initial success and the ultimate failure of the participative work-redesign scheme in selected sections of Bharat Heavy Electricals Ltd., Hardwar, as mentioned above, amply justify this point. The fact that even in Japan the significant majority of the organisations having Quality Circles reward employees for outstanding service clearly indicates the importance of the financial rewards and other tangible benefits as motivating factors for higher productivity. In U.S., the success of the Scanlon plan, which made wide use of labour-management consultation and mutal agreements both for cost reduction and sharing the gains resulting therefrom, also is a pointer to the importance of satisfactory gain-sharing agreements for labour's effective involvement in raising productivity. Unfortunately in India, this is often not adequately recognised and that might have stood on the way of the success of the officially formulated schemes for workers' participation in management in achieving productivity improvement, as they explicitly separated the interest bearing issues like financial rewards etc. from the issues coming under the perview of the consulative forums. Possibly the Japanese approach of working out the details of the proposed productivity-improvement measures or technological changes through joint consultation at different levels, followed by union-management agreements to work out the labour-safeguards and the gain-sharing arrangements resulting from the anticipated improvements, might offer a satisfactory solution to this problem. However, although the forums for discussion may be separate, the change should follow the completion of both the processes of joint-consultation and collective bargaining. This may be a distinct departure from the existing schemes for participation and may help in removing the labour's suspicion about the participative forum being used for the purpose of exploitation of the worker.

The approach suggested above may also partly meet the problem noted by Thomas Woodhouse in the context of the British technology agreements in which it was found that in the face of the compulsions of the technological change and under the shadow of the recession, the unions might show interest mainly in the

sharing of the gains of higher productivity, without trying to extend their influence over the decision-making process for the technological change. If the workers' participation in this context is kept confined only to collective bargaining and the resulting collective agreemeet, the trade union due to its greater involvement with the conflict-oriented issue over the whole industry, or the whole undertaking, may neglect or lose sight of the details of the productivity-raising measures or technological changes, which are matters of direct interest for the shop floor level workers and others directly affected by the new changes. But if the matters are settled both through the consultative forums at different levels and the bargaining mechanism, this problem may be more successfully tackled.

Conclusion

In the light of the achievements reported and problems encountered in respect of the participative management's role in improvement of labour productivity in different countries, it would be quite fair to be hopeful about its scope and possibilities for raising the productivity. Although the problems and limitations are quite formidable and the success story is not uniformly encouraging, the extent of success achieved in some advanced countries, and also in certain individual undertakings even in the developing countries, clearly indicates that participative management may be an effective approach for raising the level of productivity, provided certain preconditions are fulfilled and the problems are sought to be encountered seriously. For that, of course, the scheme should be meaningful and significant in coverage, so as to make the workers interested in participation and the management also must be ready in spirit (not only in letters) to involve the workers in the process of decision-making and implementation of the schemes for improving labour productivity. There should be elaborate provisions for joint consultation at different levels on the details of the proposed measures which may create sufficient ground for union-management bargaining followed by collective agreements on matters of conflict-oriented issues like gain-sharing and job-security for workers in the context of higher productivity. As indicated above, some of the suspicions and attitudinal problems from the labour side may be eased out through this approach and also through an effective and mutually acceptable plan for sharing the gains of the higher productivity. For changing the attitude of management, training programmes on different forums of workers' participation may be quite useful. There should be joint as well as separate programmes for trade union activists at the plant as well as the shop-floor level in the techniques of joint consultation and joint decision-making in matters connected with productivity. In spite of the seriousness of the obstacles, the participative management must be given a sincere trial for improving labour productivity in the developing countries, which have hardly any prospect of achieving self-sustained growth without continuous increase in productivity and better utilisation of the human resources. A beginning might have been made in India in this respect, but this is by no means enough and much more is to be done.

REFERENCES AND NOTES

1. In the Western countries, particularly in the U.S.A. and U.K., there is a strong school which favours consideration of collective bargaining as a form of workers' participation in management. See for example, (a) E. Cordova, Workers Participation in Decisions within Enterprises, *International Labour Review*, *Vol. 12*, (*1982*) *No. 2*; (*b*) *H.A. Clegg, A New Approach to Industrial Democracy*, Blackwell, Oxford, 1960, Chs. 15 and 17, (c) K. E. Walker, Workers' Participation in Management in Practices, *International Institute of Labour Studies Bulletin No. 12*, (*1974*).
2. R. J. Adams and C.H. Rummel, Workers' Participation in Management in West Germany : Impact on the Worker, the Enterprise and the Trade Union, *Industrial Relations Journal*, *London*, *Vol.* 8, (*1977*), *No. 1*, p. 13.
3. Ibid, p. 13.
4. Y. Delamotte, British Productivity Agreements, German Rationalisation Agreements and French Employment Security Agreements, *International Institute of Labour Studies Bulletin*, *No. 9*, (*1972*), p. 39.
5. Ibid, p. 41.
6. Ibid, p. 38.
7. Ibid, p. 41.
8. Thomas Woodhouse, Technological Change Economic Recession and Industrial Democracy : A Case Study in England, in *Velko Rus, Akihiro Ishikawa and Thomas Woodhouse* (*eds.*), *Employment and Participation : Industrial Democracy in Crisis*, Chuo University Press, Tokyo, 1982, pp. 89-90.

9. Ibid, p. 89.
10. H. Clegg. op. cit., p. 38.
11. Ibid, p. 38.
12. W. L. Batt Jr. and E. Weinberg, Labour Management Co-operation Today, *Harvard Business Review*; January-February, 1978, p. 102.
13. M. W. Rodgers, Employee Decision Making in American Industry, *American Labour News Supplement*, Vol. 9, No. 3, March, 1982, p. 4.
14. Ibid, p. 4.
15. Ibid, p. 5.
16. M. Brower, Starting Labour Management Quality of Work-life Programs, *American Labour News Supplement*, Vol. X, No. 1, January 1983, p. 15.
17. F. Herzberg, Motivation and Innovation : Who are Workers Serving? *California Management Review*, Vol. 22, (1979), No. 2, p. 3.
18. R. Johansen, Changes in Work-planning Increase Shipboard Democracy, *National Labour Institute Bulletin*, Delhi, January 1977, p. 16.
19. P. G. Herbst and I. Getz, Work Oranisation at a Banking Branch, *National Labour Institute Bulletin*, January 1977, p. 32.
20. N. Mortensen, Industrial Participation in Advanced Capitalist Society : A Critical Review, in *Velko Rus, Akihiro Ishikawa and Thomas Woodhouse (eds.) op. cit.*, p. 51.
21. Japan Labour Bulletin (Japan Institute of Labour), Vol. 21, No. 2, December 1982, p. 4.
22. T. Inagami, Labour-Management Communication at the Workshop Level, *Japan Institute of Labour*, Tokyo, 1983, p. 29.
23. Ibid, p. 29.
24. Naomi Maruo, Japanese Model of Labour Management Relations and Workers' Participation, in *Volko Rus, Akihiro Ishikawa and Thomas Woodhouse (eds.), op.cit.*, p. 142.
25. T. Inagami, *op.cit.*, p. 23, See also *Naomi Maruo, op.cit.*, pp. 151-153.
26. K. Odaka : Japanese Style of Workers' Self Management : From Voluntary to the Autonomous Work Groups, in *Velko Rus, A. Ishikawa and T. Woodhouse (eds.), op.cit.*, p. 233.
27. T. Inagami, *op.cit.*, p. 32.
28. Ibid, p. 32.
29. Ibid., p. 34.
30. Ibid., p. 32.
31. Industrial Disputes Act, 1947, Sec 3(2).
32. Government of India, Planning Commission, Second Five Year Plan, Manager of Publications, Delhi, 1956, p. 577.
33. (a) Ministry of Labour, Govt. of India, Resolution No. 8.61011(4)/75-DK.I(B) dated the 30th October 1975, Sec. 5(i), (ii) and 7(i) and 7(ii);
    (b) Ministry of Labour, Govt. of India, Resolution dated January 4, 1977, Sec. 5(i), 7(ii) and 7(viii).
34. Ministry of Labour, Govt. of India, Pocket Book of Labour Statistics. 1982, p. 168.
35. International Centre for Public Enterprises in Developing Countries, Workers' Self Management and Participation, National Reports, Vol. II, ICPE, Ljubljana, 1981, p. 209.
36. Ibid, pp. 229-230.
37. Supplement Agreement for Closer Association of Employees with Management between the Tata Iron & Steel Co. Ltd., and Tata Workers' Union, August 4, 1956, Sections 9(a), 9(b), 11(a), 11(b) and 20(a).
38. L.P. Upadhyay, Manager Joint Consultation, Tata Steel Ltd., Workers' Participation in Industry, a Successful Experiment in Tata Steel (mimeographed for private circulation, 1978). Also see, Public Relations Department, Tata Iron & Steel Co. Ltd., Working Together : Closer Association of Employees with Management in Tata Steel.
39. Nitish De, Participative Redesign of Work System and the Quality of Working Life, National Labour Institute Bulletin, Vol. 3, No. 6, June 1977, p. 248.
40. Letter No. HYQA/QC/82 dated September 21, 1982 from Mr. N. Nagarajan, Manager, Q. A. of Bharat Heavy Electricals Ltd., Hyderabad, and the enclosed filled-in questionnaire and Note set for the Research Project on "Management of Labour Productivity in Manufacturing Industries under the Public Sector" conducted by the author of this paper under the sponsorship of Indian Institute of Management, Calcutta.
41. Indian Institute of Management, Calcutta, Proceedings of deliberations of the Group of Trade Union Representatives in the Workshop on Workers' Participation in Management and Equity, September 23-24, 1977.
42. International Centre for Public Enterprises in Developing Countries, *op. cit.*, p. 218.
43. Kyong-Dong Kim, The Labour Management Joint Consultation System in Korea, in *Velko Rus, Akihiro Ishikawa and T. Woodhouse, op. cit.*, p. 245.
44. International Centre for Public Enterprises in Developing Countries, *op. cit.*, p. 222.
45. Ibid, p. 223.

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Productivity
1983, XXIV, 3, 361-365

Planning for Domestic Tourism

ABHAY EKBOTE

In today's economic and political environment, one industry more truly a segment of the economy that moves to the forefront as the greatest single opportunity for economic, social and political exhange is tourism. Tourism to flourish needs planning which inter-alia involves upgradation of environment and maintenance of ecological balance.

Mr Abhay Ekbote, Management Consultant, Institute of Public Enterprise, Hyderabad.

Tourism in its broadest sense can do more to understanding among people, provide employment, create foreign exchange and raise living standards than any other economic force known. It is not dependent on a diminishing resource.

Tourism is not only the biggest business but also the world's fastest growing industry. It ranks next only to oil as the biggest organised industry in the world. Tourism denotes the temporary, short term movement of the people to destination outside the places where they normally live and work, and their activities during the stay at these destinations.

By its very nature tourism is a conspicuous phenomenon. The incidence of mobile population visiting places outside their normal domicile is an expression of the living standards and of the quality of life. It is one of the visible pressures, which modern civilisations exert on the environments. Tourism is a highly complex phenomenon. It involves the activities of not only large transport organisations and of various tourist services at the destination but also of Central and Local Government. Tourism today has become an important factor in the world trade and a major element in the balance of payments of many countries. It generates wealth and employment, it is a major source of income and employment for individuals in many places deficient in natural resources other than climate and scenery.

Light Industry—No Capital

It makes use of resources which may not be used other-wise, in particular of unemployed labour in developing countries and regions with few or no alternative sources of employment as in India. With all these inherent advantages Tourism is rightly defined as the light industry requiring no capital. There is no other industry on which so little capital (excluding investment on infrastructure) would have to be expanded which in turn would yield foreign exchange in a short time.

Tourism in a broad sense, includes both foreign and domestic tourists. About 75 to 80% of the World's tourist expenditure is made by visitors within their own countries. This equally holds good in India where Domestic Tourism is virtually a separate entity. The characteristics of the existing internal or domestic tourists, the nature of their demands, the kind of facilities that they seek and the pattern of their movement (itineraries) are substantially different from those of the foreigners.

The Government of India has successfully marketed 'India' as a tourist region abroad through Indian Tourism Development Corporation. The Market Research Division of the Department of Tourism, Government of India at Delhi has done appreciable work in identifying the profile of the foreign tourist, their demands and tastes and their travel pattern to foster the development of Foreign tourism. Their efforts have been adequately supported by the hotel industry which catered to the accommodation needs of the Foreign tourists by constructing state Hotels in the various tourist places, all over India. Not lagging behind, in its effort to help the foreign tourist go from one spot to the other, the Indian Airlines provided the tourists a network well connected to all the important tourist spots of India.

The table no. 1 reveals the trend in the arrivals of the foreign tourists in India from 1975 to 1980.

Foreign Exchange Earner

It is seen that the average increase in the arrivals of the Foreign tourists till 1979 was well around 15%.

Table No. 1

Trend in the Arrivals of Tourist in India

Year	No. of foreign tourist arrivals	% Increase
1975	4,65,275	—
1976	5,33,951	14.8
1977	6,40,422	19.9
1978	7,47,995	16.8
1979	7,64,781	2.2
1980	8,00,150	4.6
1981	8,53,200* estimated	—
1982	10,98,000* estimated	—

It is the country's fourth largest foreign exchange earners. In the sixth plan outlay for civil aviation and tourism of Rs. 965 crores, an amazingly small sum of just Rs. 30 crores has been earmarked for promotion of tourism. This amounts to a meagre sum of Rs. 6 crores per annum.

In its endeavour to promote foreign tourism the needs of a major segment of the tourist industry i.e. Domestic tourist was overlooked by the Government. There has been very little effort in the past by the government to let alone promote, but even identify the domestic tourists market. In all the five year plans, emphasis was placed on the demands of the Foreign tourist, very little mention, if so any has been made of the domestic tourist.

The sheer oversight of the department of Tourism is evinced from the fact that the market research division of the department of Tourism only attempted to compile and analyze the data on foriegn tourists and completely left out huge number of the domestic tourists. Further it is monitoring continuously the arrival of foreign tourist and the travelling pattern, nature of demand, origin etc. While information on these variables for the domestic tourist, wherever available is scanty and not sufficient for any useful analysis. It is very much surprising to note that the planning for tourist industry was done on information on expenditure, data profile, travel pattern etc., obtained on foriegn tourists only (while expenditure incurred by

domestic tourist which constituted approximately 80 to 85% of the total tourist expenditure) does not seem to have been taken into consideration at the time of planning or formulating of policies by the government.

The centre however, recently became aware of the importance of the problem of planning in the absence of sufficient data and information about tourist activity, and invited the four participating southern states (In the southern states, Tourism conference). Andhra Pradesh, Karnataka, Kerala and Tamil Nadu to draw up perspective plans for the next ten years so that the micro and macro level plans indicated their requirements regarding the number and category of hotels at the tourists spots, the tourist spots to be developed and the quantum of assistance needed from centre. This was a positive step taken in the right direction by the goverment in approaching to tackle the problem of promoting Domestic tourism and deserves a word of applause. However, this one time attempt does not itself serve as the solution to the problem.

Gearing for Promotion of Domestic Tourism

While a perspective plan may be the right step in planning for the development of Domestic Tourism this by itself will not help to achieve the objectives of the plans. In the absence of adequate data on the number, characteristics, nature of demand and the kind of facilities needed by the domestic tourist, it becomes increasingly difficult to draw up definite plans for the promotion of domestic tourism. The problem is further made complicated by the fact that the domestic market comprises of a heterogenous mix of individuals with different needs and tastes.

In order to build up the necessary data base for helping in formulating the plans and policies for the promotion of domestic tourism, the example of the European countries can be followed with the necessary changes to suit the Indian conditions. In order to promote domestic tourism, an understanding of the characteristic of the domestic tourism, the kinds of facilities they need, the nature of their demand, travel pattern etc., have to be identified in each state by the State Tourism Development Corporation. The information can be obtained periodically by conducting household survey with a primary objective to assess the travel pattern of the households. This may be termed as the National Holiday/Summer holiday survey and the short holiday survey depending upon the objectives of the survey. If the survey depending upon the objectives of the survey intends to obtain information on the travel habits of individuals for short duration trips (trips made for not more than 4 days) it would fall in the second category of survey while if the duration of stay outside the residence is long then it would fall, under the National Holiday/holiday survey. Generally the short duration trips would last not more than four days out of the residence of the traveller.

These surveys would provide information or data on the characteristics of the holiday market. The volume and value of holiday traffic to particular destination, its source of origin, socio-economic characteristics. average length of stay, expenditure under various heads such as hotel, transport etc. This information could be supplemented by data obained from various hotels on their room strength, occupancy rates, and from the State Road Transport Corporation, and private tour operators on the total number of travellers from and to the various tourist spots. This would provide the tourism development and plans for developing domestic tourism. For example when at the state level a profile of halts, duration of each halt etc. are obtained, this would help the Department in planning for the total fleet of buses to oprate in the direction(s) where the public is observed to be heavy. Further, it would also throw light upon the requirement of not only the type of hotel rooms required by each type. Apart from this the other daily requirements of the travelling public can also be estimated and accordingly plans could be formulated for the purpose of providing the necessary infrastructure facilities on the identified routes and direction.

Estimating Demand

Net Travel Propensity : The proportion of the total population or of a particular group in a population who have made at least one trip away from home in the period under investigation (normally 12 months), i.e. one or more trips as defined for the purpose of

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Management of Industrial Sickness

DR. S. S. SRIVASTAVA

The data of over 200 projects has been analysed for their main weaknesses as these projects could not successfully be completed in time. 44% of these projects have failed because of lack of good management and poor implementation. A model has been developed to predict incipient sickness in badly managed projects in different industrial areas. The model makes use of the financial ratios, operational ratios and technical ratios using multiple discriminant analysis. Discriminant equations for a few selected industries have been developed. Forewarning parameters have been derived which make it possible to sense the study of incipient sickness in industries. A close monitoring of some or all of these parameters can give an advance warning of the state of health of the industrial units.

Dr. S.S. Srivastava, Consultant, Delhi.

The sickness in Indian industry is spreading at an alarming rate according to the Reserve Bank of India Report 1980. The total of units reported as sick was 24,550 which locked up an amount of bank money of Rs. 1808.66 crores. The sickness is spread in small scale, medium and large units. The small scale sick units are 23,149 in number locking up an amount of Rs. 305.77 crores. In the medium scale industries with bank credit limit of Rs. 1 crore, there are 992 sick units locking up a capital of Rs. 178.42 crores. There are 409 large units enjoying a credit of more than Rs. 1 crore locking up an amount of Rs. 1324.47 crores. If, however, the rescheduling of payment is also considered, the total locked up capital in all sick industries would easily exceed Rs. 7000 crores. The financial assistance of sick units from all sources has already crossed Rs. 3000 crores by the end of 1981. In 1982 more of sick units have been added to all the three groups. The assistance provided to sick units and the number of industrial undertakings whose management has been taken over by Government under the Industries Act, 1951 has been steadily increasing every year.

There are several causes of increasing industrial sickness and the one that has been identified in all the three groups of industries is the miss management of industrial units. There are a few additional causes like non-availability of raw material, power shortage, increased cost and obsolescense of plant and equipment and out-dated technology. Poor industrial relations and unhealthy trade unionism has also affected some units.

if it will raise itself to a high level of true industrial statesmanship. To illustrate the positive impact of this type of statesmanship, a few such examples from other industries also will be discussed briefly.

There is one lesson which, throughout the many decades of the union movement, its leadership has been lax in learning and in teaching to its membership : in the last analysis, management and labor are in the same boat in an often stormy economy and had better row together lest they sink together. While it is understandable that labor thinks in terms of maximizing its share of industry's income, equal and even greater attention should be given—as a matter of labor's self-interest—to maximizing that income. Union leaders, consequently, should echo management's concern over such hindrances to employees' productivity as obsolete and outdated work rules.

The "same boat" concept should induce union leadership to be the peak of its statesmanship at the collective bargaining table, where work rules which impede or improve employees' productivity are established. The issue is not a matter of making employees work harder. Harder is not necessarily better. Frederick Winslow Taylor, the "father" of time-and-motion study, amazed both management and labor by demonstrating that a man who loaded heavy iron ingots into a freight car could double his production by cutting his worktime in half; alternately working fifteen minutes and resting fifteen minutes. The function of work rules should be to enable employees to work more safely and more productively.

Manpower Work Rules in the Railroad Industry

The railroad industry, which is in a desperate plight (due to a very substantial degree to years of oppressive government regulation), provides an informative example of the deleterious effect on employees' productivity of work rules imposed on management by labor at the collective bargaining table. Labor imposed work rules for the short-run purpose of creating more jobs, but with inadequate attention to the long-run need for employees to have a healthy industry in which to enjoy lifelong jobs.

A classic example was the labor contract of 1959 which provided that coal-shoveling firemen, with no more steam engines on which to work, could ride until their retirement dates on the new diesel-electric locomotives—which appreciably reduced the industry's productivity statistics and financial health. No proof was demonstrated at the time that this arrangement was the only, or best, solution to the firemen's pending unemployment.

The cause of the firemen's predicament was technological change, which increasingly makes trades and skills obsolete. Statesmanlike cooperation is required between union and management officials to plan means for mitigating the impact of technological change on displaced employees, partly to avoid reduction in productivity when unneeded employees are retained, and partly to avoid the lowered self-esteem of employees who are forced into a position of receiving a good day's pay without a good day's work. An obvious solution, often practiced, is retraining, and the need for it should be anticipated.

In 1959, the railroad industry faced another situation, one which was less critical at the time but, in the end, more cataclysmic. That year, the industry announced that it desired to void the decades-old tradition—written into its bargaining agreements—of work requiring two, and sometimes three, brakemen on a train and two on a yard crew. The industry claimed that in most situations one brakeman was sufficient. Productivity statistics certainly were involved, but the industry was not thinking then in terms of productivity, the concern was its poor financial status.

This was an opportunity for union statesmanship to rally to the support of a sick industry by working with management toward the solution of a manpower problem. The brakemen's union—or, rather, its dynamic president—was adamant in its opposition, however. The proposal was unthinkable for the president, and for thirteen years he fought the industry, and won.

The railroad "crew size" dispute is particularly interesting because what the industry basically wanted was something in the area of economic philosophy: the "management right" in a free enter-

prise environment to determine the number of employees in a work force, a principle generally not challenged by unions in any industry. The common union argument in these cases is safety and work burden particularly the former.

In the case of the brakemen, the union claimed that safety and work burden made the subject of the number of brakemen in a crew properly one to be resolved across the collective bargaining table. Yet such disputed questions in labor-management relations should be, and easily can be, settled by arbitration initiated by an individual employee who believes that his job is hazardous or too difficult without an additional employee working with him.

The "crew size dispute" was in constant stalemate at the bargaining table from 1959 to 1972. President Kennedy sought to break the impasse by appointing a Railroad Commission in 1961 to investigate the matter. But its findings were inconclusive; management's claim to a "management right" should not be considered "at this time," it stated, and told the parties to return to their table and bargain some more. In 1963 the President acted again, appointing Emergency Board No. 154. Side-stepping the "management rights" issue, the Board stated that safety and work burden were issues that should be settled locally on individual railroads and not by industrywise negotiations and added its belief that "no force reductions should be made (on crews) except by natural attrition." At the level of economic philosophy, that recommendation infers that once an employee has been hired his employer owes him, as a matter of the employee's rights, a lifetime job. If the courts were to adopt that philosophy, it would be the end of industrial productivity statistics.

In 1964, the congressionally established Arbitration Board No. 282 rendered its decision, which ignored "management rights" and told the industry to bargain some more. Either party in a stalemate on any particular railroad was allowed the right to invoke arbitration. Management from several railroads called in arbitrators—the only time during the dispute that anyone left the bargaining table in a serious effort to obtain the facts regarding safety and work burden—and the arbitrators granted management reduced crews (one brakeman per crew) for most of those arbitrated.

As matter of mutual self-defense, throughout the dispute the railroads attempted to deal with the union on an industry-wise basis, as is the industry's practice regarding wages and fringe benefits. In 1968, however, the Supreme Court ruled that the "crew size dispute" be handled individually on each rail-road—whereupon the union used its strike power at one railroad after another until by 1972 it had won back all the brakemen's jobs which the arbitrators had abolished in 1964. There were, however, some extremely interesting exceptions.

The significance of the exceptions lies in the statesman like manner in which certain union officials, associated with individual railroads in particularly bad financial situations, listened to management's plea for relief from unnecessary brakemen and cooperated at the bargaining table to rewrite the applicable work rules and pay scales. Several case studies follow.

Providence & Worchester Railroad: This fifty-mile-long railroad began operation in 1973 after the Penn Central sought to abandon the trackage as a $ 3 million loser. In its first year, it grossed nearly $ 5 million, earning $ 2.2 million in net revenue and almost $ 800,000 in net income, made possible by the union's cooperation. Each crew had only one brakeman, and job titles (requiring the cooperation of other unions) were abolished so that employees could do whatever work they saw should be done instead of being limited to individual trades. The 100-mile rule, under which an extra day's pay was granted for travel beyond 100 miles per day, was abolished, although schedules called for considerable overtime. In return for these union concessions, this sixty-employee railroad placed a brakeman on the board of directors, provided a guaranteed annual wage of $ 16,640, and established a profit-sharing plan which could be as much as $ 3,500 or more annually, payable at management's option in cash or stock.

Florida East Coast Railway: In the mid-1960s, the operating unions on this financially troubled railroad disbanded themselves. The work rules were

simplified and the railroad began operating through freight trains from Jacksonville to Miami with only an engineer and a conductor (no brakeman), and the oddity of no caboose.

Chicago & North Werstern Railroad : The employees saved this railroad by buying up its stock and controlling its management, and in 1973 the brakemen's union agreed to one-brakeman crews with increased pay for the single brakeman and a provision that surplus brakemen would be eliminated only by attrition.

Reading Railroad : This railroad recovered from the brink of bankruptcy in the mid-1960s because the unions permitted a relaxation of restrictive work rules and because management and labor, working as a team and facing severe competition from other railroads serving the same area, decided on the unique idea, for the railroad industry, of getting more business by taking it away from the truckers. The idea was to offer large-tonnage shippers what the truckers were providing : Same-day delivery instead of the three days which the restrictive work rules necessitated for the sixty-mile run between Philadelphia and Reading.

The Reading Railroad is an encouraging example of what labor-management cooperation can accomplish in improving labor productivity. Under the old work rules, one or more freight cars at a shipper's dock would be moved by a train crew to the nearest terminal, where a yard crew would assemble them with other cars into a train. The next day, a train crew would move the assembled train to another terminal. On the third day, a Reading yard crew would give the cars under discussion to a train crew for hauling to the consignee's dock. When both time and labour cost are considered, it is no wonder that the truckers took the short-haul business away from the railroads decades ago.

The Reading Railroad's management approached the unions with a proposal to eliminate all the work rules. The unions accepted the proposal and Reading's progressive "Bee Line" service was inaugurated.

Other Industries

Before mentioning other industries, an important historical development should be mentioned. During a century of negotiations between management and organized labor in all industries, the practice has been for labor to seek something and for management to give it. In other words, the traditional bargaining table has been mostly a one-way street. The reasons why that was a necessity in the early days are well known, but the substantial concessions that labor has extracted from management make it reasonable to argue that situations are now to be expected where management seeks something and labor gives it, employee productivity being in that category. Four case studies will illustrate situations where management did the seeking and where labor, acting in a statesman like manner, did the giving.[2]

Kaiser Steel : The first case involves the disastrous 116-day steel strike in 1959. Kaiser Steel and its employees avoided that strike by breaking away from the national situation and solving their mutual problems inside the company by means of their well-named "Fruits" Committee (Committee to Develop a Long-Range Plan for the Equitable Sharing of the Fruits of Economic Progress).

West Coast Longshoremen : The West Coast longshoremen, under the leadership of Harry Bridges, solved a serious employee productivity problem by signing with the dock companies the 1960 Mechanization and Modernization Agreement, which eliminated contractual "make-work" rules, permitted the companies to reduce their labor costs by mechanizing the loading and unloading of ships, reduced the expense incurred by the time ships being tied up at docks, and guaranteed the existing work force against loss of jobs while giving it a portion of the net savings from machanization, preserving its safety rules, and ensuring it of no "speedup" acts by management.

The City of Jamestown : The third case is unique because the impetus for labor management cooperation developed not within the ranks of labor and management but in the civic community in which they worked, the economically decaying city of Jamestown, New York. The community's civic leaders induced labor and management in four dying industries located in the city to establish the 1971 Labor-Management

Committee of Jamestown, which after a slow and painful start began reversing eighteen years of declining industrial activity. Employee productivity was selected as the primary objective : waste and absenteeism were to be reduced, job lossess resulting from the committee's activities were to be avoided, and the community's reputation as a source of productive labor in a good labour-management relations environment was to be developed. The committee saved the city; within a year strikes had been eliminated, and one company negotiated a contract which tied wages to productivity increase.

Jamestown's economic momentum increased in 1973, assisted by federal grants to set up labor-management committees.

For the first time in fifty years several plants were saved from liquidation, partly as a result of the committee's efforts and partly by the improved labor-manegement relations climate. Two companies announced major expansion programs, and a large new company entered the area. The community's unemployment rate dropped, and the number of manufacturing employees increased.

The Steel Industry : The fourth and final case is the steel industry (apart from the Kaiser Steel case already mentioned), which in 1971 took a hard look at the situation created by foreign competition. Japan, for example, was underselling Kaiser Steel in galvanized pipe even though it was using California iron ore. The industry approached the steelworkers' union on the subject of productivity, and some 250 labor-management committees among ten basic steel companies were formed. The committees were titled Employment Security and Productivity Committee, a psychological device to indicate that benefits would not accrue solely to management. From the beginning it was recognized that constructive results would be proportional to how well the committee worked with employees, alleviating their fear of "speedup" and firing, and enhancing their morale and their motivation to cooperate with committee projects. The committees improved productivity by such means as avoidance of bad quality, better identification of warehoused steel, more efficient handling of scrap, energy conservation, more efficient phasing out of old equipment, and better care of new equipment. The union's leader, I.W. Abel, credited the committee with laying the foundation on which labor and management built the historic 1973 Experimental Negotiation Agreement, used for the first time in the 1974 negotiations. This agreement established a stable peace in the industry by providing that, in the event of deadlocked negotiations, the result would be arbitration instead of a strike.

These cases are success stories. Unofortunately, however, they are exceptions and not the rule in labor-management relations.

Union Statesmanship

One of the glories of the American way is its devotion to progress in human affairs in the "the pursuit of happiness." Selfish management and selfish unions—and there is much of each—are not conducive to that goal. Statesmanship not only at the governmental level but also in the ranks of industrial and union leaders is required if this nation is to realize the dream of its founding fathers.

Labor productivity is one of the elements in the program for an ever improving economy, not only for the United States sake but also as an example for the underdeveloped nations. Over the last decade, the news media have dramatized the fact that, according to the government's appraisal, there is 10 per cent poverty in this country, implying that the dream of the founding fathers has failed. The positive view must be emphasized : The United States has reached 90 per cent of its objective, and should roll up its sleeves—with government, management, and labor working cooperatively—to go the last 10 per cent of the way.

It is to be hoped that union statesmanship will see its opportunity and do its part by leading organized labor, working productively, into a prosperous economy.

Job security is a positive concept. As such, it is something that can be hoped for and worked toward. Human nature being what it is, however, the negative side of job security is more often emphasized: fear of unemployment. That fear, although its reality must

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Even with the often perceived macro-level necessity of productivity as the means of expediting economic growth—a key for early eradication of poverty, one finds relatively very little in terms of an organised effort for translating it into action. Similar to what other societies have experienced in our country too, it is not uncommon to see a vast majority of people still considering productivity as someone else's concern. This paper focusses on the need for building a deliberate well-organised effort for management of productivity in the entire organised sector and otherwise.

Our respected Prime Minister's call to observe the Year 1982 as Productivity Year came to us at a time when BHEL operations were facing growing pressure of increasing cost of inputs. Material costs had gone up substantially in the preceeding 3-4 years, interest on borrowings had more than doubled and enhancement in personnel payments was due to be taken up at the ensuing wage agreement. On the other hand was BHEL's determination to match the international enterprises in the competitive market environment, at a time when power equipment manufacturing capacity in developed countries was grossly under-utilised. The call to observe 1982-83 as the Productivity Year thus provided the right impetus for introducing the productivity dimension. Following are some of the essential features of the BHEL experience.

A. Intensive Group Interaction : Intensive group activity generated at the senior management levels was subsequently spread down the line through a chain of productivity coordinators who were identified in each work area.

B. On the Job Productivity Problem Solving : Groups—small and large, were encouraged to locate productivity improvement projects. As many as 1053 projects were identified and were taken up for investigation by different groups on a planned basis. This in turn created a large on-the-job environment and a favourable psychology for experiment based learning opportunity.

C. Class-Room Education : The Divisional training centres and the Corporate Management Development Institute reoriented their programmes laying greater stress on productivity improvement.

D. Intensive Workers' Training : In this direction one of the Division took the lead by developing a crash productivity course to train 2600 artisans. A comprehensive 2-day package "Greater Prosperity Through Higher Productivity" was introduced for batches of 30 artisans. In all 12,800 employees were trained during the Productivity Year. Teaching aids like close circuit television, a slide projector, overhead projector, films and charts made the training highly effective.

To bring about core-impact, communication with the employees through their mother tongue became the policy. The awareness that productivity improvement and poverty eradication and increasing employment opportunities brought greater involvement on the part of employees.

E. Feedback Survey—Training Impact : In a subsequent feedback survey the workers showed a more positive response in their respective areas of work. Other than their involvement in reduction of wastage etc., their responses to supervisors and relationships with their own colleagues improved.

F. Future Training Needs Reinforcement : The success achieved has encouraged us to extent the training programme to the entire population of the company including supervisors and all levels of Executives. These are currently under execution.

III. Enriching Motivational Processes

Conflicts in the managers' minds about the choice of motivators poses a formidable problem. Some consider financial reward as the only real motivator whereas others view it just one of the many motivators. In operating BHEL's Productivity Movement emphasis has been mainly on the non-financial motivators. Some of the more prominent motivators utilised in the process included :

A. Communication : Intensified communication established through seminars, workshops, conferences, and a case reporting journal developed during the year under the caption 'Productivity Movement in BHEL' helped the spread and snow-balling of the movement and also in reinforcing the competitive processes.

B. Recognition & Rewards : Company level and Divisional level awards were instituted to provide recognition to the best performing groups. To enable retaining of focus on achieving a better culture of work, and not mere physical ratios, emphasis on the following functional elements was considered in evaluating the best performer.

1. Commitment and intensity of effort in planning for productivity including long range and annual budgeting.
2. Identifying and allocating of organisation for accelerated on-going productivity effort.
3. Monitoring and control at group, divisional and corporate level—frequency and regularity of review.
4. Training of artisans, supervisors and executives.
5. Promotional efforts.
6. Number of employees, involved in the effort through any mode like volunteering or nominated individuals/groups including Quality Circles or the Productivity Enhancement Groups.

7. Cultivation of involvement and participation culture towards teamed-up working, where employees including executives, supervisors and workers jointly participate in the effort in all stages commencing from planning.
8. Achievement through productivity projects both qualitative and quantitative vis-a-vis the 1982-83 plan.
9. Effectiveness of coordination and facilitating/ organisation.
10. Identifying critical areas for improvement, seeking expert staff help (internal and external) and implementation of recommendations.

C. Perpetuating Learning : Moving up the experience sharing process through conduct of workshops/ seminars at the divisional level, the inter-divisional level on to the inter public sector enterprises became a great source of inspiration and encouragement to those involved in the effort. The latter was organised as a sequel to a decision of Heavy Engineering Sectoral Group of which I happen to be the Chairman. A workshop thus conducted under the joint auspices of BPE and BHEL not only provided a healthy outlet for the work conducted in the organisation but brought in the organisation's fold considerable experience from other public sector undertakings. Their recommendations lead to the formulation of a model organisation for productivity management.

With our eyes set on sustenance of a new work culture in the long run we experienced the inherent motivational features which provide perpetuating learning. Similarly spreading the new culture to sister organisations revealed the generation of mutually supporting forces which developed in the process. Keeping this philosophy in view BHEL welcomed the request for a major participation in the AIMA's annual convention. The Convention theme was "Productivity—The Current Managerial Challenge".

D. Data/Information Generation: It is common knowledge that specific target setting, precise time-based planning and clearcut laying out of responsibility with reference to measurement oriented datum lines, creates a much favourable climate for achievers as compared to general lose situations. In the latter case instructions from the top are usually perceived in their worst form as exhortations. It is human nature to respond to the latter only in a coercive work environment. On the contrary the available organisational ethos in the country today is becoming more and more democratic with time. In such a situation information dissemination and creating a logical response act as a much greater motivational force.

IV. Participation Synthesised

Any number of studies and researches are available from the developed countries which indicate a direct relation between the participative style of management and productivity.

In practice, however, managers, though recognising its relevance, find it very hard to put it in action. BHEL has been more fortunate in this respect, as a variety of methodologies leading to participation have been already experimented by various divisions from time to time like Work Redesign, Team Building, Organisation Development, Communication and lately Quality Circles. Our organised thrust during the Productivity Year provided the right environment for their synthesis and integrated well with the effort. Two focal areas emerged :

A. Workers' Involvement Through Quality Circles : The planned intensification of the Quality Circles movement was extended from one division where it was started to other divisions of the Company. The number of circles multiplied to 268 and became an excellent example of workers' involvement in the productivity process.

B. Employee Productivity Enhancement Groups : In addition to the Quality Circles some divisions felt the need for constituting special groups covering such areas of study which require specialist/managerial inputs. Accordingly, productivity Enhancement Groups were constituted to tackle areas requiring intensive technical inputs or specialist methodologies like Industrial Emgineering, Computers, Organisation Research. These groups included executives, supervisors specialists and workers. In this case the group developnent

became part of an organised management effort bringing out participation in a planned manner.

V. The Movement

Phase I-Planning & Productivity Improvement Projects Identification : This phase initiated a planning process wherein the Divisions split into convenient Responsibility Centres (mostly at the departmental levels yet others going to the levels below). These centres identified areas for productivity improvement with stress on possible improvement from within. This emphasis is essential to bring forth the concept of 'looking within' to impact change, a feature often lost in the generalised approach to productivity improvement. At this juncture it may be worth referring to John Steward of US Consultants from Mckenzie & Co., "Although it is Hard to Find a Manager Who Would Not Agree That Productivity is a Problem But It is Harder To Find one Who Agrees That It is His Problem".

It has indeed been a heartening experience to see, particularly Manufacturing Divisions, taking the lead to establish the planning process. The planning activity subsequently spread all over the organisation and in the first run 1053 projects got located for investigation.

Phase 2-Monitoring & Review : Once the plans got crystalised, Divisions set for themselves monitoring mechanisms most suited to each. Various methods of monitoring and progressing the projects got developed. A reporting link with the Corporate Productivity Management Desk has been established.

Phase 3-Sustenance : To enable sustaining of the movement the organisation is currently engaged in linking the effort with the following :—

1. Making Productivity Reporting a part of Corporate MIS
2. Inclusion of Productivity Improvement as a Part of Annual Budgeting Exercise
3. Recognition System : A process of public recognition in terms of an annual Divisional Award for the best group has been launched.

VI. Achievements

The joint conscious effort in the Productivity Year had its rewards. The assessment conducted by teams which evaluated each productivity project added upto Rs. 5.41 crores during the year.

In addition to the financial gains the Company also registered qualitative improvement in many areas like :

—Improvement in working conditions.

—Reduced down time of machine.

—Reduction in rework/rejection.

—Reduction in manufacturing cycle time.

—Increased safety.

—Improved cash inflow.

—Quicker flow of information through computerisation.

—Reduction in inventories.

—Reduction in work load of critical machines by offloading them to non-critical machines through process of improvements.

—Reduced operator factigue due to process improvements.

VII. The National Award

The combined productivity efforts brought to BHEL the national acclaim of "Best Productivity Performance Award" for the Productivity Year of the Heavy Engineering Group. Such national recognition has given our employees a tremendous satisfaction and reinforced their enthusiasm for continuing with this effort. Needless to say that this is yet another exmple of how a non-financial motivator enriches the motivational process far beyond the immediate money gains.

VIII. Productivity, an Ongoing Programme

Generation of new work cultures, if attempted through an organised effort, have an in-built snowballing feature. Given the right quantities of boost at appropriate times the processes involved in the effort lead to a continuing enrichment of the group effort.

A. 1983-84 and Beyond: BHEL has already developed its 1983-84 productivity improvement programme incorporating 1332 projects to cover area like energy, innovating technology, resource utilisation, human resources, and systems including computers. An expected saving exclusively on account of productivity projects is more than Rs. 20 crores during this year in addition to many intangible benefits.

B. Enriching the Managerial Dynamics: To maintain continuous support to the programme beyond the Productivity Year conscious efforts are being made by the various levels of the hierarchy in the following areas to enrich the processes further :

—Productivity planning and monitoring effort.

—Building model productivity Coordination Centres.

—Intensified training, to expand the movement through programmes designed for a multiplier effect. Through this managers/executives will not only learn but also teach productivity methodology.

—Reinforcing cost/statistical analysis for bringing promptness and control.

Lessons for Future

Looking in retrospect, the detailed components which a large organisation like BHEL has experimented with the launch of the productivity movement has taught us many a lessons. On the features supporting the success one could list three focal points i.e. total commitment of the top and senior management; utilising the positive features of the organisation's agility; and infusion of the thought process by an institutionalised catalyst group.

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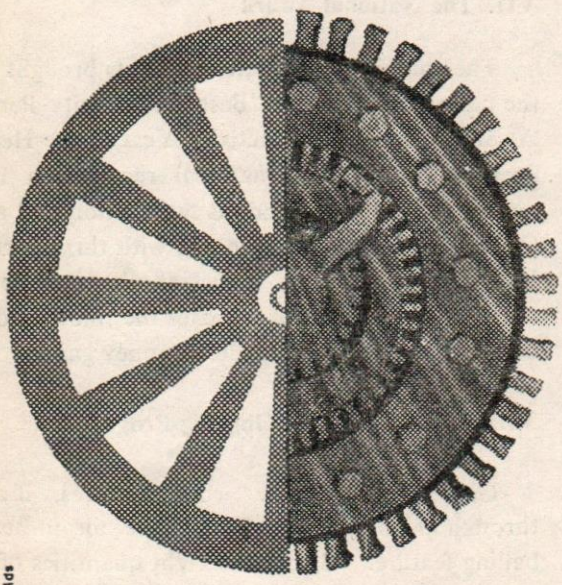

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Productivity
1983, XXIV, 3, 387-393

Productivity and Industrial Relations: The Role of International Labour Standards



PAUL BANGASSER

At the enterprise level as well as at the national level, the experience shows that, what benefits the over all group will not necessarily benefit the individual members. The asymmetry of costs and benefits leads to varying degrees of resistance to productivity improvement measures. It is here, then climate of Industrial relations becomes a critical variable. The author discusses the role of International Labour Standards in this context.

Mr Paul Bangasser, is Deputy Director, ILO Area Office, New Delhi. The views expressed in this paper are those of the author and do not necessarily reflect those of the International Labour Organisation.

Productivity can be somewhat like the proverbial elephant examined by the seven blind sages. Each specialist tends to side the productivity question in terms of his/her own specialisation. A vocational trainer, for instance, thinks in terms of workers' skills and abilities; an industrial engineer in terms of machinery and plant layout; and so forth. As in the case of the sages, each of these analysis is partially right... and therefore partially wrong. Productivity, and its improvement, depends on many variables : the skills and experience of the workers, the effectiveness of managements, the quality of raw materials, the appropriateness and reliability of plant and equipment, etc... All of these factors will need to be examined and improved *jointly* in any serious effort to improve a specific enterprise's productivity.

But in addition to these questions of *how* to improve productivity, there is also the question "why?" It is often easy to show that improved productivity is beneficial to the immediate enterprise and also to the society as a whole. But it is not always evident that this improvement will benefit the person expected to produce it. Indeed, it is not difficult to imagine circumstances in which he might even suffer, because measures to enhance productivity mean changes : new machinery or tools, different product designs, different raw materials, shifts in plant layout, etc. And any change involves a risk. Normally, the bigger the change (not

just "big" in money terms but also in organisational/social/psychological terms), the more likely the final results will be different from what was planned; and not all of these results will necessarily be desirable.

Even if things do work out as expected, there is still the problem of who will bear the costs (again, not just financial costs but also organisational/social/psychological costs) vis-a-vis who will reap the benefits. At the enterprise level as well as at the national level, it does not necessarily follow that what benefits the overall group will also benefit (and be perceived as benefiting) its individual members or sub-groups. One can perhaps go further and predict it is quite unlikely, in absence of some explicit mechanism for this purpose, that these benefits will be equally distributed. The same will also hold true for the social and psychological costs of productivity improvements. Some individuals or sub-groups will almost certainly have to make greater adjustments and/or bear more risks than others. The distribution of these costs unfortunately is rarely the symmetrical mirror-image of the distribution of benefits. Given this asymmetry of costs and benefits, it should not be surprising to find varying degrees of resistance to specific productivity improvement measures notwithstanding a wide and genuine agreement that a rising productivity trend is to everyone's long-term benefit.

This "fear" of productivity changes exists in industrialised as well as developing societies. Dr. Markley Roberts, Research Economist for the American Federation of Labour and Congress of Industrial Organisation stated recently while on a lecture tour of India that :

> "We (the AFL-CIO) believe that raising productivity and technological progress are essential to raise the standards of living. But we also see dangers to workers and their families.... There are possible adverse effects like displacement from jobs and lowered earnings."[1]

Similar apprehensions have been expressed by many trade unionists from both developed and developing countries. Labour is not opposed in principle to productivity changes; but it is decidedly cautions about specific managerial initiatives towards productivity enhancement and the actual or potential problems these might create for individual workers. It is also known that no productivity measure can achieve its hoped-for impact without at least the passive acceptance (but preferably the active cooperation) of the workers directly involved.

Clearly then, the climate of industrial relations has a critical influence on productivity improvement campaigns. If the relationship between workers and employers is charaterised by a spirit of genuine partnership and *joint* endeavour, then the individual worker will be less apprehensive about changes in his/her immediate work package. If management makes a regular and systematic practice of seeking out and incorporating the views of workers and their representatives before making important decisions, then trade unions would become less suspicious about employers' "hidden motives". If workers representatives, when dealing with management at the enterprise level, limit their attention to the legitimate interests of the workers directly involved and if they genuinely accept the need for a healthy enterprise as a paramount criterion, then management would feel confident in incorporating workers' representatives' views in its decisions.

India's Union Minister for Labour and Rehabilitation, the Honourable Shri Veerendra Patil has recently put the problem as follows :

> "...the nature of the relationship between employer and employee has changed from that of master/servant to that of a functional relationship where management and labour work as equal partners in a joint enterprise performing different functions; the workers have as much interest in the working of an enterprise as the management ... Correspondingly, the workers should have a say in the decicision-making process of the undertakings. In other words, the workers should be fully involved in any measures designed to achieve prosperity through productivity and appropriate institutional arrangements should be made for the purpose."[2]

These principles are widely accepted at least in the abstract. Why, then, are they not more widely followed in practice in India ? There is no simple answer to

this question; but there seem to be two broad factors militating against them. First is a sort of vicious circle of attitudes. The absence of a feeling of personal involvement and vested interest in the enterprise on the part of the worker and his representatives tends to call forth an authoritarian style on the part of management, with little or no consultation and involvement of workers in decision making. And vice versa ! When management isolates itself from the views and opinions of those directly involved and simply hands down its decisions from "on high", this undercuts and frustrates any spontaneous initiatives by workers to get involved and take an active role in their workplace. Both these attitudes (or either of them) foster a pattern of labour-management relations in which each side views the other with suspicion and mistrust, which in turn encourages the worker and his representative (s) to resist any change in the status quo which doesn't offer him immediate and tangible benefits. Each of these attitudes feeds upon, and is reinforced by, the other in a more or less self-sustaining vicious circle of hostility and suspicion.[3]

The second factor is that, while focussing attention on the long-term harmony of interests between employers and employees, we may tend to overlook the fact that at least some of their respective interests do not coincide. While there is no doubt of the mutual long-term benefits deriving from a healthy productive enterprise, a specific proposal may affect them very differently over the short-run. Furthermore, management and labour may have decidedly different priorities from each other, both in the short and long-run. For example, management may want to increase productivity through greater utilisation of machinery and therefore calls on workers to put in more overtime. The trade union, on the other hand, may see this as a means of avoiding hiring additional employees (and incidentally, potential union members). Similarly, many productivity improvement measures focus on more efficient use of raw matarials, less wastage, etc. which will call for tighter quality control, more precise workmanship, and greater industrial self-discipline on the part of the worker. It is hardly surprisingly that the worker would feel compelled to make most of the immediate sacrifices while being expected to content himself with a rather ethereal and distant rewards. Likewise, labour and management may have quite different views on what they respectively consider as "fair" or "adequate" return on investment. Experience suggests that these divergences of priorities and interests exist in varying degree regardless of whether the enterprise is in the private or the public sector.

Given such a vicious circle of attitudes and this basic divergence of priorities, how then can the industrial relations "foundation" for productivity growth be developed? Much has been written on the subject of productivity, and a number of specific "tools" are available. One such "tools", however, has received relatively little attention. This is the use of international labour standards as a means of setting disputes and minimizing labour-management frictions at the level of the enterprise.

Industrial relations issues can generally be classified into two broad categories. "Interest" issues are the bread and butter of the collective bargaining process. They focus primarily on how the fruits of labour will be distributed. As such, they tend to be issues concerning groups of workers. "Rights" issues, on the other hand, relate to the respective duties and privileges which pertain to the employment relationship. They are often centered on procedural questions such as how a decision (e.g. retrenchment) is implemented. They tend to be more individualised than "interest" issues. Available statistics indicate that "interest" issues relating to wages and allowances and bonuses account for about 40% of the total man-days of work lost through industrial disputes in India.[4] What is of interest here is that a very substantial portion (indeed the majority) of industrial disputes and lost production are not related to demands for more money. The stem from "rights" issues such as personnel and retrenchment, leave and hours of work, discipline and violence, and other such matters.

How can international labour standards help resolve these disputes and thereby "recoup" this lost output? International labour standards are not in themselves *solutions* to industrial disputes. Rather, they constitute a coherent collection of guidelines and guiding principles by which the parties themselves can reach mutually agreeable solutions. A meter stick by itself

is incapable of measuring a length of cloth. Someone must physically take it up and compare the item to be measured against this pre-established standard. Similarly, in an industrial relations issue, someone must take the known facts and compare them against some sort of norm or standard. But for virtually every such issue, there will be at least two sides, often several sides; and each side will be comparing and weighing these facts against what it consideres to be "normal". If each side is judging the facts against a different norm, then the chances of reaching a mutually agreed conclusion are slim indeed, and the issue will must likely be settled on the basis of raw power. In other words, the vicious circle of attitudes is perpetuated and the seeds of further disputes are planted. On the other hand, if the facts are jointly compared against a neutral and mutually accepted standard, then the chances of resolving the issue amicably are significantly improved and the prospects of future industrial harmony are strengthened.

International labour standards play precisely such a role. They are promulgated only after thorough tripartite examination of their contents. Thus, both workers and employers can be confident they respect their respective legitimate interests. They are formulated collectively by individuals from every political system and cultural background. Hence the resulting standards are politically and culturally "neutral". They are, in short, ideally suited to play the role of neutral, objective, outside standard to which both sides of an industrial dispute can turn for guidance.

There are several different types of international labour standards, with differing degrees of rigour and applicability.[5] International labour *Conventions* and *Recommendations* are the most rigorous and widely applicable. These are formally adopted by the tripartite delegations at the International Labour Conference after an extensive process which includes a detailed analysis of relevant national laws and practices, independent tripartite examinntion at the national, international and sometimes regional levels plus extensive debate and discussion during at least two regular sessions of the International Labour Conference. All member states of the ILO are obliged to bring each Convention and Recommendation to the attention of the competent authorities (normally the Parliament) "for the enactment legislations or other action" suitable to national conditions.

Through the application mechanisms for these Conventions and Recommendations, and in particular through the adjudication of formal complaints and representations by the committees of experts on freedom of association and application of standards, there has also developed a substantial body of *international labour jurisprudence*—a continuous collection of reasoned opinions, decisions and definitions relating to labour matters and to the detailed implementation of international labour Conventions and Recommendations. These individual case-by-case interpretations give concrete practical "flesh" to the framework of the Conventions and Recommendations.

The annual International Labour Conference also passes from time to time technical resolutions, such as the resolution concerning "conditions and equality of treatment of migrant workers" or "labour and social implications of automation and other technological developments". These resolutions are not subject to as through a process of examination and discussion as are Conventions and Recommendations. Nevertheless, they represent a sort of "sounding of the house" on that specific subject and thus constitute a good indicator of the current tripartite international consensus on that particular issue.

In addition to the various deliberations of the International Labour Conference, the ILO maintains a series of standing tripartite "Industrial Committees" (inland transport, iron and steel, metal trades, etc.), each of which meets every three to four years to review the situation in that industry. As in the case of conference resolutions, the pronouncements of these meetings do not reflect the same degree of analysis and discussion as Conventions and Recommendations. They do, however, reflect accurately the current tripartite international consensus on particular issues for that industry. They also have the advantage of being somewhat more "focussed" than the more universal pronouncements of the International Labour Conference.

It is worth noting that many of the topics which

end up as international Conventions and/or Recommendations actually start out as resolutions of a regional conference of industrial committee meeting. Thus, there is considerable complementarity and reinforcement among the different types of international labour standards. It is also worth noting that, whereas all of these documents are formally voted upon, the actual results of the votes are normally overwhelmingly "for", with at most "abstentions" but rarely many "against" votes. This stems from the principle that the basic moral force behind all international labour standards depends upon how accurately the document reflects the genuine consensus of independent representatives of employers and workers and governments coming from a wide variety of political systems and cultural backgrounds. Consequently if there are major reservations regarding a particular item on the part of a substantial portion of ILO constituents, then even if the final instrument manages to garner a majority of the votes it would still lack the moral force and persuasiveness necessary to be effective as an international labour standard. Therefore, the practice is followed of continuing to debate, to amend and to adjust the text until a genuine consensus is reached.

How can these documents adopted by high-level international meetings be of relevance to the "factory level" relations between labour and managemenet in India ? Let us consider a practical example. The Indian Labour Journal reports that in June 1983 "major"[6] ongoing industrial disputes related to retrenchment or layoff of workers had, so far, generated a total of nearly one million mandays of lost production.[7] In 1982, after two years of extensive study and debate, the International Labour Conference adopted a convention (No. 158) and a complementary recommendation (No. 166) on "termination of employment at initiative of the employer."[8] These instruments spell out (a) what does and does not constitute justification for termination, (b) procedures to be followed prior to or at the time of termination and procedures for appeal, (c) period of notice and severance allowance and other income protection, and (d) a number of supplementary provisions for termination of employment for economic, technological, structural or similar reasons. It is doubtful whether these two international labour standards could have prevented these terminations from taking place. Nor is it obvious that reference to these standards would have prevented all these industrial disputes from arising. But it is very probable that, had these standards been used by management in implementing the terminations and then by the workers' representations and government officials in examining and reviewing these management decisions, much of the argument over who was "right" and who was "wrong" could have been eliminated. The resulting power confrontations and the subsequent strikes/lock-outs with their accompanying lost productivity could thus have been avoided or at least substantially reduced.

Let us take another example. Much productivity is lost through industrial accidents. The Government of India reported 312,444 injuries in factories in 1981 (to say nothing of accidents in other areas such as mines or plantations).[9] Occupational safety and health has been a major subject area for international labour standards since the very beginnings of the ILO. There are now fourteen formal conventions dealing exclusively with different aspects of occupational safety and health, plus twenty formal recommendations. Occupational safety and health clauses also appear in a number of other conventions and recommendations. There are, in addition, a number of conference resolutions plus recommendations from the various industrial committees. Moreover, the ILO publishes a wide range of model codes of practice, such as "safety and health in shipbuilding and ship repairing" or "safe design and use of chain saws."[10] Perhaps the most comprehensive single standard on occupational safety and health is the convention (No. 155) and its complementary recommendation (No. 164) which were adopted in 1981. These two documents taken together set out in extensive detail (a) the basic tenants of national policy, (b) eighteen separate technical factors (lighting, use of electricity, maintenance, first aids etc.), which affect the safety and health of the workplace, and (c) actions to be taken at national level and the level of the undertakings. All these documents taken together provide a comprehensive and detailed set of international labour standards and guiding principle for occupational safety and health.

Industrial accidents hurt more than just the workers

involved. In addition to the personal suffering and anguish to the worker and his family, there are very considerable costs inflicted on the enterprise and the society : reduced productivity due to lost production time of the injured worker, lost time by other workers who assist the injured (or who stop their own work out of sympathy or even simple curiosity), lost executive and supervisory time and energy spent on investigating the cause of the accident and implementing corrective action, destroyed or damaged plant and machinery and raw materials, etc. But these accidents don't just happen. They result from a combination of unsafe working conditions and unsafe working habits. They can be prevented through the systematic, rigorous and determined application of the relevant international labour standards. Accident prevention is the responsibility of all three social partners of the work-place; employers and managers, workers and their representative, and concerned goverment officials such as factory inspectors. International labaur standards are an important tool at their disposal.

Similar examples could be cited for other areas of joint labour management concern at the workplace. There are separate international labour instruments dealing with: voluntary conciliation, arbitration and cooperation at the level of the enterprise, workers representatives within and at the level of the enterprise, workers' participation, hours of work and weekly rest, night work, maternity protection, etc. There are also standards dealing with the special problems of certain categories of workers such as young persons, migrant workers or indigenous and tribal populations. There is, in addition, an extensive body of "international labour case law" consisting of nearly a thousand individual decisions handed down by the committees of experts on freedom of association and the application of conventions and recommendations. All this collective wisdom is available to both labour and management to help them make their industrial relations more harmonious and mutually beneficial and their enterprise (in which they *both* have a personal stake) more productive.

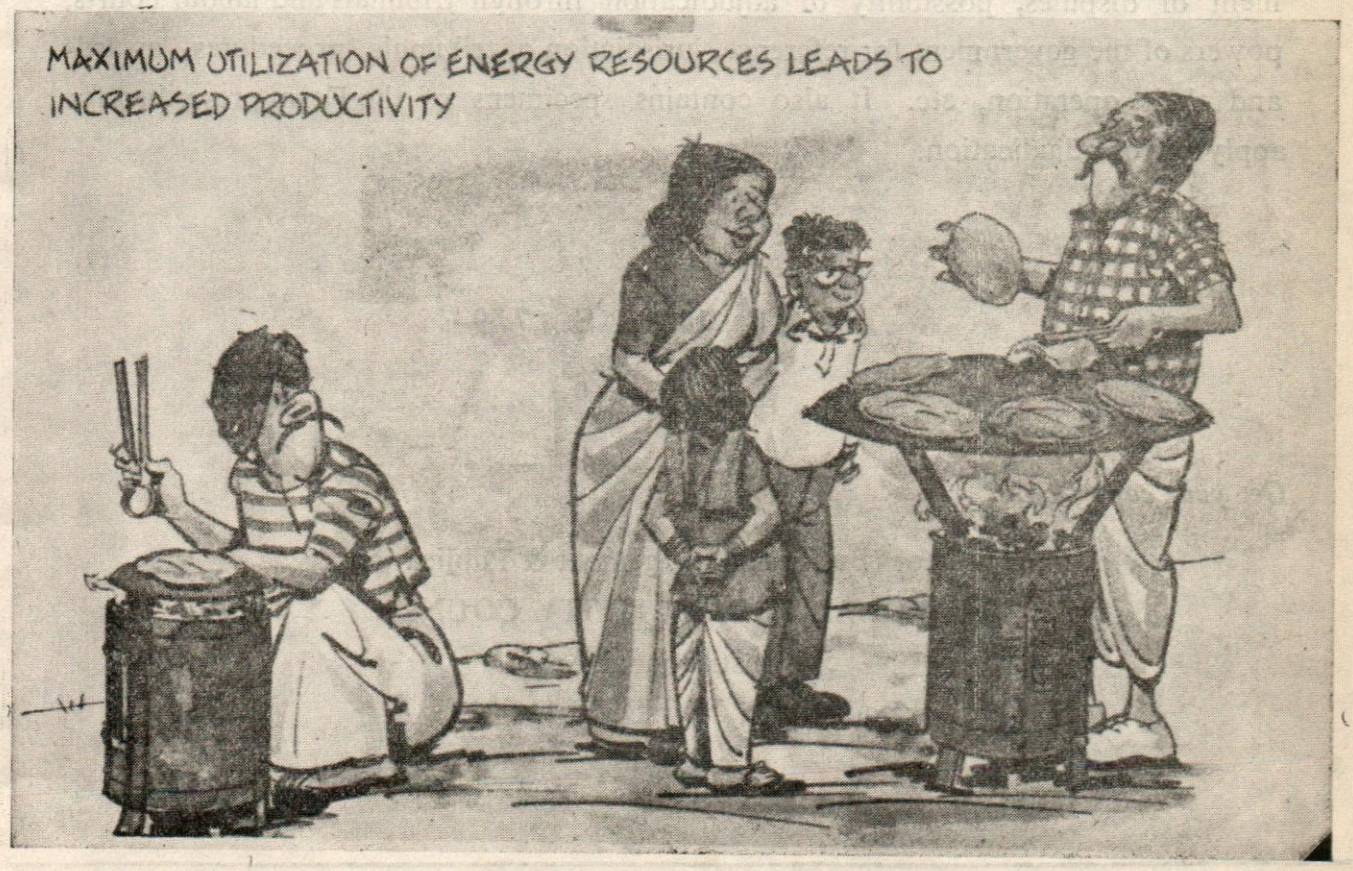
In conclusion, international labour standards can be an important component of any productivity campaign. Their active and constructive application at the "shop floor" can prevent genuine differences between labour and management from developing into confrontations. They help generate the kind of positive attitudes and sense of harmony of interests which are the industrial relations prerequisites for any long-term sustained increases in productivity. Similarly, they can provide technical and policy guidance so that accidents as well as disputes can be prevented *before* they happen. But, like any tool, they are only effective when the craftsmen take them out and put them to use on the jobs at hand. International labour standards can only improve productivity when managers, workers and government officials take them off the bookshelves and bring them to bear on the day-to-day problems and decisions they face.

REFERENCES

1. "U.S. Labour Faces Challenges"; *Span*; June 1983; p-46.
2. Speech delivered to the Convention on "Prosperity Through Productivity" organised by the Bata Chowk Industrial Area, Faridabad, 9 April 1983.
3. It may be worth noting here that the national structural changes in industrial relations which have been proposed (e.g. restricting registration of trade unions to those whose membership includes a minimum of 10% of the workers, the designation of a single bargaining agent) will undoubtedly greatly affect the *mechanics* of labour management relations. But these changes will not of themselves cut through this vicious circle of attitudes.
4. To be precise; 37.2% for 1976, 46.4% for 1977, 38.6% for 1978 and 40.7% for 1979. Source—Pocket Book of Labour Statistics, 1981 published by the Ministry of Labour, Government of India.
5. The following description of the differing types of international labour standards is necessarily very brief. There are a number of ILO publications which provide greater detail on how they are established and applied. These publications and the actual texts of the Conventions, Recommendations, resolutions, etc. can be obtained through the ILO Area Office, New Delhi.
6. "All disputes involving a time-loss of 50,000 or more mandays."
7. Indian Labour Journal; Bureau, Ministry of Labour & Rehabilitation, Government of India, Vol. 24 No. 9; September 1983, pp. 1364ct. seq.
8. The full texts of the convention and recommendation appear in the ILO's Official Bulletin, Vol. LXV, 1982. Series A. No. 2.

9. "Pocket Book of Labour Statistics—1983"—Labour Bureau, Ministry of Labour, Government of India; Table 8.1 p. 203.

10. These model codes of practice are not international labour standards in the strict sense, since they are actually drafted by the International Labour Office and are not formally adopted by independent tripartite bodies after due deliberation and discussion. However, these codes draw heavily from other international labour standards and many of them grow out of the deliberations of meetings such as industrial committees or special ad hoc meetings of experts. In any case, they are extremely practical and useful international guidelines.



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1983, XXIV, 3, 395-402

Enterprise Level Productivity

PROMOD K. BATRA

This paper presents briefly, the principles. Concepts and approach that EDDAL follow for increasing productivity in their enterprise.

Shri Promod K. Batra is with Escorts Dealers Development Association Limited (EDDAL).

About EDDAL

* Escorts Dealers Development Association Limited is a unique association, not only in India, but in the world! It is a Mutual Benefit Association of Escorts Limited and its dealers—for Tractors (Escort & Ford) and Motorcycles (Rajdoot & Yamaha).
* The idea was conceived in 1970 and it was started as a Dealer Development Fund. In 1977 it was formed into a limited company.
* The objectives of the Association are to increase the effectiveness and efficiency of the 600 plus member dealers spread all over India. Profit is not a dirty word at EDDAL!
* Ideas towards these objectives are conveyed through a quarterly house journal "Profitably Yours" and monthly news bulletins.
* The financial resources of the Association are in the form of contributions by the dealers and Escorts Ltd. The human resources consist of men who have been exposed to dealerships over the years and are capable of assisting each dealer member in his different areas of operation.

The Principles We Follow

(a) *Think...there must be better way!*

* An increase in productivity, efficiency and effectiveness will come out as and when you believe in this principle. Think of any situation and this principle

will apply there. I have never come across a situation where the ultimate could not be improved upon.



* Once you genuinely believe this to be a fact i.e. there is a better way, you can and will, with the assistance of the following principles and concepts, find better ways.

* Another important thing to remember is that "THINKING" can be done by your subordinates too! You have to encourage them to do so—I have been doing it for years and it works very well. As a matter of fact, many thought starters emerge when this is encouraged in an organisation. It is important to keep ones eyes and ears open for the "better ways".

(b) *Do it now*



* After you have done the "THINKING" it's time for action. DO IT NOW! As simple as that. If the decision you made was good you will soon find out. If it was wrong you will find out sooner and think of a still better way. I am assuming that you will be using your better judgement—and apply this principle to the "potato" type of decisions. Of course, the "earth shaking" ones can wait for consideration and thought. Often, so much time is wasted on sorting "potato" type of decisions, that very little time is left for the real big decisions—those we get paid for.

* Think about those situations which are bothering you now. How many of them really warrant the time you are spending on them. Often you find that identifying small problems and delegating to subordinates will leave you time to handle bigger and more complex problems. Experience will make you better and better.

* Do not postpone what you can do now. Very often a dealer (our member) is happier to get our reply on his own letter because it takes less time. We reply many of our letters in this way, the very same moment they are received. We attach the following to the returned letter :

  * If Americans do it, why not EDDAL ?

  * We want to reply you the same day i.e. today—and vice versa.

  * We believe you would prefer efficiency as compared to the formalities of a nicely typed letter.

  * We can send you

    * gold embossed replies—after 30-45 days—at your cost.

    * individually dictated and typed letters—after 15 days.

    * routine reply—in 7 days.

    * returning your letter with our comments—same day.

  * You can also give your reply on this and return."

* This reminds me of an article which I read sometime back. I am giving relevant excerpt :

  * "Abraham Lincoln, in the midst of a raging war, found time to write the now-famous letter to Mrs. Bixby. "Dear Madam", he wrote "I have been shown in the files of the War Department a statement of the Adjutant—General of Massachusetts that you are the mother of five sons who have died gloriously on the field of battle. I feel how weak and fruitless must be any word of mine which should attempt to beguile you from the grief of a loss so overwhelming. But I cannot refrain from tendering you the consolation that may be found in the thanks of the republic they died to save. I pray that our Heavenly Father may assuage the anguish of your bereavement and leave you only the cherished memory of the loved and lost and solemn

pride that must be yours to have laid so costly a sacrifice upon the altar of freedom."

* If President Lincoln could write this letter when he had a thousand preoccupations, I strongly feel that you and I should also find time to attend to the minute details of our day-to-day life.

(c) *Ask for it !*



* Once you have a conviction and you are not "begging" for your own benefit entirely, go ahead and 'ASK FOR IT'. Do your home work as if you are having a "love affair". Write it down, only the 6th draft can be good enough to send in, then hope for the best. This works 90% of the time.

* This principle will help you further to increase your productivity. It has been wisely said, "Ask dumb questions—and you will not make dumb mistakes"! How true! More questions means you have been thinking (supposedly!). It will also rule out what should not be done.

* Let me illustrate. In the French army, the caps were being changed from one design to another. The General asked his ADC what the status was. The ADC took this to be a very serious assignment and worked on it for the next six days. When he gave the general a compiled report the General put it in File No. 13 (waste paper basket). The ADC was shocked at first, but then he realised that he should have asked the General "How accurate do you want the information to be ?" May be he could have answered from experience and that was probably what the General wanted.

* I ask questions whenever there is something even remotely connected with my work—and on several occassions clues have come my way on which one can build. This is how most of my ideas have been generated. We, at EDDAL, never feel shy of asking questions; we do not care if others laugh at us.

The Concepts We Follow

(a) *Do not make best the enemy of better*

* Many times it so happens that we forget "better" in our quest for the best. Experience has taught me that if we implement "better" in nine out of ten cases it would lead us to "still better" and hopefully to the "best" eventually.

* Any situation is normally a compromise. You are not the best person for the job, your company is not the best and so on. We can either complain about it or do something about it.

* Four years ago, we at EDDAL wanted to develop a suitable desk diary for our dealers. We came across a diary from the New York Retailers Association; that was where the idea was born and we developed an appropriate dealers' diary quickly enough. Now, every year we improve upon it. Similarly for our booklet on schemes (for our members) we consolidated various circulars into a folder and made a booklet. This is now in its 3rd edition. Had we waited for the best one, we might have still been correcting the first manuscript.

(b) "*If you have a rupee and I have another, And we swap, we have only one rupee each. If you have a Better Idea and I have another, And we swap, we have two Better Ideas each.*"

* Needs no explanation! And I can vouch that it works beautifully. No idea should be kept confidential because those who want it will get it anyhow! Why not give it on your own and nine out of ten chances are that the other person will share an idea with you too.

* You get many thought starters when you visit counterparts in other companies. Have you done it ? No ! Then please 'DO IT NOW' ! You will be surprised that if nothing else you will atleast find out that you are smarter than the other. Reward enough!

(c) "*Stick Your Neck out*"

* "Ships are safer in harbour but they are not meant for that purpose." Doing your job or running your business should be a pleasure. And if

"sickness" is un-avoidable, relax and enjoy it. You may learn the hard way, but working smarter is better than working harder. DO IT NOW AND THINK, THANK AND SMILE.

* A tortoise makes progress only when it sticks its neck out. I am sharing my knowledge with you, hoping that you will share your knowledge with me. Please do so!

(d) *"Six Most Important Things to do"*

* The first ever employees to make a million dollars a year were Walter Chrysler and Schwab in U.S.A. And Schwab once asked a consultant to suggest him how to get more done in a day. The consultant after spending a week with him suggested the following.

"Every morning write down what are the six most important you want to do today. And start doing the first one first. And then the second and third. And if by then the day is gone next day add three more. Do it for one month and if it] works send me your payment."

* Schwab sent him $ 25,000.

The Approach We Follow : (The "MISER" Way)

* The MISER way to productivity is a step towards finding better ways.

* "MISER"—Where M stands for Merging Operations
  I stands for Improving Activities
  S stands for Simplifying things
  E stands for Eliminating Jobs
  R stands for Reducing Operations

* Take any activity—in your office or in your home—and apply this approach; you will be surprised with the results.

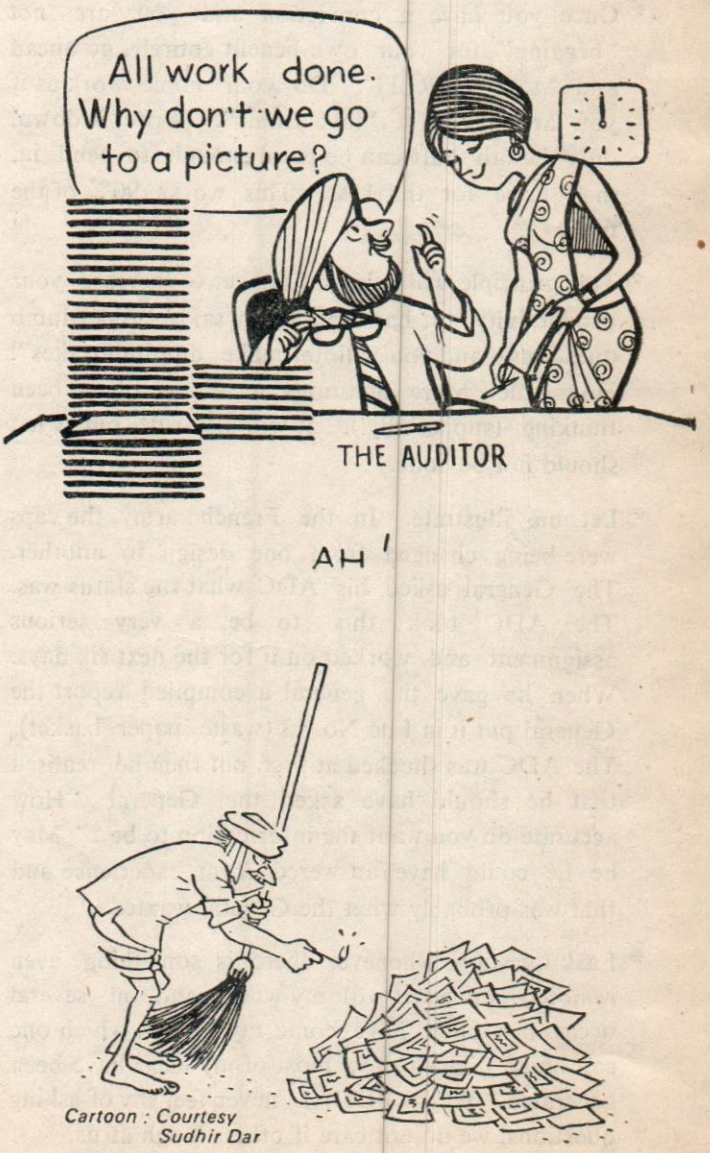
* Let me illustrate the MISER way with a few examples :

  * Bank Drafts : At EDDAL, we send and receive only Bank Demand Drafts to and from our members. Earlier, when we were using cheques, one of our members complained that cheque of Rs. 30,000 was credited to him after 45 days. The Demand Drafts have brought goodwill all around and a lot of paper work has been reduced.



The Sticker we use

* When EDDAL recovers a loan in instalments, the amount of each instalment is equal and



Cartoon : Courtesy Sudhir Dar

without paisas. It falls due on the 1st of the quarter.

* In the areas of records management, our old records looks like a "Library". We follow the Binding and Destruction concepts.

* To expedite replies—both ways—we encourage our members to return original communication with their comments. There was a little resentment to start with, but none now.

* Pre-Punching of papers is a simple but effective concept. We get it done at the printing stage itself.

* The "MISER" way has to keep in mind, no matter what you do. Try it for 6 days ! It really helps.

The Illustrations of the "MISER" Way

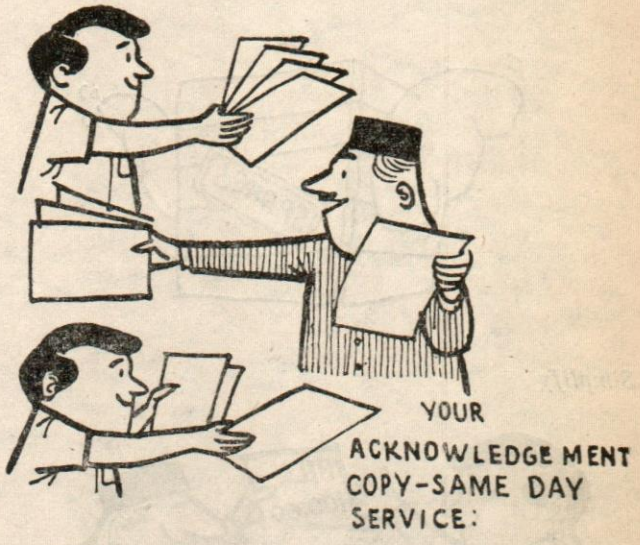
Merge



* Registered Letters Journal—The register in which outgoing registered letters are recorded was merged into the Journal which is issued by the post office.

* Despatch Advice and Bill have been merged into one document. Thus, bill is ready automatically when the goods are despatched.

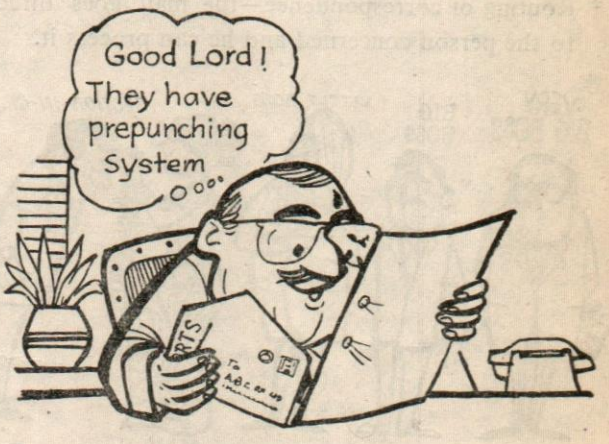
* Order form and its acknowledgement have been merged into one document. This has resulted in the acknowledgement of an order the moment it is received.



* Bill pertaining to DGSD have the required certificates printed on reverse to save extra enclosures and paper work. These have standard information pertaining to the company preprinted on them.

Improve

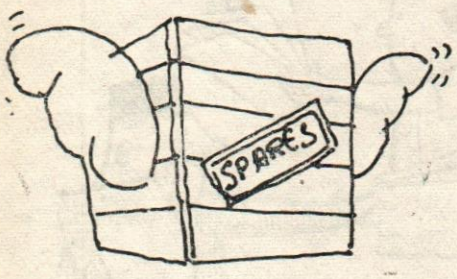
* Pre-punching of forms at the printing stage.



* Use pre-addressed envelopes. We use Bradma and cyclostyled lists, depending upon the volume of mailing to be done.

* Instead of separate pay-in-slips of bank for depositing the drafts, company's pay-in-slip having provision for depositing 10 drafts is used. Address and Account particulars are pre-printed. Bank acknowledges on its copy which becomes voucher.

* Big spare parts kept pre-packed in cases so that they are ready to go the moment an order is received.



Simplify

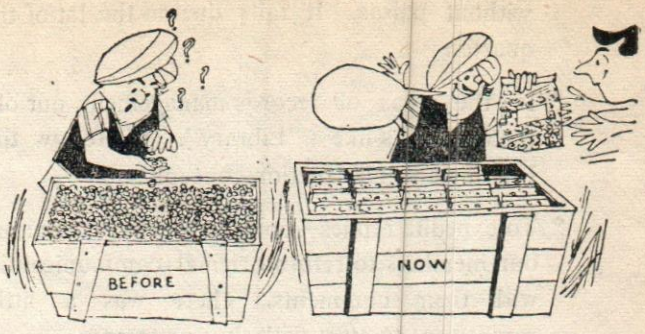


* Depending upon value, bills rounded off to nearest Rs. 10 or Rs. 100 to facilitate cash handling.

* Routing of correspondence—the mail goes directly to the person concerned and he can process it.



* Packing charges not based on packing case size but charged as a percentage of value of goods.



* Signing of each bill not done by the manager or supervisor but by the pricing section incharge.



* Debit note sent in duplicate. Concerned party returns copy with demand draft.

Eliminate

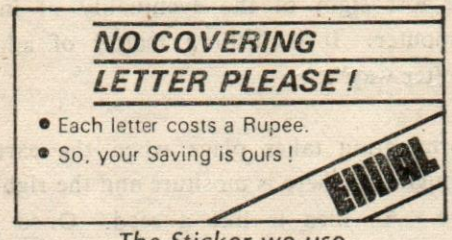


* We have eliminated mail receipt and despatch registers. The franking machine becomes a record of monies spent on mailing.





* Bills are not sent with covering letters as the letter is not required. No more paise in our accounts. Simplifies cash handling.



The Sticker we use

* No official receipt issued by Accounts department for payments received through demand draft. Party's inward letter returned with a sticker to serve as receipt.

* Bin cards are no longer used in stores as cardex cards serve the purpose.



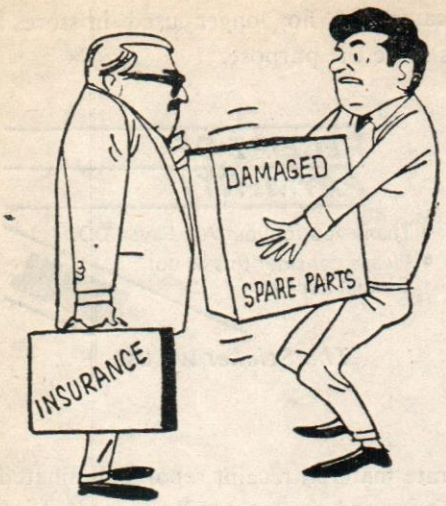
The Sticker we use

* Separate material receipt reports eliminated because party's inward challan can be converted into receipt report itself.

* Separate packing slip has been eliminated. A carbon copy of Despatch Advice serves the purpose.



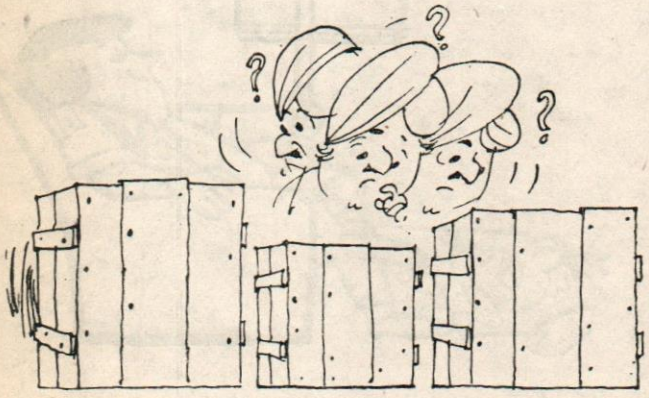
* Insurance claims not raised for items valued below a certain amount because raising the claims and follow-up costlier than the value of items.



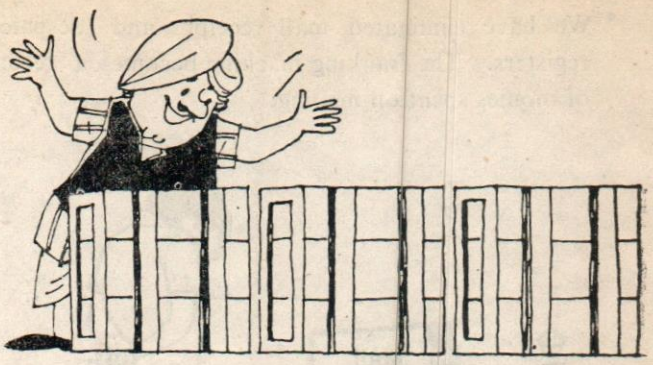
Reduce



* Reduction of typing strokes—side address consists of name and station only.
* Rs. 25,000/- only written as Rs. 25,000 and so on.
* Small parts supplied in pre-packed units of 10 and 100s to reduce counting at our end. Results in faster payment to suppliers.



Before



Now

* Waste Computer Cards (available free of cost from computer section) used to print mail shots thus saving paper cost.

The Cautions

* There is a business axiom "attitude of suspended conclusion." An idea may be good for us but may not necessarily be good for you. If you are doing a thing in a particular way, continue doing so till you have seen the new idea from every angle. Start slowly and the take off will be smooth.

* In an association, for example, we have been thinking of Mini Computers. When we started thinking, the cost was about Rs. 6 lacs. Now it is under a lac. The important thing to consider is not the "price" but "the better way." We can improve our systems and achieve the desired results while working manually as well. So inspite of our state of "suspended conclusion", we have not lost sight of the eventuality of installing a computer. It is just a matter of adopting the "better way".

* Germination takes place when the earth is loose enough and there is mositure and the right temperature. An idea is like a seed. Once you have prepared your field and the seed is planted, you are on the track to increased productivity. This write up is to help prepare the "field" ! Good Luck ! !

Productivity
1983, XXIV, 3, 403-408

EXECUTIVE READINGS

Role Stress Scales Manual and Organisational Role
Pics Manual by Udai Pareek

Published by Navin Publications, Ahmedabad, 1983
Rs. 50/- Role Stress Manual pp. 36
Rs. 75/- Role Pics Manual pp. 58

Reviewed by :
Dr. J.P. Singh
Director, Behavioural Science,
National Productivity Council, New Delhi

Until recently, Managerial Stress has not received much attention in India. The training programmes and seminars organised by professional institutions in the country have met with a limited success and often the discussions in these programmes have centred around the question of the extent of stress in Indian organisations. In the absence of a valid measuring instrument, management trainers have occasionally found it difficult to help managers develop appropriate skills for coping with organisational stress. At last, we have two indigenous psycho-metric instruments which can assess organisational stress faced by a manager as also identify an individual's coping styles. It is in this context that the development of Role Stress Scales Manual and Role Pics Manual are welcome publications.

The Conceptual Contribution

The contribution of the author to the field of organisational behaviour, however, goes much beyond a mere development of the instrument and real contribution is in terms of refining the concept of organisational stress. Until recently the organisational stress has been seen in three dimensions, as originally developed by Kahn viz. the role conflict, role ambiguity and role overload.

Sifting through the literature and basing upon his own researches, Pareek gives the concept a new dimension and proposes two concepts of role systems; the role space and the role set. He has further identified five types of stress and conflict in each of these role sets. In doing so Pareek has thus added a new dimension to research in this area. And this conceptual analysis over and above his contribution to management development through measuring techniques is the real contribution of the author.

The Psychometric Criteria

The Role Stress Scales Manual describes development of the organisational Role Stress Scale and gives psychometric information about the reliability, validity, and the norms, and gives instructions about its administration and scoring. The test-retest correlations for various variables in the scale vary between .37 and .73 and all but one are significant at .001 level. Even the lowest correlation is significant at .003 level. A measure of self-consistency of the scale is provided by the fact that the values correlation for the items-total scores for all but two are significant at .001 level.

The construct validity of the instrument was tested with factor analysis and testifies to the independence of various variables and strengthens the author's conceptual formulation of organisational Role Stress. The only limitation of the

instrument is the Norms which are somewhat restricted at present. However, this limitation will automatically vanish with the future use of the instrument and in no way affects the value of the instrument.

The scale can be used for several purposes including research, OD interventions and development of individual skills in coping with stress. Cousultants in organisational Behaviour, Management Trainers and Psychologists in general, will find this as a useful instrument in their tool box.

Organisational Role Pics Manual

Role Pics is a semi-projective technique aimed at eliciting information about stress coping styles of an individual. Once again, the author has broken new ground by identifying eight styles of coping with stress. As in case of the organisational Role Stress Scale, adequate standardisation data of reliability, Validity and Norms is provided and testifies to the robustness of the instrument. Being a semi-objective technique, its administration and scoring can be more tricky. Although adequate information for scoring, along with a large sample of scoring examples, is provided, a user must achieve an acceptable level of scoring reliability before he can use the scale for an intervention strategy.

By developing and publishing these two manuals, the author has made a significant contribution to the twin fields of research in organisational behaviour and management training. Its use should help the O.B. specialists in tackling organisational and managerial problems.

Indian Spices :
Problems and Prospects

Dr. Badar A. Iqbal

Aligarh Muslim University Press,
Aligarh.
Price : Rs. 20.00
pp. : 54

Reviewed by :
Shri T.P. Ojha,
Central Institute of Agricultural Engineering,
Shri Guru Teg Bhadur Complex,
T.T. Nagar, Bhopal—462 003

The author has tried to give large number of statistics about the production, export etc. of different spices produced in India.

He has highlighted the exploitation of farmers by middlemen in exporting the spices to different countries.

The author has suggested that State Governments, particularly, Karnataka, Kerala and Andhra Pradesh should take special care to give inputs to the farmers, so that the yield of these spices may be increased. In his own opinion, the Indian product has higher fibre content and not so good appearance. He has also indicated that adulteration of the spices by the Indian suppliers has resulted into poor acceptability of the Indian products in the foreign markets.

In his opinion, standardization of processing technology and quality control must be enforced by State and Central Governments.

The most important issue the author has not focussed is about the post harvest losses and poor quality of the spices due to improper drying and storage technology followed by the producers. If adequate processing controls are made by the Government or a separate Board is created for this purpose, most of the problems raised by the author can be avoided.

How to Diagnose Prevent and Cure Industrial Sickness—A Practical Guide
Dr. V.S. Kaveri

Sultan Chand & Sons Publishers
23, Daryaganj, New Delhi-110 002
Price Rs. 75.00
pp. 182

Reviewed by :
Shri Ram Dev
Officer, Andhra Bank,
Chandni Chowk, Delhi

The Officers in a bank, at the branch level, have limited experience with regard to industrial sickness. Although they are exposed to some theoretical knowledge in this regard, their practical experience in this regrard tends to be very minimal. Put against this back drop, the present book is handy.

The present book in a systematic manner, gives a history of industrial development in the country, directed by the Five Year Plans; followed by a discussion on what is industrial sickness and what are its dimensions in the Indian context.

Dr. Kaveri then goes on to discuss the causes of sickness, signals of sickness and sources of such sickness. As preventive measures, how financial statements and balance sheet can be analysed is discussed along with utility of Inter-firm comparison.

With regard to actions to be taken to cure sickness, the role of Government, Reserve Bank of India, IRCI, IDBI, ICICI & IFCI is delineated, followed by a presentation of guidelines for nursing a sick unit. What the Bank can do to recover its loan, at various levels is also presented. Chapter 10, gives a summary of a few studies on industrial sickness in small and medium industries, conducted by the author. This makes an interesting reading. The Book is a must for all the bank officers. The quality of the paper used and the getup of the book are good.

Accounting Principles

Donald F. Istvan & Clarence G. Avery

Harcourt Brace Jovanovich Inc.
New York
A. H. Wheeler, Bombay

Reviewed by :
Shri P. Chattopadhyay,
P240 Lake Road,
Calcutta-700 029

This is an introductory textbook on accounting addressed to students for the purpose of imparting a more-than-nodding acquaintance with what accounting is, the guiding principles and standard accounting procedure and practices, how they take shape in different types of organizations and how the softspots are sought to be accommodated in the accounting formats. In fact, the authors are singularly placed on the basis of their long teaching experience to take different levels of students in their strides from the beginning to end over the entire territory that accounting covers. Thus, beginning at the beignning, the basic nature of accounting is explained with reference to different elements of the accounting style starting from the initial recording of the commercial transactions, ledgers, trial balance, balance sheet and the various ways of interpreting the data that accounting throws up. All this is done with an aplomb that comes with one's long experience and exposure to the ways that students find most convenient to assimilate. The plethora of theories, concepts and principles is explained with proper illustrations, contrasting and comparing the alternatives that are there with their respective weights of plus and minus points. Thus one finds a fairly competent exposition of acctual accounting typicalities as against those of cash accounting, the rationale of each and the conditions in which each may be found appropriate. Similarly, the interpretation of financial statements highlights each individual component of these statements and its behaviour and impact. The sidelights are financial accounting standards in the United States which have in that country a history longer than in any other country. The work of the FASR and the Guidelines issued by the SEC have had far-reaching impact on the accounting practices of other countries as well. In the context of accounting for managerial control of operations and business decisions the authors discuss departmental and branch accounting, direct costing as against absorption costing, standard costing and budgetary control, contribution and differential analysis, impact of taxes on accounting and social and human resources accounting. In all these, the current state of the debate on various controversial issues has been clearly indicated with good pointers as to their directions. Though the treatment of this part is not quite complete the discussion of individual topics is competent throughout. Study assignments, illustrations and problems at the end of each chapter have enhanced the value of the book not only to the university and professional student but also to the practical manager at the helm of different activities in the organization.

Structure of Rajasthans Economy

B. C. Mehta

Published by :
Anuj Printers, Park Lane,
Jaipur
Price : Rs. 100/-
PP : 194

Reviewed by :
Shri D.P.S. Verma
Deptt. of Commerce,
Delhi School of Economics,
University of Delhi,
Delhi

Resource allocation forms an important element of the planning process. The key sector/industry identification based on the backward and forward linkages, derived from the input-output framework, may be considered as an important criterion of resource allocation. However, the construction of an input-output table calls for the collection of comprehensive data pertaining to the different inflows and outflows, some of which are not easily available. There has been difficulty in measuring inter-State transfers of 'income earned and the expenditure

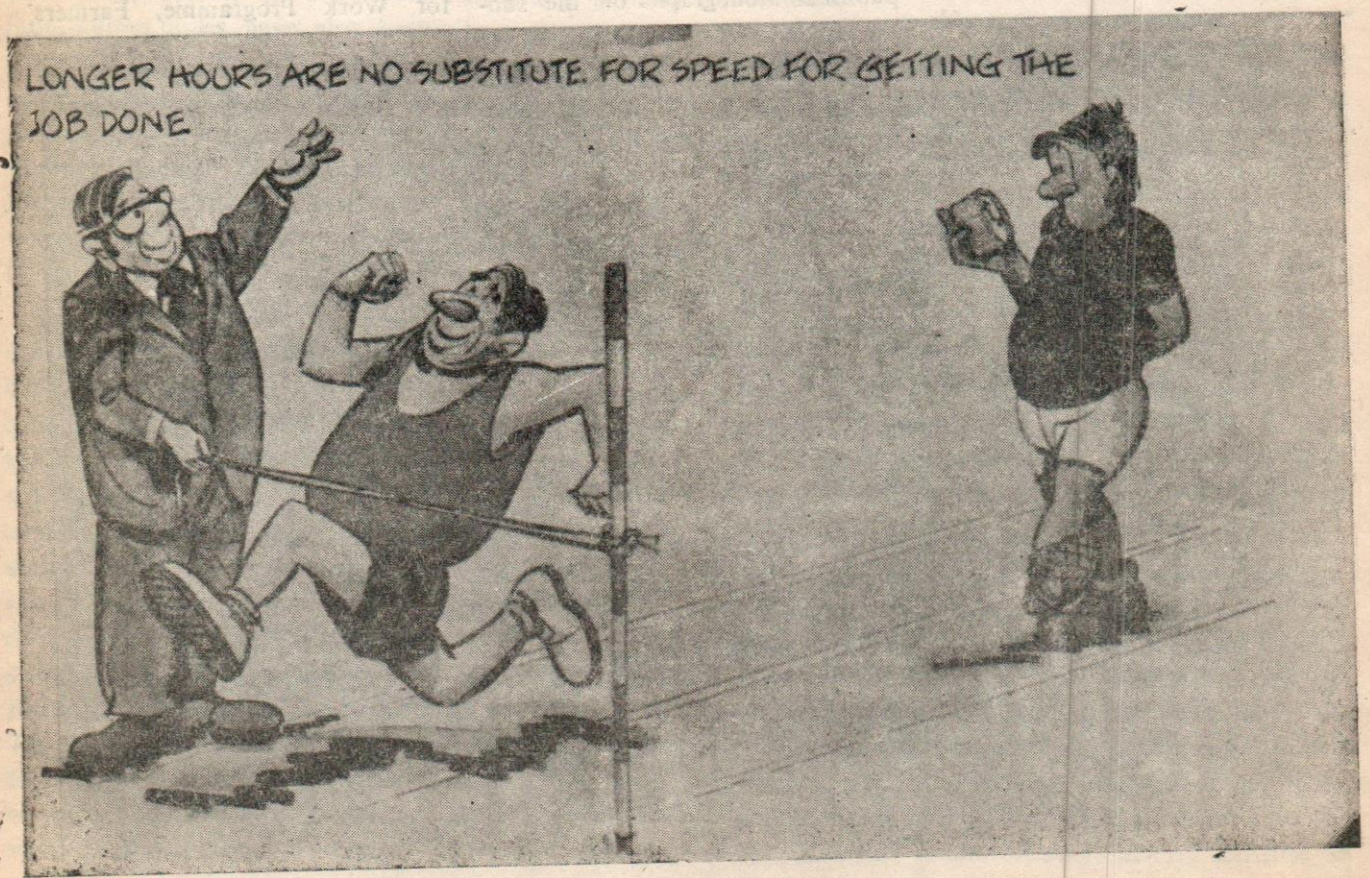
Service Cooperative Society (FSCS), Pilot Intensive Rural Employment Project (PIREP) and the like have also been critically examined by Prof. Desai. Considerable amount of time has already been invested in knowing the malaise of rural poverty and ways and means of curing the same are also known. The implementation of developmental plans should be, as far as possible, decentralised at the district/block level. The fear psychosis created by politicians and the bureaucrats should be done away with. Only then, one can seriously think of uprooting rural poverty.

Prof. Desai has done a good job to pinpoint the need for Area Planning (Monograph on Area Planning: Precepts and Practices by Sambrani & Pichholiya) which has not been widely applied in the country.

One important dimension which Prof. Desai has projected in his observations is that the emphasis should be on need-based activities. Once the need for economic activities are felt by the rural poor, they will either pay for them to improve their life style or exert pressure on their political godfathers. Most of the earlier programmes were either to provide subsidy, seeds, fertiliser, loans on easy terms or monetary help to be self employed where the need was not felt by villages, they could not bring about, the impact on the rural poor. Moreover, more than half the funds were utilised for setting up of local offices and other overheads.

The FSCS was created with a view to enable the local farmers to develop leadership within the village and help others in decision making. But in this case also, the bureaucrats from banks and other organisations took the reins in their hands. This defeated the very purpose of setting up of FSCS.

This book should be of immense use to decision makers as it throws ample light on the failures of most of the schemes as enunciated by the government and the reasons thereof. The workable solutions, suggested by the author can be considered and implemented by those interested in eradicating rural poverty.



Productivity
1983, XXIV, 3, 409-426

A Select Bibliography:

Japanese Management

Y. SUMATHI & P. R. K. MURTHY

Japan has achieved spectacular economic recovery after the II World War and continues to register substantial economic growth till now. Since 60's Japan's GNP has been increasing by nearly 9 per cent and it has become one of the world's most leading industrial nations.

Management specialists attribute this phenomenal success of Japan to their cultural heritage. They use such pharases as 'paternalistic management—labour relations', 'life long employment', 'group productivity', 'quality circles' etc. However, these factors together, and not one or two factors individually, could have contributed to such great achievements of Japan.

Culturally, India and Japan have much affinity and therefore Indian managers will be much benefited by a study of Japanese management systems, principles and success factors. This bibliography is to aid that purpose.

Y. Sumathi & P. R. K. Murthy, Administrative Staff College of India, Bella Vista, Hyderabad-500049.

1. MANAGEMENT (GENERAL)

Articles

Ahmed N : Explaining Japanese miracle—labour management harmony. *Business Standard*, 4 Jan. 1983, p. 5, Col. 3-6.

Alexander CP : Learning from the Japanese. *Personnel Journal* 1981, 60(8), 616-19.

Aonuma Y : Japanese explain Japan's business style (elements of national and international origin that have served to accelerate Japan's economic growth). *Across the Board*, 1981, 18, 41-50.

Ballon R J : Contract, control and authority in Japan. *Journal of Contemporary Business*, 1979, 8(2), 9-17.

Bartels R : Culture—business relation—US vs Japan. *Management International Review*, 1982, 22(2), 4-12.

Bell D W : Japanese industry. *Industrial Participation* 1981, Summer 4-21.

Beresford MD : Joining battle with Japan. *Management Today* 1981, October, 60-5.

Bhatt V V : Japanese methods of industrial management. *Development Management*, 1977, 15(2), 69-72.

Bishop D : True lessons of Japan. *Management Today* 1981, December, 42-5.

Brown W : Japanese management—the cultural background. (*In* R A Webber *Ed.*); *Culture and Management : text and readings in comparative management*. Homewood, III., Irwin, 1971, 428-42).

Brown R L : Japanese way of management. *Management in Action* 1970, 1(9), 6-8.

Chandler M K : Management rights—"Made in Japan". *Columbia Journal of World Business* 1966, 1(1), 131-40.

Clay J : Social factors in Japan's growth. *Banker* 1972, 122)560), 1283-8.

Clutterbuck D : How Koss took on the Japanese at their own game. *International Management* 1982, 37(2), 17-20.

Collard R : The key resource is people. *Industrial Society* 1981, 63 (Sept.), 9-11.

Drucker P F : Behind Japan's success. *Harvard Business Review* 1981, 59(1), 83-90.

——: Japan—the problems of success. *Foreign Affairs* 1978, 56(3), 564-78.

——: What we can learn from Japanese management. *Harvard Business Review*, 1971, 49(2), 110-22.

Edfelt R : Japanese challenge—threatening or benign. *Journal of Contemporary Business*, 1980, 9(2), 177+.

Ellenberger J N : Japanese management—myth or magic. *The Afl-Cio American Federationist* 1982, 89(4), 3-11.

Fox W M : Japanese management—tradition under strain. *Business* 1977, 20(4), 76-85.

Froomkin J N : Management and organization in Japanese industry. *Academy of Management Journal* 1964, 7(7), 71-6.

Funaki Y : Japanese management and management training. *BACIE Journal* 1981, 9-12.

Harbron J D : How Japanese executives manage? *Business Quarterly* 1980, Summer, 15-18.

Hasegawa N : Corporate management in free economy. *Management Japan* 1978, 11(2), 10-14.

Hayes R H : Reflections on Japanese factory management. *Harvard Business School Working Paper* 1981, January, 59-80.

Houser M : Are the Japanese workaholics? *Personnel Management* 1981, 13(2), 38-42.

How the Japanese manage in the US? *Fortune* 1981, 103(12), 97+.

Howard N, Teramoto Y : Really important difference between Japanese and Western management. *Management International Review* 1981, 21(3), 19-29.

Ichikawa T : Management and the environment. *Management Japan*, 1981 14(1), 3-6.

Imaj Research Department : Adjusting to foreign business climate—a case study of a Japanese company overseas. *Management Japan*, 1971, 5(2), 28-32.

Itami H : Japanese—American comparison of management productivity. *Japanese Economic Studies* 1978, (Fall), 7, 3-41.

Jain K : Secret of Japan's success. *Effective Manager* 1981, 2(1), 29-32.

Johnson R T, Ouchi W G : Made in America (under Japanese Management). *Harvard Business Review* 1974, 52(5), 61-9.

Kagono T *& Others* : Machanistic vs. organic management systems : a comparative study of adaptive patterns of U.S. and Japanese firms. *Annals of the School of Business Administration* (Kobe University) 1981, No. 25, 115-45.

Kelley L, Worthley R : The role of culture in comparative management—a cross-cultural perspective. *Academy of Management Journal* 1981, 24(1), 164-73.

Ken T : Are the Japanese workaholics? *Japan Quarterly* 1981, 28(4), 510-17.

Kobayashi N : Problems of international business management in Japan. *International Studies of Management and Organisation*, 1971-72, 1(4), 363-76.

Kono T : Japanese management philosophy-can it be exported ? *Long Range Planning* 1982, 15(3), 90-102.

Lambert P : Selecting Japanese management practices for import. *Personnel Management*, 1982, 14(1), 38-41.

McClenahen JS : Bringing home Japan's lessons. *Industry Week* 1981, 208, 69-73.

McMillan C : Is Japanese management really so different ? *Business Quarterly* 1980, 45 (Autumn), 26-31.

Marengo F : Learning from the Japanese—what or how ? *Management International Review* 1979, 19(4), 39-46.

Matsuda T : Japanese way of management. *Optimum* 1978, 9(4), 5-16.

Matsusak I H : Conflicts in cross-cultural management—a symmetric contrasts of Japan and North America. (*In* Mattson L G, Wiedersheim-Paul F, *Eds : Recent research on the internationalization of business* Stockholm, Almquist & Wikel International, 1978. pp. 319-38).

Matulka R R : Japanese team work. *Fortune* 1980, 101(13), 120+.

Meissner F : Cracking the Japanese walnut. *Business Horizons* 1980, 23(1), 64-70.

Miller I, Gelles P F : Japan's success. *Harvard Business Riview* 1981, 59(3), 196+.

Neff R : The other side of the Japanese miracle. *International Management* 1982, 37(10), 19-20.

Noda M : Business management in Japan. *Technology Review* 1979, 81(7), 20-30.

Oh T K : Japanese Management. *Academy of Management Review* 1976, 14-25.

Ono T : Personal survey of the modernization of business administration in Japan. *Management Japan* 1972, 6(1), 20-7.

Ouchi W G : Organizational paradigms—a commentary on Japanese management and theory Z organizations. *Organizational Dynamics 1981*, 9(4), 36-43.

Pascale R T, Athos A G : Art of Japanese menagement—applications for American executives. *Journal of Applied Behavioural Science* 1982, 18(1), 105-9.

Pascale R T : Zen and the art of management. *Harvard Business Review* 1978, 56(2), 153-62.

Peterson R B, Sullivan J : Applying Japanese management in the United States. *Journal of Contemporary Business*, 1982, 11(2), 5-15.

Prasad S B : A new system of authority in Japanese management. *Journal of Asian & African Studies* 1968, Nos. 3-4, 216-25.

Putting Japanese management to work. *Industry Week*, 1980, 206(5), 61+.

Rai S K : Management—a Japenese experience. *India Management* 1982, 21(2), 10-13.

Rehder R R : Japanese management—an American challenge. *Human Resources Management* 1979, 18(4), 21-7.

Rubinstein S P : New management. concepts from Japan—a tale of two conferences. *Paperboard Packaging*, 1970, 55(1), 44-5.

Schonberger R J : Japanese manufacturing management. Academy of Management Review 1982, 7(3), 479-87.

Seiler R E, McMillen J A : Making it in Japan. *Management World* 1982, 11(3), 8-10.

Shiina T : Some characteristic feature of business management in Japan. *Management Japan* 1979, 12(1), 8-11.

Shiota M : Are Japanese workaholics? *Indian Management* 1982, 21(1), 3-4.

Spoelstra H I J : Japanese management principles. *People and Profits* 1981, December, 12-17.

Storry G R : Japanese business world. *Banker* 1972, 122(560), 1279-82.

Struthers J E : Why can't we do what Japan does ? *Canadian Business Review*, 1981, 8(2), 24+.

Takamiya S : Japanese management at the crossroads—new system of Japanese management. *Management Japan* 1979, 12(2), 6-12.

Takanaka A : Experience of Japan in developing modern management consulting services. *International Studies of Management and Organization* 1974, 4(3), 59-69.

Takezawa S : Management innovations in Japan. *Labour and Society* 1979, 4(2), 129-41.

——: Socio-cultural aspects of management in Japan—historical development and new challenges. *International Labour Review* 1966, 94(2), 148-74.

Tanaka H : How Japan prepares its graduates for future management. *Journal of College Placement* 1980, 40(4), 37-41.

Tracy P, Azumi K : Determinants of administrative control—a text of theory with Japanese factories. *American Sociological Review* 1976, 41, 80-94.

Trade Wars—Japan vs. the world. *International Management* 1982, 37(7), 8-10.

Tsuchiya M : Is Japanese type management really Japanese? *Japanese Economic Studies*, 1979, 8(1).

Tsurumi Y : Best of times and the worst of times – Japanese management in America. *Columbia Journal of World Business* 1978, 13(2), 56-61.

Ulrich H : Let us learn from the Japanese—but not copy them. *Absatzwirtschaft* 1982, June, 6-9.

Vondran R : Japanese way of management. *Manager Magazin* 1980, November, 106-111.

What we are learning from Japan ? *Nation's Business* 1981, 69(3), 39-48.

Wright-Boulton J, Jenney B W : The secrets of Japanese success. *Management Today* 1981, January, 64-7.

Yamada T : Japanese management practices. *Conference Board Record* 1969, 6(11), 22-3.

Books

Abegglen J C : *The Japanese factory—aspects of its social organization*, Glencoe, Illinois, Free Press, 1958.

Adams T F M, Kobayashi : *The world of Japanese business—an authoritative analysis*. Tokyo, Kodansha International, 1969.

Baranson J : *The Japanese challenge to U.S. industry*. Lexington M.A., D.C. Heath, 1981.

Clark R : *The Japanese company*. New Haven, Conn., Yale University Press, 1979.

Dimock M E : *The Japanese technocracy—management and government in Japan*. New York, Walker, 1968.

Furstenberg F : *Why the Japenese have been so successful in business* ? London, Leviathan House, 1974.

Glickman N : *Growth and Management of the Japanese urban system*. New York, Academic Press, 1979.

Hayes R H : *Reflections on Japanese management*. Boston, MA, Harvard University, Graduate School of Business Administration.

Inohara H : *Japanese middle management*. Tokyo, Sophia University, 1975.

Kobayashi S : *Creative management*. NY, American Management Association, 1971.

Lee S M, Schewendiamang *Eds.* : *Japanese magegement—cultural and environmental consideration*. New York, Praeger Publishers, 1982.

Marsh R M, Mannari H : Modernization and the Japanese Factory. Princeton, Princeton University Press, 1976.

Pascale R T, Athos A G ; *Art of Japanes management—applications for American executives*. New York, Simon & Schuster, 1981.

Sasaki N : *Management and industrial structure in Japan*. New York, Pergamon, 1981.

Sato K *Ed.* : *Industry and business in Japan*. London, Croom Helm, 1980.

Seo K K : *Effect of the traditional management system in economic development—the case of Japan*. Proceedings of the Top Management Symposium Tokyo, Asian Productivity Organization, 1969.

Sethi S P : *Japanese business and social conflict*. Cambridge, Mass., Ballinger Publishing Co., 1975.

Takanaka A : *Dynamic business management in Japan*. Tokyo, Asian Productivity Organization, 1965.

Tsurumi Y : *Japanese business*. London, Hold-Saunders, 1979.

Vogel E F : *Japan has number one-lessons for America*. Cambridge, Mass., Harvard, 1979.

Wakabayashi M : *Management career progress in a Japanese organization*. Ann Arbor, UMI Research Press, 1980.

Yoshino M Y : *Japan's managerial systems—tradition and innovation.* Mass., The MIT Press, 1968.

2. MANAGERS

Articles

Are Japanese executives better ? *Dun's Review* 1969, 94(4), 64-6.

Asian manager and modernization of management. *Management Japan*, 1981, 14(2), 20-32.

England G W, Lee R : Organization size as an influence on perceived organizational goals—a comparative study among American, Japanese, and Korean managers. *Organizational Behavior & Human Performance* 1973, 9(1), 48-58.

—— : The relationship between managerial values and managerial success in the United States, Japan, India, and Australia. *Journal of Applied Psychology* 1974, 59(4), 411-19.

Hill R : Are Japanese managers really better ? *International Management* 1976, 31(7), 35-36.

Huggler P V : How Japanese top managers live ? *Management Zeitschrift* 1982, Febrvary, 60-6.

Japanese managers tell how their system works. *Fortune* 1977, 96, 126-32.

Okuda K : Managerial evolution in Japan. *Management Japan* 1971, 5(3), 13-19; *ibid.* 1972, 5(4), 16-23; *ibid.* 1972-73, 6(1), 28-35; also in *Personnel Review* 1974, Summer, 52-58.

Pucik V : Promoters and intraorganizational status differentiation among Japanese managers. *Academy of Management Proceedings* 1981, August.

Rehder R R : What American and Japanese managers are learning from each other ? *Business Horizons* 1981, 24(2), 63-70.

Sethi SP : The Japanese managerial scene—an introductory view. *Marquette Business Review* 1973, 17(4), 201-6.

Tanaka H : Japanese method of preparing to-day's graduates to become tomorrow's managers. *Personnel Journal* 1982, 59(2), 109-12.

What Japanese managers know that American managers don't ? *Administrative Management* 1981, 42(9), 36-9.

Winsbury R : The managers of Japan. *Management Today* 1969 July.

3. MANAGEMENT STYLES

Articles

Efficient management—the Japanese style (editorial). *Lok Udyog* 1982, 15(10), 3-6.

Goshi K : Japanese versus American management styles. *Executive Report* 1980, 17, 6-7.

Hazama H : Characteristics of Japanese-style of management. *Japanese Economic Studies* 1978, 6, 110-73.

Ishikawa A : A survery of studies in the Japanese style of management. *Economic and Industrial Democracy* 1982, 3(1), 1-16.

Japanese challenge. *Buro+EDV* 1981 May, 8.

Kraar L : Japanese are coming—with their own style of management. *Fortune* 1975, 91(3), 116-21; 160-4.

Nadler L : Managerial styles in the U.S. and Japan—which is better ? *Advisor* 1976 (Summer), 10, 2-12.

Schein E H : Does Japanese management style have a message for American managers ? *Sloan Management Review* 1981, 23(1), 55-68.

Wilson D : Japanese chairman—a different style of management. *Director* 1980 February, 40-2.

Books

Iwata R : Japanese style management—its foundations and prospects. Tokyo, Asian Productivity Organization, 1982.

4. CORPORATE PLANNING

Articles

Abe Y : Managerial strategy of Japanese corporations during the 1960s. *Management Japan* 1978, 11(1), 12-17+

Hayashi K : Corporate planning practices in Japanese multinationals. *Academy of Management Journal* 1978, 21(2), 211-26.

Horvath D, McMillan C : Industrial planning in Japan. *California Management Review* 1980, 23(1), 11-21.

Kono T : Comparative study of strategy, structure and long range planning in Japan and U.S. *Management Japan* 1980, 13(1), 20-34.

Murakami T : Recent changes in long range Corporate planning in Japan. *Long Range Planning* 1978, 11(2), 2-5.

Nagashima Y : Response of Japanese companies to environmental changes. *Long Range Planning* 1976, 9(1), 20-8.

Ohmae K : Mind of the strategist—the art of Japanese business. *Research Management* 1982, 25(4), 34-9.

Rapp W V : Japan—Its industrial policies and corporate behavior. *Columbia Journal of World Business* 1977, 12(1), 38-48.

Tsurumi Y : Japan's challenge to the U.S.—industrial policies and corporate strategies. *Columbia Journal of World Business* 1982, 17(2), 87-95.

5. DECISION MAKING

Articles

Hattori I : Efficient decision making in Japanese corporations. *Indian Management* 1978, 17(1), 21-7+.

——— : Proposition on efficient decision making in the Japanese corporation. *Columbia Journal of World Business* 1978, 13(2), 7-15.

Hesseling P, Konnen E : Culture and subculture in a decision making exercise. *Human Relations* 1969, 22(1), 31-51.

Noda K, Glazer H : Traditional Japanese management decision making. *Management International Review* 1968, 8(2-3), 124-31.

Pascale R T : Communication and decision making across cultures—Japanese and American comparisons. *Adminisirative Science Quarterly* 1978, 23(1), 91-110.

Sullivan J & *Others* : Relationship between conflict resolution approaches and trust—A cross cultural study. *Academy of Management Journal* 1981, 24(4), 803-15.

Books

Vogel E F : Modern Japanese organization and decision making. Berkeley, University of California Press, 1975.

6. ORGANIZATIONAL ASPECTS

Articles

Abegglen J C : "Organizational Change" (*In* R. J. Ballon (*Ed*). : *The Japanese Employee*. Rutland, Verman, Charles E Turtle). p. 99-119.

Amano M M : Organizational changes of a Japanese firm in America. *California Management Review* 1979, 21(3), 51-99.

Aonuma Y : Japanese Corporations—its structure and dynamics. *Wheel Extended* 1972, 2(2), 3-12.

Balloun J S : Japan and the excellent organization. *Managerial Planning* 1982, 30(6), 10-15.

Claude de Bettignies H : Japanese organizational behavior—a psycho-cultural approach. (*In* Graves D *Ed.* : *Management Research—A Cross Cultural Perspective*, Amsterdam, Elsevier, 1973.)

Cox C J : Developing OD skills in Japan and UK. *Journal of European Training*, 1976, 1, 4-12.

De Bettignies H C : Japanese organizational behavior—A psychocultural approach. (*In* D Graves *Ed.* : *Management Research—A Cross Cultural Perspective* New York, Jossey Bass, 1971, pp. 75-93).

Doko T : Man and business organization—Japanese pattern. *Management Japan* 1972, 6(2), 10-12.

Hijikata B : Toward constitutional renovation of corporate organizations. *Management Japan* 1971, 4(4), 24-9.

Kobayashi M D, Burke W : Organization development in Japan. *Columbia Journal of World Business* 1976, 11(2), 113-23.

Kobayashi S : Creative Organization—A Japanese experiment. *Personnel* 1970. 47(6), 8-17.

Kono T : Long range business planning in Japanese Enterprises. *Management Japan* 1971, 5(2), 33- ; *ibid* 1971, 5(3), 26-33.

Lim H : A Japanese agenda for management development. *Training and Development Journal* 1982, 36(3), 62-71.

——— : Japanese Management—a skill profile. *Training and Development Journal*, 1981, 35(10), 18-21.

Marsh R M, Mannari H : Technology and size as determinants of the organizational structure of Japanese factories. *Administrative Science Quarterly* 1981, 26(1), 33-57.

Ouchi W G, Jaeger A M : Type Z organization—stability in the midst of mobility. *Academy of Management Review* 1978, 3(2), 305-14.

Ouchi W G. Johnson J B : Types of Organizational control and their relationship to emotional well being. *Administrative Science Quarterly* 1978, 23(2). 293-317.

Sim A B : Decentralized management of subsidiaries and their performance—a comparative study of American, British and Japanese subsidiaries in Malaysia. *Management International Review* 1977, 17(2), 45-51.

Suzuki Y : The strategy and structure of top 100 Japanese Industrial enterprises 1950-1970. *Strategic Management Journal* 1980, 1(3), 265-91.

Books

Azumi K, McMillan C J : Management strategy and organizational structure—a Japanese comparative study. Unpublished paper, Rutgers University and Bradford University Management Centre, 1974.

Caves R E, Uekusa M : Industrial organization in Japan. Washington, The Brookings Institute, 1976.

Nihon B S : Doing business in Japan. Tokyo, Japan External Trade Organization, 1973.

——— : Planning for distribution in Japan. Tokyo, Japanese Bxternal Trade Organization, 1972.

Richardson B M, Ueda T *Eds.* : Business and society in Japan—fundamentals for businessmen. New York, Praeger, 1981.

II MULTINATIONAL CORPORATIONS

Articles

Burton F N, Saelens F H : Partner Choice and Linkage Characteristics of International joint ventures in Japan—An exploratory analysis of the inorganic chemicals sector. *Management International Review* 1982, 22(2), 20-9.

Hayashi K : Japanese management of multinational operations—source and means of control. *Management International Review* 1978. 18(4), 47-57.

Ishida H : Japanese multinational corporations. *Sumitomo Quarterly*, 1981, August, 15-18.

Kobayashi N : Present and future of Japanese multinational enterprises—a comparative analysis of Japanese and U.S. European multinational management. *International Studies of Management & Organization* 1982, 12(1), 38-58.

Lin K M, Hoskins W R : Understanding Japan's international trading companies. *Business* 1981, September/October, 20-32.

Peterson R B, Shimada J Y : Sources of management problems in Japanese—American joint ventures. *Academy of Management Review* 1978, 3(4), 796-804.

Sullivan J, Peterson R B : Factors associated with trust in Japanese—American joint ventures. *Management International Review* 1982, 22(2), 30-40.

——— : Trust in Japanese—American joint ventures. *Management International Review* 1982, 22(2), 30-40.

Takamiya M : Japanese multinationals in Europe—internal operations and their public policy implications. *Columbia Journal of World Business* 1981, 16(2), 5-17.

Tsurumi Y : Japanese multinational firm. *Journal of World Trade Law* 1973, January-February, 74-90.

Wright R W : Joint ventures in Japan. *Columbia Journal of World Business* 1979, Spring, 25-30.

Yoshihara H : Japanese multinational. *Long Range Planning* 1977, 10(2), 41-5.

Books

Yoshino M Y : Japan's multinational enterprise. Cambridge, Harvard University Press, 1976.

III FINANCIAL MANAGEMENT

Articles

Bhandari D : Taxing for development—corporate taxation in Japan. *Bulletin for International Fiscal Documentation* 1982, 36(3), 99-110.

Hoshino Y : Mergers in Japan. *Journal of Business Finance and Accounting* 1982, Summer, 153-66.

Ikeda K, Doi N : Mergers and economic concentration in Japanese manufacturing industry. *Industrial Organization Review* 1980, 8, 1+.

ITO T : High growth of Japanese economy and the problems of small enterprise. *Developing Economics* 1963, 2, 137-68.

Kirkland R I : Are the Japanese rigging the yen ? *Fortune* 1982, 105(11), 91-104.

Nakao T : Profit rates and the market share of leading industrial firms in Japan. *Journal of Industrial Economics* 1979, 27, 371-83.

Sullivan J J, Kameda N : The concept of profit and Japanese—American business communication problems. *The Journal of Business Communication* 1982, 19(1), 33-40.

Tamari M : Equity financing and gearing in the U K, US, Japan and Israel. *Management International Review* 1981, 21(3), 80-98.

To what extent Japanese firms depend on foreign loans? *Oriental Economist* 1976, 44(785), 6-9.

Books

Hadley E : Anti-trust in Japan. Princeton University Press, NJ, 1970.

1. PRODUCTION MANAGEMENT

Articles

Hartmann B : Cybernetic management systems in the Japanese steel industry. *Productivity* 1973, 14(3) 254-67.

Takei F : Evalution method for engineering activity—one example in Japan. *IEEE Transaction on Engineering Management* 1981, 28(1), 13-16.

Wheelwright S C : Japen—where operations really are strategic. *Harvard Business Review* 1981, 59(4), 67-74.

2. PRODUCTIVITY

Articles

Clutterbuck D : Productivity of Japanese Car manufacturers. *International Management* 1978, April, 17-19.

Cutts R E : Productivity proposition—notes on the Japanese approach. *Japan Airlines Travel Magazine* 1980 October, 4.

Deming W E : American who remade "Made in Japan." *Nation's Business* 1981, 69(2), 67-71.

Dobyns L : Decline of American productivity, if Japan can, why can't we ? *Training and Development Journal* 1982, 36(8), 54-61.

Emerson R S : Japanese productivity—myth or miracle ? *Oriental Economist.* 1981, January, 49, 12 +

Fruin W M : Japanese company controversy. *Journal of Japanese Studies* 1978, 267-300.

Fujita Y : Worker's autonomous small group activities and productivity in Japan. *Management Japan* 1981, 14(2), 16-18.

Garzony L G : A perspective on Japanese manufacturing success 1950-1985. *Industrial Management (USA)* 1981, 23(5), 16-21.

Hatvany N, Puick V : Japanese management practices and productivity. *Organizational Dynamics* 1981, 9(4), 5-21.

How Japan's steel industry has improved its productivity. *Management Japan* 1981, 14(2), 10-15.

Juran J M : Is Japan cornering market on product quality ? *International Management* 1981, 36(1), 22-24.

Karatsu H : What makes Japanese products better ? *Advanced Management Journal* 1982, 47(2), 4-7.

Monden Y : Adaptable Kamban system helps Toyota maintain just-in-time production. *Industrial Engineering*, 1981, 13(5), 29-46.

Narayana C L : Aggregate images of American and Japanese products—implications on international marketing. *Columbia Journal of World Business* 1981, 16(2), 31-5.

Nippon Steel Corporation : How Japan's industry has improved its productivity ? *Management Japan* 1981, 14(2), 10-15.

Riggs JL, Seo KE : Productivity—next Japanese import? *Management Services* 1982, January, 12-15.

—— : Personnel factor of Japanese productivity. *Industrial Engineering* 1979, 11(4), 32-5.

Shimokawa K : Entrepreneurship and social environment change in the Japanese automobile indurstry—on the key elements of high productivity and innovation. *Social Science Information* 1982, 21(1), 273-92.

Shinkai Y : Patterns of American and Japanese growth and productivity—a Japanese perspective. *Japan Quarterly* 1980, 27, 357-75.

Sugimori Y & *Others* : Toyota production system and Kanban system—materialization of just-in-time and respect—for—human system. *International Journal of Production Research* 1977, 15(6), 553-64.

Takei F : Productivity improvement in engineering work—the "EPOC" campaign in a Japanese company. *Engineering Management International* 1981, 1(1), 23-8.

Takeuchi H : Productivity—learning from the Japanese. *California Management Review* 1981, 23(4), 5-19.

Tashiro K : Productivity in public administration concept and application in Japan. *Indian Journal of Public Administration* 1982, 28(3), 458-65.

Tsurumi R : The origins of Japanese productivity—rejection of Hawthorne experiment. *Pacific Basin Quarterly* 1982 Spring/Summer, No. 7.

Books

Baranson J : Japanese challenge to US industry. Lexington, M.A., Heath, 1981.

Mastumoto K : Organizing for higher productivity—an analysis of Japanese systems and practice. Tokyo, Asian Productivity Organization, 1982.

Pan American Union Department of Economic Affairs : Policies and institution for promotion of export of manufactures—a selected case study—Japan. Washington D.C., The union, 1964.

Saso M : Japanese industry—how to compete and how to cooperate ? London, Economist Intelligence Unit, 1981.

United States. Congress. House Committee on Ways and Means : Quality of production and improvement in the workplace—hearings, October 14th, 1980. (96th Cong. 2nd Session) (Serial No. 96-127) Pa-Washington D.C.

3. QUALITY CIRCLES

Articles

Arbose J : Quality control circles. *International Management* 1982, 23-4.

Arbose J R *Ed.* : Quality control circles—the West adopts a Japanese concept. *International Management* 1980, 35(12), 31-9.

Bocker H J, Overgaard H O : Japanese quality circles—a managerial response to the productivity problem. *Management International Review* 1982, 22(2), 13-19.

Bonner J S : Japanese quality circles—can they work in education ? *Phi Delta Kappan* 1982, 63(10), 681.

Brooke K A : QC circles' success depends on Management readiness to support workers' involvement. *Industrial Engineering* 1982. 14(1), 76-9.

Collard R : Quality circles. *Personnel Management* 1981, September, 26-36.

Deming W C : What happened in Japan ? *Industrial Quality Control* 1967, August, 89-93.

ment : Japan (*In* OECD : *Policies for the stimulation of industrial innovation—country reports*. Paris, OECD, 1978. pp. 278-346)

1974, 3(3), 55-67.

Tsuchiya M : Japanese business as a "capsule". *Japanese Economic Studies* 1979, 8(1), 21-6.

Hird J L : "Japan's Q.C. circles." *Industrial Engineering* 1972, 4(11), 8-12.

puters for 1990's. *Electronic Design* 1981, 29(25), 58-74.

Bylinsky G : Japanese chip challenge. *Fortune* 1981,

Wattenberg U : JICST. Japan—information center for science and technology. *Nachrichten Fur Dokumentation* 1982, 33(2), 82-5.

Wilford S M : Industry and innovation in Japan. *Journal of Royal Society of Arts* 1982, May, 321-32.

Winiecki J : Japan's imports and exports of technology policy. *Studies in Comparative International Development* 1979, 14(3-4)—10-6.

Woudhuysen J : Factory robotization. *Design* 1977, March, 26-31.

Books

Livermore A H *Ed.* : Science in Japan. Washington D.C., American Association for the Advancement of Science, 1965.

McGaffigan E D, Langer P : Science and technology in Japan—brief analytic survey. Santa Monica, Pand Corporation, 1975.

Marsh R M, Mannari : Modernization and the Japanese factory. Princeton, N.J., Princeton University Press, 1976.

Nariai O : Modernization of the Japanese economy. Tokyo, Foreign Press Center, Japan, 1977.

Nakayama S : Characteristics of scientific development in Japan, New Delhi, CSIR, 1977.

Ozawa T : Transfer of technology from Japan to developing countries. NY, UNITAR, 1971.

——— : Japan's technological challenge to the West. Washington, MIT Press, 1971.

V. 1. HUMAN INDUSTRIAL RELATIONS

Articles

Aoyama H : Workers' participation in occupational safety and health in Japan. *International Labour Review* 1982, 121(2), 207-16.

Azumi K, McMillan C J : Worker sentiment in the Japanese factory—its organizational determinants. (*In* Austin L, *Ed.* : *Japan—the Paradox of Progress.* London, Yale University Press, 1976. pp. 215-29.)

Bryan L A : Japanese and the American first-line supervisor. Training and Development Journal 1982, 36(1), 62-8.

Can lifetime employment in Japan last ? *Economist* 1977, 265(6996), 91-2.

Chung K H, Gray M A : Can we adopt the Japanese methods of human resources management ? *Personnel Administrator* 1982, 27(5), 41-6.

Clarke O : Industrial relations—some insights from Japan. *OECD Observer* 1977, No. 86, 23-5.

Cole R E : Changing labour force characteristics and their impact on Japanese industrial relations. (*In* Austin L, *Ed* : *Japan the Paradox of Progress.* London, Yale University Press, 1976. pp. 165-213.)

——— : Learning from the Japanese—prospects and pitfalls. *Management Review* 1980, 69(9), 22+

——— : Permanent employment in Japan—facts and fantasies. *Industrial and Labour Relations Review* 1972, 26(1), 615-30.

Cook N E & *Others* : Fixed variable labour costs. *Personnel* 1982, January/February, 71-8.

Doi L K : Amae—a key concept for understanding Japanese personality structure (*In* Sugiyama T, Lebra W P *Eds. Japanese culture & behaviour.* Honolulu, University Press of Hawail, 1974. pp. 145-54).

Duncan B : Japan—training comparisons. *Industrial and Commercial Training* 1978, November, 455-60.

Evans R *Jr.* : Japanese economic growth and industrial accidents. *Monthly Labor Review* 1978, 101(9), 50-3.

Furuya K : Labor-Management relations in postwar Japan—their reality and change. *Japan Quarterly* 1980, 27, 29-38.

Godo T : Characteristics of Labour management in Japan. *Management Japan* 1967, May 15, p. 25+

Hamada T : Winds of change—economic realism and Japanese labor management. *Asian Survey* 1980, 20(4), 397-406.

Hanami T A : Worker participation in Japan. *Japan Labour Bulletin* 1977, 16(1), 5-8.

——— : The influence of ILO standards on law and practice in Japan. *International Labour Review* 1981, 120(6), 765-82.

Harari E, Zeira Y : Attitudes of Japanese and non-Japanese employees—a cross-national comparison in uninational and multinational corporations. *International Journal of Comparative Sociology* 1977 (September-December) 18, 3-4.

Hashimoto M : Bonus payments, on-the-job training and lifetime employment in Japan. *Journal of Political Economy* 1979, 87(5), pt. I, 1086-104.

Hayes R H : Why Japanese factories work ? *Harvard Business Review* 1981, 59(4), 56-7.

Hepler C W : Labor boss system in Japan. *Monthly Labor Review* 1949, 68(1).

Inoue K : Structural changes and labour market policies in Japan. *International Labour Review* 1979, 118(2), 223-35.

Ishino I : Motivational factors in Japanese labour supply organization. *Human Organization* 1956, 15(2).

Jacoby S : International labour markets in Japan. *Industrial Relations* 1979, Spring, 184-95.

Kogi K : Social aspects of shift work in Japan. *International Labour Review* 1971, 104(5), 415-33.

Koike K : Japan's industrial relations—characteristics and problems. *Japanese Economic Studies* 1978, 7(Fall), 42-90.

Koshiro K : Industrial relations in the Japanese iron and steel industry. *Japan Labor Bulletin* 1966, 5, 4-8.

Levine B, Taira K : Japanese industrial relations—is one economic 'Miracle' enough ? *Monthly Labour Review* 1978, 101(3), 31-3.

Levine S B : Labor market and collective bargaining in Japan. (*In* Lockwood W *Ed.* : *The state and enterprise in Japan.* Princeton, NJ, Princeton University Press, 1969)

Levine S B : Unionization of white collar employees in Japan. (*In* Strumthal A, *Ed.* : *White Collar Trade Unions.* Urbana, University of Illinois Press, 1964.)

Lincoln J R & *Others* : Cultural orientations and individual reactions to organizations—a study of employees of Japanese owned firms. *Administrative Science Quarterly* 1981, 26(1), 93-115.

Lynn R : More brainpower coming down the line from Japan. *International Management* 1982, 37(12), 37-41.

Marsh P : Japan's industrial planning. *New Scientist* 1980, 88, 430-3.

Marsh R M, Mannari H : Employee performance in Japanese firms—an explanation. *Organization & Administrative Sciences* 1976, 7(1-2), 89-105.

——— : Japanese workers—responses to mechanization and automation. *Human Organization* 1973, 32, 85-93.

——— : Lifetime commitment in Japan—roles, norms, and values. *American Journal of Sociology* 1971, 76, 795-812.

Marshall B K : Japanese business ideology and labour policy. *Columbia Journal of World Business* 1977, 12(1), 22-9.

Mathew V : Unique approach to industrial relations. *Financial Express* 1973 January 2, p. 4, col. 3-8.

Matsuda Y : Government employees in Japan. *Japan Labor Bulletin* 1966, 5, 4-8.

Matsuno S, Stoever W A : Japanese boss, American employees. *The Wharton Magazine* 1982, 7(1), 44-8.

Mire J : Workers' morale in Japan. *Monthly Labor Review* 1975, 98(6), 49-53.

Moran R T : Japanese participative management—or how *rinji seiods* can work for you. *Advanced Management Journal* 1979, 44(3), 14-22.

Nakayama I : Modernization of industrial relations in Japan. *British Journal of Industrial Relations* 1965, 3(2), 225-36.

Nishikawa S : Domestic labor migration in Japan. *Keo Business Review* 1962, 1, 79-99.

Nodera Y : Japanese employment policies for older workers. *Aging and Work* 1981, 4(2), 101-7.

Odaka K : Implications of dual allegiance in the modernization of industrial relations in Japan. (*In The Changing patterns of industrial relations.* Tokyo, Japan Institute of Labor, 1965.)

Shimada H : Structure of earnings and investments in human resources—a comparison between U.S. and Japan. (Ph.D. Dissertation, University Wisconsin, Madison, 1974).

Sumiya M : Social impact of industrialization in Japan. Tokyo, Japanese National Commission for UNESCO, 1963.

Takezawa S : Work ways—Japan and America. Tokyo, Japan Industitute of Labour, 1981.

Takezawa S, Whitehill A M : The other worker—a comparative study of industrial relations in the United States and Japan. Tokyo, Japan Institute of Labour, 1961.

—— : Work ways—Japan and America. Takyo, Japan Institute of Labour, 1981.

Thurley K, Tawara J : Industrial supervision in Japan and Europe—a research report in industrial training. Tokyo, Nehon Saugyo Kunrenn Kyokai, 1967-68.

Tsuda M : Basic structure of Japanese labor relations. Tokyo, The Society for the Social Sciences, Musahi University, 1965.

2. WAGES

Articles

Alston J P : Awarding bonuses the Japanese way. *Business Horizons* 1982, 25(5), 46-50.

Bluementhal T : The effect on socio-economic factors on wage differentials in Japanese manufacturing industries. *Economic Studies Quarterly* 1966, 17, 53-67.

—— : Scarcity of labour and wage differentials in the Japanese economy. *Economic Development and Cultural Change* 1968, 17, 15-32.

Evans R : Shunto Japanese labour's spring wage offensive. *Monthly Labor Review* 1967, 90, 23-8.

Funahashi N : Industrial reward system—wage and benefits (*In* Okochi and *Others Eds.* : *Workers and employers in Japan.* Princeton, NJ, Princeton University Press, 1974).

Hashimoto M : Bonus payments on-the-job training and life time employment in Japan. *Journal of Political Economy* 1979, 87(5) Pt.I. 1086-1104.

Koshiro K : Japan's wage determination re-examined. *Japanese Economic Studies* 1982, 10(2), 49.

Mackawa K : Labour union movements and "shun-to" (Spring Campaign) in Japan (efforts to raise wages nation-wide and improve working conditions through an annual centralized representation of the individual company unions) *Kyoto University Economic Review* 1979, 49, 1-12.

Nakao T : Wages and market power in Japan. *British Journal of Industrial Relations*, 1980, 18(3), 365-8.

Paine S H : Wage differentials in the Japanese manufacturing sector. *Oxford Economic Papers'* 1971, 23, 212-38.

Sakurabayashi M : Wage administration in Japan. *International Asian Forum* 1977, 8(3/4), 357-72.

Schulze G C : Wages in Japan. *Fortschrittliche Betriebsfuhrung and Industrial Engineering* 1979, December 395-403,

Shirai T : Changing pattern of collective bargaining in Japan. *British Journal of Industrial Relations* 1965, 3, 201-9.

Shirai T, Shimada H : Labor in the 20th Century—Japan. (*In* Dunlop J T. Galenson W, *Eds.* : *Labor in the Twentieth Century—Studies in Labor Economics Vol. 1.* NY, Academic, 1979, pp. 241+.

Tachibanaki T : Further results on Japanese wage differential—Nenko wages, hierarchical position, bonuses and working hours. *International Economic Review* 1982, 23(2), 447-62.

Taira K : Inter-sectoral wage differential in Japan, 1881-1959. *Journal of Farm Economics* 1962, 44 (May), 322-34.

Tan H W : Wage determination in Japanese manufacturing—a review of recent literature. *The Economics Record* 1982, 58(160), 46-60.

Tsuda M : Japanese wage structure its significance for international comparisons. *British Journal of Industrial Relations* 1965, 3(July), 79-101.

Weiner N : The Japanese wage system. *Competition Review* 1982, 14(1), 46+.

Books

Ballon R J : Japan's salary system—the basic salary.

Tokyo, Sophia University, Socio-Economic Institute, 1975.

—— : Japan's salary system—the bonus. Tokyo, Sophia University, Socio-Economic Institute, 1975.

Ballon R J, Inohara H : Japan's salary system—monthly allowances, Tokyo, Sophia University, Socio-Economic Institute, 1975.

Fujita Y : Wages and labour situation in to-day's Japan. Tokyo, Japan, Federation of Employers' Association, 1965.

Shimada H : A quantitative analysis of negotiated wage settlements in Japan. 1968.

3. TRADE UNIONS

Articles

Cole R E : Japanese workers, unions, and the Marxist appeal. *The Japan Interpreter* 1970 6(2), 37-9.

Karsh B : The exportability of trade union movements—the Japan—U.S. trade union culture exchange program (*In* his *The changing patterns of industrial relations*. Tokyo, Japan Institute of Labour, 1965.)

Levine S, Taira K : Labor markets, trade unions and social justice—Japanese failures ? *Japanese Economic Studies* 1977, 5, 66-95.

Taira K : Japanese "enterprise unionism" and interfirm wage structure. *Industrial & Labour Relations Review* 1961, 15 (October), 33-51.

Ujihara S : Enterprise-based labor unions in Japan. *Annals of the Institute of Social Science* 1980, 21, 1-23.

Versagi F S : What American labour-management can learn from Japanese Unions ? *Monagement Review* 1982, 71(6), 24-8.

VI. MARKETING

Articles

Agarwala P N : Indian, Japanese trading companies—a study in contrasts. *Business Standard* 26 March 1982, p. 5, col. 3-8; 2. Lessons to learn. *ibid* 31 March 1981, p. 5, col. 3-6.

Arbose J R : Wise men from the East bearing gifts—why Japanese salesmen beat the opposition in the middle East ? *International Management* 1982, 37(5), 67-8.

Chiesl N E, Knight L L : Japanese buyers attitudes toward U.S. supply sources. *Industrial Marketing Management* 1981, 10(4), 243-51.

Chung K H : Theory Z—how American business can meet the Japanese challenge ? *Academy of Management Review* 1982, 7(2), 317-18.

International trade—Are we persecuting the Japanese ? *Forbes* 1982, 130(5), 41+

Japanese market barriers—myths and realities. *International Management* 1982, 37(7), 11+

Kobayashi Y : Fundamentals for success in Japanese market place. *Journal of Contemporary Business* 1979, 8(2), 81-6.

Kotler P, Fahey L : Japanese marketers. *Journal of Business Strategy* 1982, 3(1), 3-14.

Nagashima A : Comparative "Made in" product image survey among Japanese businessmen. *Journal of Marketing* 1977, 41(3), 95-100.

Roehl T W : Industrial policy and trade—3 myths of Japan. *Journal of Contemporary Business* 1982, 11(i), 129-38.

Shimaguchi M, Lazer W : Japanese distribution channels—invisible barriers to market entry. *MSU Business Topics* 1979, 27(1), 49+

Sujuki I : Structure of the Japanese distribution system. *Rivista Internazionale di Scienze Economiche Commerciali* 1980, 27, 744-61.

Sujuki N : Changing pattern of advertising strategy by Japanese business firms in the U.S. market—content analysis of advertisements in Business Week and News Week 1965-77). *Journal of International Business Studies* 1980, 11, 63-72.

Tsurumi Y : Managing consumer and industrial marketing systems in Japan. *Sloan Management Review* 1982, 24(1), 41+

Wilson D : Japan—the trade challenge. *The Banker* 1982, 132(675), 27-38.

Books

Yoshino M Y : Japanese marketing system—adaptations and innovations. Cambridge, MIT Press, 1971.

——— : Marketing in Japan—a management guide. NY, Praeger, 1975.

VII. SMALL BUSINESS

Articles

Morita A : Yes, no, or the important of however. *Industrial Management (USA)* 1981, 23(4), 12-15.

Sato Y : Recent trend of the small business problem in Japan. *Keio Business Review* 1964, 3, 77-94.

Watanabe S : Small enterprises and subcontracting in Japan and India. Development Digest 1977, 15(1), 113-24.

Books

Asian Productivity Organization : Outline of policy for smaller enterprises—Japanese experience. Tokyo, the Organization, 1969.

——— : Technological survey of small industry in Japan a general survey report on the food, textile, paper & pulp and cast iron, iron and steel industries. Japan, the Organization, 1971.

Vepa R K : Small industries in Japan. Bombay, Vora & Co. 1967.

Yamanaka T *Ed.* : Small business in Japan. Tokyo, Japan Times Co., 1960.



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LETTER FROM THE EDITOR-IN-CHIEF

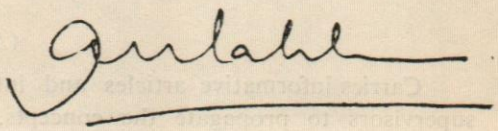
Nature has created environment conducive for all living beings—plants, birds, animals and human species. There is enough in the world for every one's need but not enough for every one's greed. All the resources in our environment need careful management and suitable policies to prevent environmental damage before it occurs. Socio-economic development is to be carried out with minimal ecological harm.

Increasing environmental degradation and ecological disruption has generated deep concern for the conservation and proper care of the biosphere in which we live and from which we draw sustenance. The use of resources is increasing exponentially not only because we are too many, but also because so few of us are demanding too much from the fragile biosphere. There is now a deep anxiety about the rapid diminishment of what have become essentials to our way of living.

The important World Conservation Strategy document released in 1980 very aptly pointed out 'Ultimately the behaviour of entire societies towards the biosphere must be transformed if the achievement of conservation objectives is to be assured. A new ethic, embracing plants and animals as well as people is required for human societies to live in harmony with the natural world on which they depend for survival and well being. The long term task of environmental education is to foster or reinforce attitudes and behaviour compatible with this new ethic.'

Significant work has been done with regard to environmental protection. The Stockholm Conference has also pointed out the need for change in attitudes and atmosphere for environmental presentation. As a result the developed nations have already taken several measures to mitigate the damage they have caused by indiscriminate exploitation of the natural resources. The developing nations like ours have also started working with an awareness that environmental protection is a pre-requisite for sustained development.

The Government of India's commitment to environment protection and education has been total. Our Prime Minister has used national and international forums including the recent non-aligned conference held in New Delhi to give a proper perspective and orientation to environmental debates and action in the context of developing countries like India. We are confident that we will move along the path of least environmental damage in our destination to a happy and comfortable life. The present issue is a humble contribution in that direction.



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Environmental Impact Assessment--Panacea for Environmental Management

CHRIS C. PARK

A central dilemma within environmental management centres around the need to integrate conservation of environment with development, in both developed and developing countries. Whilst the planning systems and contexts of environmental decision-making vary considerably between countries, there is overall a mounting awareness of the inherent limitations of many existing planning systems which focus on relatively short time-scales, place short-term social and economic gain above long-term environmental stability ond sustainability, and in general fail to appreciate the fundamental links between the human and physical environments.

Mr. Chris C. Park, Department of Geography, University of Lancaster, Bailrigg, Lancaster LAI 4YR, England.

Recent years have witnessed mounting concern over the quality of environment in both developed and developing countries. Since about 1970 in particular the search for more sustainable, more appropriate and more ethically responsible approaches to the planning and allocation of environmental resources has both diversified and intensified. The spirit of global environmental interdependence, born at the 1972 United Nations conference on the human environment in Stockholm has recently been reactivated in the World Conservation Strategy. Whilst much of the driving force for improved environmental management has come from the developing countries in general, and from the United States and Great Britain in particular, the urgency of finding rational and sustainable solutions to environmental problems in the developing countries (where direct dependence of the population on rural environments is generally the norm) is recognized and appreciated by all. The conflicts between conservation and development are most acutely seen in the developing countries. Yet conservation and development are not of necessity mutually exclusive, and the World Conservation Strategy echoes the sentiments of many thinking peoples in calling for 'conservation based development'. The WCS argues that 'development that is inflexible and little influenced by ecological considerations is unlikely to make the best use of available resources', an argument which lies at the very heart of recent debates about the advent of post-industrial society in some western countries by the mid-1980's, as well as the North-South debate on development, and the earlier Blueprint for Survival proposed in Britain in the early 1970's.

and environmental protection (such as nature conservation). The most important single catalyst for NEPA was growing appreciation of the need to consider fully all possible environmental and social side effects when evaluating project proposals. NEPA, which aimed 'to declare a national policy which will encourage productive and enjoyable harmony between man and his environment', was thus a timely milestone in the evolution of environmental thinking in the United States. But its impact has spread far beyond the shores of America, because environmental legislation and administration in a growing number of countries (both developed and developing) has been based on modifications of American practice, designed to capitalise on American experiences and to cater for the peculiarities and priorities of the adopting countries.

NEPA created two institutions in environmental planning which have been mirrored elsewhere—one a formal institution (the Council on Environmental Quality, or CEQ), and the other an institution in practice (Environmental Impact Assessment, or EIA). Whilst CEQ plays a major role in the implementation of environmental management policies in the United States (through setting environmental quality standards, monitoring changes in environmental quality and so on), it is the EIA system introduced by NEPA that has so captured the interest of environmental planners throughout the world.

NEPA directed all federal agencies in the United States to 'identify and develop methods and procedures which will ensure that presently unquantifiable environmental amenities and values are given appropriate consideration in decision making, along with economic and technical considerations'. More importantly, the Act introduced measures designed to ensure that systematic environmental protection is incorporated into all stages of policy formulation, programme preparation and specific project appraisal—so that the assessment of environmental impacts would need to be carried out for all types of development from the site specific proposal (such as the building of an airport at a named site) to broad policy and programme proposals (such as nuclear power plant developments nationwide).

There are five principal objectives behind Environmental Impact Assessment, as introduced in America through NEPA:

1. to consider the environmental impacts of the proposed action,
2. to consider any adverse effects which could not be avoided if the proposal were to be implemented,
3. to consider alternatives to the proposed action (including doing nothing at all),
4. to consider the relations between local, short term use of the environment, and the maintenance if not enhancement of long term productivity, and
5. to consider any irreversible commitments of resources involved in the proposed action.

The basic product of carrying out an EIA on a particular proposal is a detailed report (the Environmental Impact Statement) where the evaluation of possible environmental impacts is set into context, alternative schemes which would produce similar results to the proposed action are evaluated, the original environment of the area in question is described in detail, and the long term and broad scale implications of the proposal are summarized and evaluated. Environmental Impact Statements tend to be extremely lengthy documents—as indeed one might expect from so important and wide ranging an assessment—and they provide the background on which planning decisions are made. Between 1970 and 1980 around 12,500 EIS's were filed in the United States by over 70 federal agencies.

Procedural aspects of the EIA process have commanded much attention. If the aim of EIA is to reach rational decisions concerning applications for developments which might have adverse impacts on environmental quality, then EIA procedures must be as rational and objective as possible. Most schemes for identifying, examining and evaluating environmental impacts are quantitative ones, which involve some form of numerical assessment of the likely magnitude and importance of different types of impact stemming from the various activities involved in the proposed develop-

ment. The Leopold Matrix, which comprises a lengthy check-list of possible interactions between environmental elements (such as air quality, noise, vegetation and so on) and development activities (such as blasting, construction traffic and highway construction), is typical of these approaches and has been widely used.

One of the main strengths of formalized EIA systems is the requirements to justify the proposed development, and to consider alternative ways of achieving similar objectives. For example, the Assessment of a proposed nuclear power plant would have also to evaluate the extent to which other means of producing power (such as tidal barrages, fossil fuels, hydro-electric or wind power) could meet the same demands, and also the extent to which they would produce more acceptable environmental impacts overall. The difficulty arises in attemping to balance the various environmental impacts of radically different schemes (eg nuclear versus wind power), and this is compounded in trying to draw rational judgements about the viability (in economic or engineering terms) of alternative schemes and at the same time weighing up the likely environmental impacts of the different alternatives.

At the end of the day political factors can (and often do) play a dominant role in reaching decisions about development proposals. It is sometimes claimed, particularly on the basis of American experience, that powerful developers with vested interests in the outcome of particular EIAs (these interests might be in favour of the application if the developer is the one who has proposed it, or against it if it would benefit a competitor) can manipulate the outcome of the Assessment in their favour. Environmental decision makers are not immune from the pressure of local or national politics, if the investment opportunities in certain large project proposals, or the political prestige of certain types of development, or employment generating prospects of proposed developments in areas with high unemployment, become important elements in the final decision-making, to be viewed alongside the environmental arguments. The rationality of decision making based on formal systems of EIA can markedly be influenced by political lobbying, distortion of information input into the evaluation procedures (either wilfully or by neglect), and the adoption of partisan attitudes by those charged with the vetting and evaluation of development proposals. The ambitious politician, entrepreneurial developer or unscrupulous administrator can influence the outcome of EIA decisions as much as he can most other types of planning decision.

In evaluating the possible contribution of EIA in developing countries, it is necessary to weigh up the merits and drawbacks of EIA in both theory and practice.

The merits of EIA are numerous, and they all relate to the improvement of decision making concerning environmental quality. It is generally necessary to consider all technically feasible options of meeting a proposed need, and so EIA enquires that the environmental side-effects of all options be evaluated, with the implication that the chosen scheme be that which makes least overall impact on the environment (an implication which is more theoretical than practical). EIA also requires a detailed justification for the proposed development, which can be judged in the public arena. Political factors can markedly influence the openness and rationality of this public justification however. EIA also requires more and more open public consultation over possible environmental (and socio-economic) impacts of a proposed development, and the need to examine all possible impacts creates the need for more information on the form of the development, the environment in question, and the possible side-effects of the different phases of the life-cycle of the development (from construction, operation to final abandonment and rehabilitation). Without doubt the most important benefit of EIA is the enforced broadening of the whole scope of planning control, to encompass broad environmental factors alongside more immediate socio-economic factors. EIA has also promoted an increased environmental-awareness and consciousness amongst planning practitioners, so that planning decisions which do not require EIA evaluation by statutory designation might even gain from greater awareness of the environmental factors involved.

Exponents of EIA point to a series of drawbacks which must be appreciated alongside these undoubted

merits. Many problems arose during the initial implementation of NEPA in the United States, during the early 1970's. These stem ultimately from the zealous manner in which EIA was adopted from the beginning; environmental commentators in the United States have identified a massive overkill which produced excessive documentation (too many EIS's of excessive length), lack of coordination in Impact Statement preparation, needless delays in approving worthwhile projects, and excessive beaurocratic involvement in environmental decision making. In some ways the EIA tail was beginning to wag the environmental dog. Since the mid-1970's legislation has been introduced in the United States, designed to rectify some of the inherent problems of the EIA machinery introduced in 1969 via NEPA, and delays have been reduced, report lengths have been reduced, coordination has been increased, and the decision making machinery has been rationalized. But there still remain some drawbacks within EIA. One stems from the essentially negative philosophy underlying EIA—the assessments concentrate on the negative or adverse impacts on environment, but some projects are highly compatible with maintenance of environmental quality, and others might even improve environmental quality (by careful site design and landscaping of some developments, for example). Some environmentalists feel that a more creative, positive basis of environmental decision making, where certain actions were encouraged positively (rather than simply discouraging certain actions, as with EIA), would greatly benefit the environment. Problems also arise from the focus of many EIA's on direct and essentially local effects. Often little attention is given to broader scale, longer term environmental impacts. Another suite of problems stem from the inherent difficulties of balancing environmental factors alongside non-environmental factors. How can you make rational judgements involving social, economic, environmental, ethical, political and even strategic factors simultaneously, for example? The final judgement must in many ways depend on the dominant value system involved. In the final analysis, for example, most American EIA decision making involving military installations takes strategic factors as dominant and all others (including environmental impacts) as subservient to the strategic needs. Yet another family of problems stem from the questionable rationality of the EIA process and decision making based on it. The impartiality of EIA assessors has at times been questioned, as has the political inclinations of those involved most centrally in the ultimate decision making.

At the end of the day it becomes a matter of faith (in the environmental management system) whether one sees EIA as having more benefits than drawbacks, or vice versa. Critics of EIA argue that it has slowed down economic recovery in the United States through needless bureaucratic involvement in planning decision making. Proponents of EIA argue that precisely because of NEPA and its legislative innovations, the quality of the American environment has been preserved if not enhanced, for the benefit of future generations and for the long term sustainability of the American economy. Two aspects of EIA have fuelled extensive dialogue, particularly outside the United States as EIA in one form or another has been introduced into the formal planning machinery of countries like Australia, Canada, and some member states of the European Community (excluding Great Britain in a formal sense, at least to late 1983). These relate to the scale at which EIA should operate, and the rigidity of applying EIA procedures in different cases.

Scale of implementing EIA procedures is highly important. The debate centres on whether EIA should operate only at the small scale, or whether it should span the full spectrum of scales from the site specific proposal to the general policy or programme issue. Project proposals are site specific; a particular project is proposed for a named site, and in many existing EIA systems the attention is focussed almost exclusively at this scale. Policy proposals on the other hand, are not site specific, so that environmental evaluations are more complicated and they must take into account broader issues such as the need at national level to embark on a particular policy which might adversely affect the environment (such as the decision by central government in the United kingdom to embark on an expanded programme of nuclear power station construction between the mid-1980's and 2000 A.D.). Many environmentalists argue that EIA should span both project proposals and policy issues.

Rigidity of application within existing EIA machinery is also of basic importance. It would be impossible and unwieldy to introduce a system of EIA which must be applied to all development proposals, no matter how small, and no matter how inconsequential to environmental quality. Therefore a cut-off point must be built into the environmental planning system, below which statutory EIA evaluations would not be demanded. During the early 1980's the Council of the Commission of European Communities has been giving much thought to the need to introduce a formalized procedure for EIA into member states of the EEC, because of broad differences in environmental policy and in environmental quality standards between member states which might introduce competitive distortions via favouring economic developments in some (more environmentally-lenient) member states than others. Central to this process of enviromental planning has been the question of what types of development would require mandatory EIA assessments, and which could be covered by discretionary assessments. The EEC favour the two tier approach, whereby EIA would be mandatory for certain types of project (such as oil refineries, steel and cement works, motorways, coal mines, airports and petrochemical complexes) which would inevitably have pronounced environmental impacts; and it would be discretionary for projects like forest management, reservoir developments and major urban expansion.

The lessons from experience of EIA in the United States and elsewhere (mainly in developed countries to date) should prove of considerable value when evaluating the need to and scope for introducing formalized EIA procedures elsewhere (particularly in developing countries). But the lessons from accumulated experience cannot be directly transferred between countries, because of inevitable differences in planning policies and practice, in public consultation procedures, and in long term national goals and objectives. The World Conservation Strategy underlines the need to adopt more global and cross-national perspectives in all aspects of environmental planning and monagement, and it remains to be seen now how these can be realized in the closing years of the twentieth century. But there are some broad conclusions about NEPA and about EIA which must be pointed out. Both NEPA in general, and the evolution of formal procedures for assessing possible environmental impacts of proposed developments *in advance*, have served as useful catalysts in the formulation of a new environmental ethos amongst planning practitioners, and they have without doubt increased environmental awareness and sensitivity. EIA has also made important contributions to the rationalization of environmental management. Since 1970 it is possible to detect in the United States and elsewhere a more systematic approach to project appraisal, a more sympathetic environment input into project design, and a greater environmental awareness amongst planners and decision makers. Whether EIA could become the panacea of environmental management, as many of its more fervent protagonists would claim, is perhaps open to debate. In the final analysis, however, there is no doubt in environmental management that PREVENTION IS BETTER THAN CURE, and EIA can rightly claim to put this concept into practice. Environmental decision making, even with the existence of formalized EIA procedures, may not in the long term be changed, and economic factors may at the end of the day still overshadow environmental factors in planning decision making, but the least which emerges from EIA is that the implications for environmental quality of a planning decision will be both clarified and publicized in the public arena. The environmental planner will perhaps always be constrained by socio-economic arguments until the wisdom of caring for the long term survival and sustainability of environmental quality is appreciated by all thinking men. EIA offers one step in that direction.

REFERENCES

Brandt, W. (1980) *North-South; A Programme for Survival* (Pan, London).

Catlow, J. & Thirlwall, C.G. (1976) *Environmental Impact Analysis*. Research Report 11, Department of Environment, London.

Chapman, K. (1981) Issues in environmental impact assessment. *Progress in Human Geography* 5 (2), 190-210.

International Union for the Conservation of Nature (1980) *World Conservation Strategy; Living Resources Conservation for Sustainable Development* (IUDN, Geneva).

Johnson, B. & Balke, R.O. (1980) *The Environment and Bilateral Aid Agencies* (IIED, Washington),

Lee, N. & Wood, C. (1980) Environmental impact assessment in the European Economic Community. *Environmental Impact Assessment Review* 3, 287-300.

Leopold, L.B., et. al. (1971) A procedure for evaluating environmental impact. *United States Geological Survey Circular* 645.

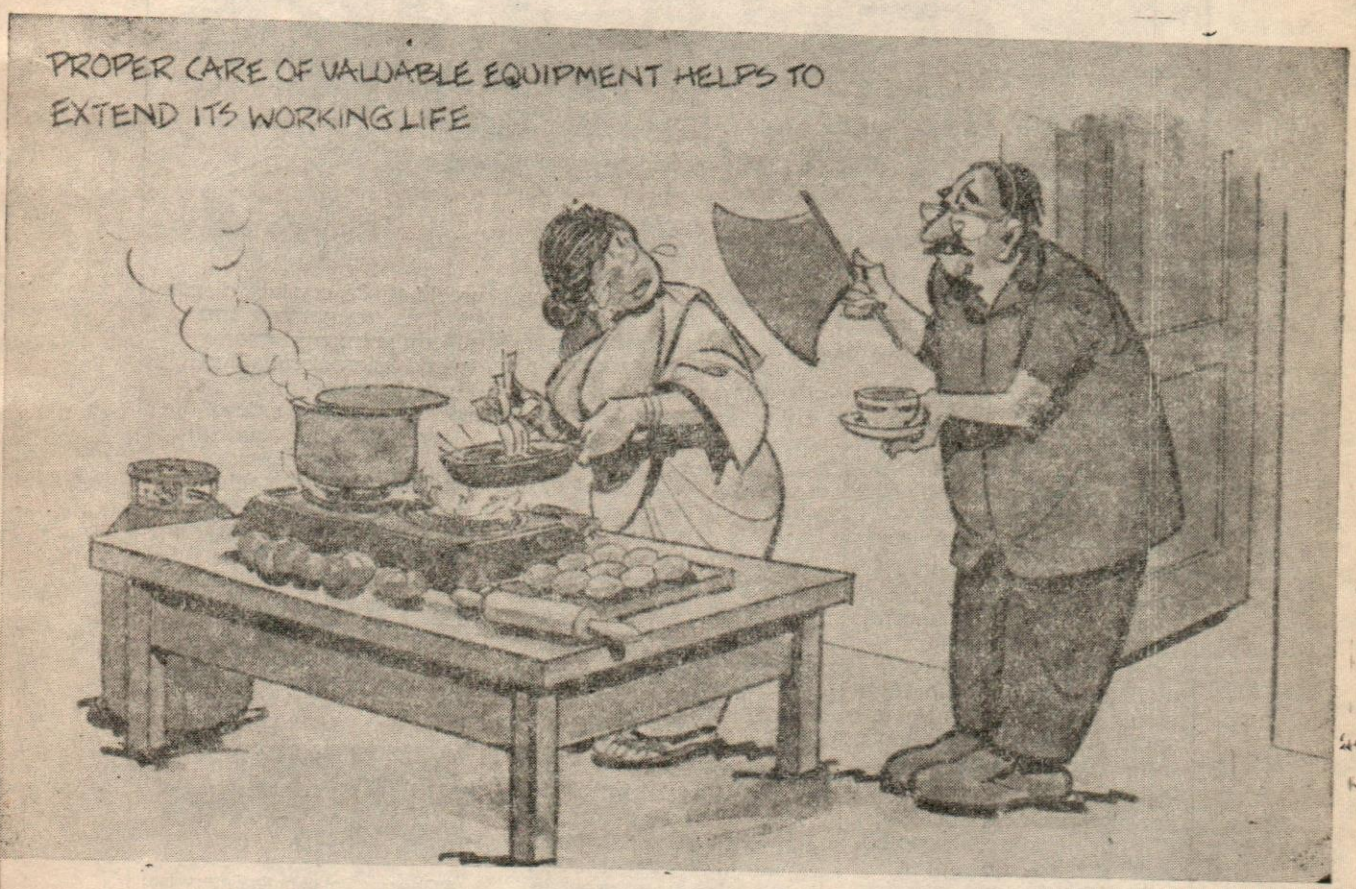
Munn, R.R. (ed.) (1979) *Environmental Impact Assessment; Principles and Practice* (Wiley, New York).

O'Riordan, T. & Sewell, W.R.D. (eds) (1981) *Project Appraisal and Policy Review* (Wiley, London).

Park, C.C. (ed) (1982) Environmental Impact Assessment. Theme issue of *ECOS (A Review of Conservation)* 3 (3).

Sewell, W.R.D. & Little, B.R. (1973) Specialists, laymen and the process of environmental appraisal. *Regional Studies* 7, 162-70.

Stein, R.E. & Johnson, B. (1979) *Banking on the Biosphere? Environmental Procedures and Practices of Nine Multilateral Aid Agencies* (Lexington Press, New York).



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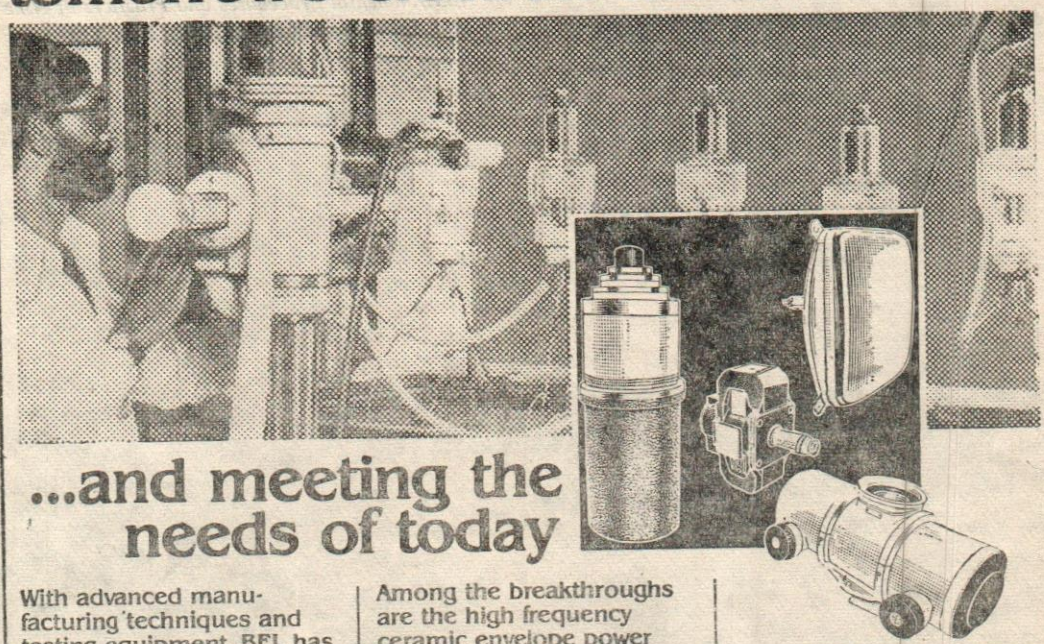

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Productivity
1984, XXIV, 4, 439-441

Managing For Improving Environment

DR. MICHAEL G. ROYSTON

How can a worker be motivated when he realizes that the pollution which he produces 8 hours a day, he and his family has to breathe for 16 hours a day? How can a worker physically deliver high productivity and high quality when he is being choked with dust, defended by noise and asphixiated by fumes? The worker is the one closest to the production technology, who understands it best and who knows better than anyone in the company how to improve it for his and everyone else's benefit. The paper discusses various approaches for improving Environment and discusses the role of organisation in this.

Dr. Michael G. Royston is an expert with International Labour Organisation, Geneva.

Management of the modern enterprise is beset by many problems—cost inflation, productivity, quality, innovation, motivation, relevancy of products, pollution, project failure, safety, criticism from government and local communities, image, problems of planning and many more, including problems of entrepreneurship and planning. All these problems arise, to some degree, because of the way in which we organize things.

For thousands of years we have been taught that if you want to analyse anything you must first chop it up into its component parts. Learning did just this, and the different faculties of the medieval universities argued endlessly as to which was the sole possessor of the truth.

Modern management has perpetuated the error by organizing enterprises so that different functions operate in different, vertical, water-tight compartments with no connection between them. The organization becomes fossilized, unable to change with the times. For example, Production has no design responsibilities but sees the impact of rising energy costs. The design engineers don't share their knowledge because they are isolated from Production, and insist that their original design is still good.

In the west this is reinforced by design engineers and production engineers belonging to different professional bodies, and attending different seminars. In Japan the engineers don't say "I am a design engineer and I work for Mitsubishi", they say "I am a Mitsubishi man responsible for design".

In Japanese companies there is a great horizontal flow of information between departments. There is

much more identity and sense of common purpose and much more grouping together in task forces or multi-disciplinary project teams to solve problems. Because of this, Japanese firms face far fewer problems than western firms in for example, responding to external cost push factors such as increased energy cost: far few problems in continuously improving their production technology; and far fewer problems in achieving high quality and high productivity. Why?—Simply because by breaking down these vertical water-tight barriers, the lower levels of management and the workers see the larger picture on the one hand, the 'environment' in which they work and in which their efforts have results—and on the other hand they sense and exercise a greater degree of responsibility for the impact of their work on the 'environment' of others within and without the company. Hence they come up with highly relevant suggestions for improving the quality of the work-place to make it healthier and safer, to make it produce less pollution and waste and to become more efficient. In short, because they see where they fit in the internal and external environment they are more highly motivated to perform well for the company and the community.

How can a worker be motivated when he realizes that the pollution which he produces 8 hours a day, he and his family has to breathe for 16 hours a day ? How can a worker psysically deliver high productivity and high quality when he is being choked with dust, deafened by noise and asphixiated by fumes ? And on top of all this, the worker is the one closest to the production technology, who understands it best and who knows better than anyone in the company how to improve it for his and everyone else's benefit.

Equally, the project manager or the marketing manager sitting in his water-tight compartment has no idea of the impact of his project or his product on the community at large or indeed whether it will be accepted or rejected by them. And yet paradoxically both project managers and marketing managers are the ones in the organization who spend the most amount of time wilh people in the community.

Those responsible for setting business policy have a blinkered view and see no virtue in sub-contracting substantial parts of production outside, despite the fact that this wider, horizontal, 'environmental' view (which is followed by Japanese companies), reduces costs, reduces stock levels, increases flexibility and management effectiveness, and leads to employment in small-scale businesses and in their upgrading if accompanied by help in training, equiping and financial guaranteeing. It also helps spread development benefits throughout the community, as does the other 'environmental' policy of industrial enterprises adopting villages and helping them with water supply, seeds, tree planting, education, or with energy systems to replace the demand for fire wood where cutting leads to erosion and the destruction of the whole physical and even social environment.

Environmental management therefore means organizing oneself in the open horizontal way rather than the closed vertical way. It means managing the enterprise as a total system within an even larger system. It means giving priority attention to motivation, to responsibility and to communication. It means developing a high quality internal and external working environment. It means a people-oriented, development-oriented, management system. It means making the enterprise prosper as never before, and at the same time ensuring that the community and its environmental resources prosper.

The implementation of environmental management requires firstly a formal commitment by management to its development responsibilities. Then it requires that each manager be made responsible for the quality of the internal and external environment. Then it needs a broadening and a flattening of the organizational structure, to extend it by self-managed groups, task forces and project teams across the organization and outside into the community, and it needs to reduce the levels of command so that managers can truly communicate with those working under them and understand their needs and what motivates them.

By this means pollution issues will be resolved and made profitable by being seen as problems of resource waste and inefficiency ; community needs and values will be met by culturally sensitive products and market-

ing techniques ; development benefits will spread through encouragement of small businesses ; agricultural and rural development will prosper through technical help, particularly in water supply, alternative energy systems and soil conservation ; quality and productivity will increase through better working conditions and higher worker motivation ; innovation will take place continuously, without relying on formalised, expensive indigenous or foreign R & D inputs ; energy water and other resources will be conserved by a multitude of minor adjustments and improvements ; planning will be realistic because it will represent an on-going process of dynamic interaction between all, rather than an isolated academic production of irrelevant plans by the few ; projects will thrive with the full cooperation of man and nature, and the enterprise will at last be the most cost-effective vehicles for national and social development.

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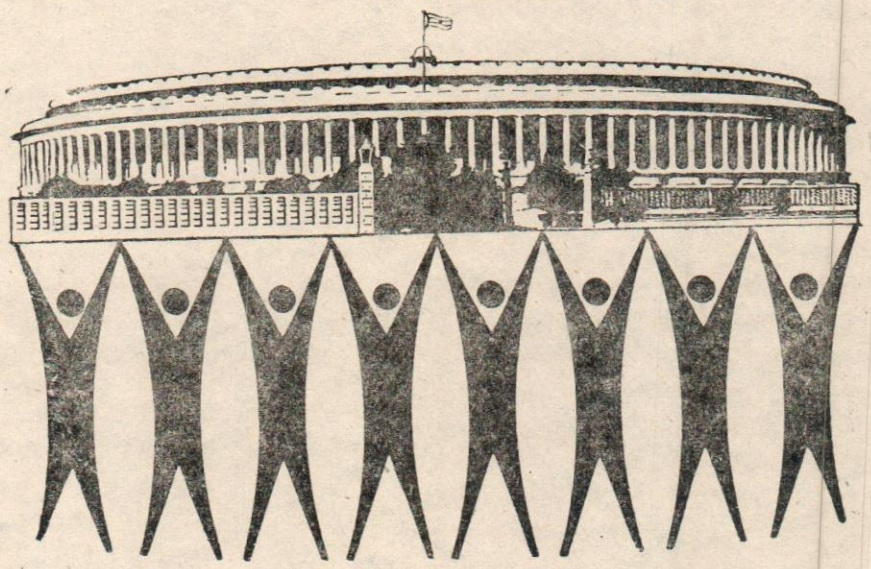

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BE PREPARED TO MEET THE CHALLENGES OF TODAY AND TOMORROW

83/369

Productivity
1984, XXIV, 4, 443-449

X-Efficiency of Past Environmental Management

CLIMIS A. DAVOS

The recent economic crisis forces us into a new era of Environmental Management. The efficiency of this management in the past will be of primary concern. However, the application of the conventional efficiency assessment obscures a number of critical issues. Hence, the X-efficiency of past environmental management is considered. The issues raised are those of effort entropy—degree of coordination among objectives and actions—and inertia-stagnation into established routines, habits and conventions. A high X-inefficiency is the inevitable conclusion after examining these issues in association with past environmental management. To reverse it, pressure and motivation will not suffice, as past experience suggests. Participatory decision-making, qualitative evaluation and synthesis appear to be more promising.

Mr. Climis A. Davos is an Associate Professor of Environmental Policy and Management in the Division of Environmental and Occupational Health Sciences of the School of Public Health, University of California at Los Angels. He received his Ph. D. from the University of Michigan, U.S.A., and he is Fellow of the International Institute of Social Economics. He has to his credit many important publications on Environmental Management.

Introduction

With the recent economic crisis we entered a new era in Environmental Management. Which legacies this new era will leave is too early to perdict. To a great extent, however, they will depend on the lessons derived from the experiences of the past. Hence a continuous reflection upon the latter is essential.

In this paper the efficiency of past environmental management as an integrated entity, in the U.S.A. is discussed. It does not concern with individual management actions for achieving individual environmental ends such as the control of sulfur dioxide emissions or the regulation of nuclear energy generation. The rational for this analytical perspective has no particular significance here but it can be found elsewhere [1].

Of greater importance is my abandonment of the conventional measure of efficiency which compares committed resources and effort with achieved end results. The significance of this comparison notwithstanding, its elevation to a sole measure of efficiency obscures a number of other critical issues for the success of environmental management to advance towards its goals.

The appropriate framework for examining these other critical efficiency issues is the X-Efficiency theory that raises them [2]. Unavoidably, its application to environmental management requires certain conceptual adjustments and parallelisms. A brief review of the major theses of this theory precedes its application.

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Industrial Pollution Control Constraints and Conflicts

DR. NILAY CHAUDHURI

Like most of the developing countries in the South East Asia and Pacific Region, India entered in the realm of environmental protection in the decade of seventies. The tenth year since the introduction of the Water Act (Prevention and Control of Pollution Act) of 1974 is knocking at the door. The implementation of industrial pollution control programme has its successes and failures. It is but logical that developing countries are under chronic shortage of all relevant resources such as finance, technology and techno-scientifically competent manpower. But all the above listed constraints are surmountable if the pollution control implementation programme is backed-up by a strong political will. India is fortunate in this regard. It is known to the world that the Prime Minister of India is out and out an environmentalist.

Dr. Nilay Chaudhuri, Chairman, Central Board for the Prevention and Control of Water Pollution, New Delhi.

Commoner in the street, so also hon'ble members in the Parliament often pose a question almost similar in nature. The question is "how many industrial entrepreneurs are put behind the prison for polluting the environment" since the introduction of the Water (Prevention and Control of Pollution) Act in 1974. The answer had been naggingly no, till August 13, 1983. On that day came a judgement for the first time in India wherein the honourable additional Chief Judicial Magistrate awarded two years' simple imprisonment in addition to a fine of rupees two thousand to the manager of a paper mill, located in the State of Rajasthan. The manager may serve the jail sentence if the proprietor does not appeal against the judgement. Even on appeal from the Magistrate Court to High Court and finally from High Court to the Supreme Court, if the paper mill loses and the additional chief judicial magistrate's verdict stands, the manager, the salaried person, goes to jail, probably as a part of his duty, the proprietor remains still an honourable citizen. In addition, the verdict spells nothing about stopping the pollution, the very cause of evil., Pollution Control Legislation with its various operative sections should be considered as a stockpile of arsenals. It need not be considered exhaustic of arsenals for combating pollution. Even to use the various arsenals as the only stockpile provided in the pollution control legislation one must be judicious in choosing and picking the appropriate arsenal from the stockpile that would aid positively in achieving the end objective which is cleaner environment. Time-bound implementation programme on behalf of the

proprietor of the paper mill as an affidavit in the Chief Judicial Magistrate Court should have been preferred to imprisonment of the manager. The indicator for pollution control should not be the number of prosecutions launched against polluter and the number of convictions obtained in favour of pollution control enforcing agencies or the number of salaried managers are either fined or imprisoned or both. The indicator should be the volume of pollutional load, liquid, gaseous, or solid, made innocuous enough to be accepted and assimilited by the receiving environment without manifesting any sign of deterioration. While the former indicator may have news value but the latter indicator has a lasting value on the environment.

> Should the industrial manager be sent to jail for industrial pollution or be forced legally to control industrial pollution. Pollution control boards would adopt that course which society demands. If society wants news values let the boards fight legal battles to send the industrial managers to jail. For lasting protection of environment recalcitrant industries must be forced to control industrial pollution.

Like most of the developing countries in the South East Asia and Pacific Region, India entered in the realm of environmental protection in the decade of seventies. The tenth year since the introduction of the Water (Prevention and Control of Pollution Act) of 1974 is knocking at the door. The implementation of industrial pollution control programme has its successes and failures. It is but logical that developing countries are under chronic shortage of all relevant resources such as finance, technology and techno-scientifically competent manpower. But all the above listed constraints are surmountable if the pollution control implementation programme is backed-up by a strong political will. India is fortunate in this regard. It is known to the world that the Prime Minister of India is out and out an environmentalist.

The Water (Prevention and Control of Pollution) Act was introduced only in 1974, hence the country has acquired a reasonable experience in this regard. Significant advancement has been made in the field of water pollution control. In the Federal form of Government with the State Government's autonomy on the control of water the very introduction of a single piece of legislation applicable in all the four corners of a country which has 22 States and 3.25 million square kilometre in command, manifests a strong political will for pollution control. The enforcing agency created in each State named as State Pollution Control Board when administers the same water protection law the industrial entreprenuers are left with no choice of flocking in a State permitting all possible incentives including pollution.

Regional imbalances in industrial growth do exist in the country which were prompted not by slackness in pollution control in some States as compared to others. These regional imbalances are more because of uneven distribution of raw material, market skill and other industrial infrastructural support. This disparity in industrial growth which is a part of history now has put dissimilar pressure on some State Pollution Control Boards as compared to the others. Thus, Assam, a State in the north-east and Himachal Pradesh, a State in the north-west are to control not more than 20 polluting industries in each of these two States. In contrast, Maharashtra and Gujarat are required to control no less than 400 to 600 industrial units in each State. On top of it more and more industrial entreprenuers are looking for opening more industrial units in these two latter States. In the backdrop of such disparity in industrial growth between States a uniform piece of legislation for the entire country has become a strong cementing force in pollution control. It is further strengthened by the creation of a Central Pollution Control Board at the Federal level, as conceived in the Water Act. This apex body not only advises the Government of India but also coordinates the activities of all the State Boards by having full involvement in all conceivable aspects of pollution control.

> In a federal form of government introduction of a common water pollution control act applicable in whole of India indicates a strong political will to combat pollution. Above precedence helped to have a common air pollution control act. Such a common law prevailing throughout the country has become a strong cementing force in

pollution control. Creation of a central board as the apex body serves that cementing force.

During the formative years of pollution control, State Pollution Control Boards, in their zeal to show result initiated asking industries to control of pollution in a 'pick 'n kick' fashion. In this process many industrial units were chased whose pollutions were not worth looking at, and thus the regulatory agencies lost otherwise gainfully utilisable time. This error in approach crept in as because the State Pollution Control Boards used the list of industrial units maintained by the Department of Industries of the State Government as the guide book for pollution control enforcement. With time when the State Boards realised that many major polluting industries were not included in the 'pick 'n kick' list, the significance of inventory of pollutionally relevant industries and arranging the pollutionally relevant units in the order of severity in pollution was appreciated. In this process the Andhra Pradesh State Board realised that by tackling 13 industrial units in a total list of 133 units in the city of Hyderabad, more than 90 percent of industrial wastewater by volume would be controlled. Similarly in Delhi control of 16 industrial units would control more than 95 per cent of industrial waste by volume.

For the 14 States (including Jammu & Kashmir, excluding Maharashtra, Tamil Nadu, Orissa and 5 North-East Hill States) and the 9 Union Territories such as Delhi, Chandigarh, Goa, Andaman and Nicobar, Arunachal, Mizoram, Pondicherry, Dadra & Nagar Haveli, and Lakshwadeep, the Central Pollution Control Board conducted an industrial survey during April-May, 1981. Out of a total 2,700 *large* and *medium* industries, 1,700 water polluting industries were identified. The progress in industrial wastewater pollution control was also noted along with legal prosecution. The information is summarized in Table 1. Slightly less than 50 per cent of industrial

TABLE-1

Statewise Polluting Industries and their Status of Pollution Control Enforcement

Sl. No.	*State*	*No. of Industry*	*No. Relevant to Water Pollution Control*	*No. of Industries control Ind. waste*	*No. of Industries under Prosecution*
1.	Andhra Pradesh	300	114	54	10
2.	Assam	42	30	8	Nil
3.	Bihar	161	95	14	5
4.	Gujarat	509	389	68	25
5.	Haryana	145	110	16	87
6.	Himachal Pradesh	30	20	1	Nil
7.	Jammu & Kashmir	28	3	1	Nil
8.	Karnataka	224	166	142	3
9.	Kerala	165	130	60	4
10.	Madhya Pradesh	277	119	108	Nil
11.	Punjab	143	68	21	19
12.	Rajasthan	156	108	82	20
13.	Uttar Pradesh	180	102	47	10
14.	West Bengal	200	120	53	2
15.	Central Board for Union Territories	140	136	36	56
	Total	2,700	1.700	781	241

units is already under control in a period less than a decade. Should it not be considered as a signifiant progress in industrial pollution control?

> Inventory of pollutionally relevant industry is a prerequisite for systematic control of pollution. Pick 'n kick approach leads you nowhere.

Any country introducing pollution control legislation at any time would have a stock of industrial units with antiquated or no pollution control and also with processes either facing obsolescence in terms of age, process changes for efficient production and lesser pollution. Pollution Control for these units is more difficult as compared to new industries because of higher cost at no or marginal benefit. Phsychologically also these entreprenuers remain averse to pollution control viewing such investment as unproductive. To hasten establishment of pollution control in the existing group of industries, the Central Pollution Control Board evolved industry-specific pollution control strategy through a strenuous process of developing industry-specific Comprehensive Industry Document. This document covers numbers, sizes, geographical distribution, material inputs, processes adopted, product mix, by-products recovery, water consumption, various waste streams and their characterization. The document particularly deals in prevention and control methods of wastewater vis-a-vis their cost implications. This is the most important aspect of the document as any specific type of industry must know the extent upto which their effluents must be treated so that they can discharge the treated effluents either on land for irrigtion or to rivers or lakes or in estuaries or in sea depending on the location of the industry. The document evolves the industry-specific MINIMAL NATIONAL STANDARDS (MINAS) by evaluating cost of various levels of treatment. The capital cost of various levels of treatment is converted in annuity taking relevant interest on capital and depreciation. This annuity is converted into annual burden by adding annual operation, maintenance, and repair cost for each level of treatment. The level of treatment for which the annual burden remains within 3 per cent of annual turnover of the specific industry is accepted as the approriate level of treatment, to be installed by each existing industry of the type. The concomitant effluent quality is termed MINAS which cannot be relaxed by any State Pollution Control Boards. Stricter effluent quality is prescribed if a specific location so demands. The consultant engaged for evolving each of the Comprehensive Industry Document is continuously guided by an Industry Committee constituted for each of the industries. The specific Industry, the Executive Ministry, Industry Association, Indian Standards Institution, Directorate General of Technical Development, and Department of Environment are all represented in the Industry Committee.

> Industry must know its financial burden to control pollution. To fulfil this requirement industry-specific minimal national standards (MINAS) are evolved correlating annual burden of pollution control to annual turnover of the industry.

The prescription of MINAS based on annual burden of treatment as certain percentage of annual turnover of the industry, is liked by industries as because the industry can pass on the cost of pollution control to the price of product. So long this is within 3 per cent, a product costing one rupee can be increased to one rupee and three paisa without creating any stir in the mind of industrial entreprenuer and consumer too. It is heartening to note that this percentage remains within one for many types of industry, and crosses the upper limit of 3 per cent for industries generating synthetic chemicals such as pesticide, pharmaceuticals, Dye & Dye Intermediates or industries having extremely high organic pollutant such as molasses based alcohol distilleries.

The nation wide implementation of industry-specific pollution control has its merit as reflected in Table 2. The 8 types of industry put in Phase I are vigorously pursued for implementation of pollution control. The preparation of Comprehensive Industry Document for the types of industry grouped in Phase II is in advanced stage, awaiting finalisation for nation wide implementation of pollution control.

While clearing the backlog of industrial pollution mess created by existing industries the regulatory

TABLE-2
Industry-Specific Pollution Control

Sl. No.	*Types of Indusrry*	*Number of Units*	*Number of Units with Efficient Treatment Plant*
1.	Sugar	300	104
2.	Distillery	128	34
3.	Caustic Soda	38	27
4.	Fertiliser	65	55
5.	Oil Refinery	13	13
6.	Man Made Fibre	29	22
7.	Integrated Steel Mill	7	7
8.	Textile (Cotton & Wool)	300	155
	Industry to be controlled in Phase I	880	417
9.	Pulp and Paper	150	55
10.	Pharmaceutical	120	56
11.	Pesticide	50	16
12.	Petrochemicals	10	10
13.	Inorganic Chemicals	150	34
14.	Dairies	50	32
15.	Thermal Power Plant	150	59
16.	Non-Ferrous Metal	12	8
17.	Dye Manufacturing Large Engg. using Electroplating, Large Tanneries and Misc.	128	24
	Industry to be controlled in Phase II	820	294
	Total	1.700	711

agencies should not loose sight of controlling new industries; otherwise the backlog would keep on mounting instead of melting. Any new industry draws attention of the provisions of the Water Act only at the stage of discharging the industrial wastewater. If the new industry does not install any wastewater treatment plant along with the commissioning of the industrial plant, the State Boards as regulatory agencies often find it difficult to ask the industry not to discharge untreated wastewater until the treatment plant is built. Because such refusal tantamounts to virtual closure of the industry, which a developing country can hardly afford. To avoid such last mo ment embarrassment, and at the instance of the Central Pollution Control Board, the Government of India issued an executive order. As per this executive order the Industrial Licensing Committee of the Government of India allows conversion of letter of intent into industrial license provided the entrepreneur through the respective State Industries Department obtains a No Objection Certificate (NOC) from the respective State Pollution Control Board. Majority of the States is not practicing this procedure and the Industrial Licensing Committee of the Government of India also

The Indian environment is said to have deteriorated mainly due to population growth, urbanization, industrialization and the modernization of agriculture. Population growth by itself brings in its wake problems like those of water supply, sewage and waste disposal. In many cases the city corporations and municipalities have failed to meet the demands of the growing population in a satisfactory way. Furthermore, the concentration of economic activity and population in large cities has caused an agglomeration of industries resulting in polluting the natural environment and also bringing in its wake problems of urbanization, thus worsening matters. As if this is not sufficient, chemical fertilizers, insecticides and pesticides are used to meet the demands of the rising population for agricultural products from a limited area which, in turn, result in the further deterioration of the environment.

From the above, the environmental problems facing India can be stated as:

(i) Population Growth;

(ii) Urbanization;

(iii) Industrial Pollution;

(iv) Agricultural Pollution.

Before going onto study certain major environmental legislations, it is essential to determine the legislative competence of the Union and State Legislatures to legislate on the identified problem areas.

At the very outset it must be mentioned that the subject "Environment Pollution Control" as such does not figure anywhere in the Constitution (The 42nd Amendment Act which incorporated some provisions relating to environmental protection is dealt with separately). But a look into the Seventh Schedule which classifies various legislative entries into three groups, viz. (a) the Union List; (b) the State List, and (c) the Concurrent List, reveals various entries which can be related to the protection of the environment. On the face of it, it is the State Legislature alone which is empowered to legislate on some of the most vital matters effecting the environment.

When the Constitution of India was amended for the 42nd time in 1976, certain environmental provisions were incorporated into it. These provisions need careful study for this was the first time that the expression 'environmental protection' found a place in the Constitution and that the environmental philosophy of the government was spelt out. They are also important because the changes brought out led many scholars to wrongly judge that by the Amendment the Central Government wanted to gain certain powers, which it did not have, to protect the environment. Art. 48 A, was added to the Directive Principles of State Policy which stated:

> "The State shall endeavour to protect and improve the environment and safeguard the forests and wild life in the country".

The only other provision dealing with environment found place in the Chapter on "Fundamental Duties" which was inserted after Part IV of the Constitution as Part IV-A Art. 51 A (g) of this Part provided:

> "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures".

A new entry 20 (a) was inserted in the Concurrent List after entry 20. This entry deals with "population control and family planning". An explanation was added to Articles 55, 81, 82 and 330 to the effect that:

> "The expression 'pollution' means the population as ascertained at the last preceding census of which the relevant figures have been published: Provided that the reference in this explanation to the last preceding census of which the relevant figures have been published shall, until the relevant figures for the first census taken after the year 2000 have been published be construed as a reference to the 1971 census".

Besides this, the entries dealing with "forests" and "wild life" were dropped from List II and inserted in the Concurrent List.

These were mainly the changes effected by the 42nd Amendment Act. What was the Government's objective in bringing about these changes? Did the government want to give expression to its willingness to prevent environmental pollution or did the government

think that it could not go about preventing pollution without occupying itself with more powers?

If, as posed above, the government's intention was only to give expression to its willingness, the incorporation of Art 48 A in the Chapter on Directive Principles of State Policy certainly served the purpose. Because of this, for the first time, the world environment was used in its broadest sense in the Constitution.

But if the intention of the government was to have more powers, then the question has to be considered at depth and at two levels: (a) What additional powers did the government gain by these changes; and (b) in what way they were incremental to the existing provision.

To start with, the provision incorporated in the Chapter "Fundamental Duties" does not make such sense, for Art 51 A (g) starts with words like "It shall be the duty of every citizen of India to protect and improve the natural environment...". As is clear, there is no enforcing machinery. When one reads this provision along with the one incorporated in the Directive Principle of State Policy, it becomes clear that the "duty" is much more sweeping and all-encompassing than the "directive". What additional powers this article gives is hard to understand.

As to the rest of the changes, the insertion of an entirely new entry (No. 20 A) in List III, on "Pollution Control and Family Planning", by its very place in the concurrent list, would give an upper hand to the Centre, *should the Centre decide to pass a Law.*

And lastly, by bringing the entries of 'forests' and 'wild life' from the State List to the Concurrent List, the Centre was not taking away the State's right to make Laws. It only meant that from then on the Union government could also pass laws covering these two areas. One may ask the question: does not the Union Government have these powers otherwise? The question is pertinent not only to study the real gains of the 42nd Amendment Act from the environmental protection point of view, but also to scrutinize the commonly held view that it is the state legislature alone which is empowered to make environmental laws. This view gains strength if one looks at the reasons as to why the enactment of the some of the Central Acts relating to environmental protection took so much time.

The much forgotten Art. 253 of the Constitution: says:

> Notwithstanding anything in the foregoing provisions of this Chapter, Parliament has powers to make any law for the whole or any part of the territory of India for implementing any Treaty, Agreement or Convention with any other country or countries or *any decision made at any international conference, association or other body* (*Emphasis added*).

This Article is in conformity with the object declared by Article 31 (e) and entries 13 and 14 of the Union List embodying the above provisions in the form of a legislation entry. Entries 13 and 14, read with Art 253, give the Union power to enact laws virtually on any entry contained in List II. A close reading of Art 253 reveals that the Union Government, *even without an international obligation*, can enact laws on matters enumerated in List II.

From the above discussion, whether the framers of the Constitution intended it to be this way or not, it is clear that the Parliament has unlimited power to pass any law, covering the State List entries even without the 42nd Amendment. Then why the Union Government did not take the lead in passing environmental legislation even after taking an active part in the Stockholm Conference on Human Environment, the Bucharest Conference on Population, the Vancouver Conference on Shelter and Human Habitat, etc., needs a more detailed study with some very interesting possibilities. The view that the Union Government does not have the power to enact environmental legislation and that it is the State Legislature alone which can do this is wholly untenable.

It is truly said that India has a multitude of legislation each in turn covering a very minor environmental area. While the number is staggering, the provisions related to environmental pollution are extremely vague and, even if they are precise at times, their implementation has always left something to be desired. However, the enacting of the wildlife (Protection) Act, 1972 and

the Water (Prevention and Control of Pollution) Act, 1974, were acclaimed as ushering in a new environmental era. To these can be added the most recently enacted legislation—the Forest Conservation Act, 1980 and the Air (Prevention and Control of Pollution) Act, 1981. These legislations were looked upon with hope by environmentalists since the legislators clearly had environmental conservation in mind, whereas the legislation brought into force prior to 1972 always had some other objective. The environmental conservation was only incidental to them. A brief study of the environmental legislations brought into existence in India since India's participation in UN Human Environment Conference in 1972 follows. It is proposed to give the salient provisions and then go on with the implementational issues. The questions related to the jurisdictional and procedural matters will not be dealt with since they were referred to above in considerable detail. However, it needs mentioning that the Wild Life (Protection) Act, 1972, and the Water Act, 1974, were passed by the Central Government after following the procedure provided in Art. 252 (two or more States adopting the enabling Resolutions empowering the Parliament to pass a Law on the subject). The Air Act, 1981, was to give effect to the decisions taken at the UN Conference on Human Environment held in Stockholm "to take appropriate steps for the preservation of the natural resources of the earth, which, among other things, include preservation of the quality of air and control of air pollution." With this a beginning has been made to make use of Article 253 of the Constitutian in the passing of environmental legislation.

The wildlife (Protection) Act, 1972, provides for the following:

(i) Constitution of a Wildlife Advisory Board;
(ii) Regulation of Hunting of Wild animals and Birds;
(iii) Laying down of procedure for declaring areas as sanctuaries, national parks, etc;
(iv) Regulation of possession, acquisition or transfer of, or trade in wild animals, animals articles and trophies and taxidermy, thereof;
(v) Provision for penalties for contravention of the Act.

The Act is definitely a great improvement over its predecessor Act in 1912. However, many things that could have been done like the establishment of natural reserves to protect certain areas in their pristine beauty was left undone. Because of the general preoccupation of the academics with such problems as water quality and air quality, the wild life Act has not been put to the same amount of scrutiny and incisive comment. By and large, however, it can be said that performance under the Act is satisfactory.

As the titles of the Water Act and Air Act follow an identical pattern, and since the same Board is to administer both the Acts, it is pertinent to comment on the title. As the titles suggest, the Acts are designed to "prevent and control" water and air pollution—where "prevention" may refer to the new sources of pollution and "control" may refer to the existing sources of pollution.

A brief study of the Water Act would indicate that the Act is very comprehensive in its coverage. It applies to "streams" which were defined to include "river water course, inland water and sub-terranean waters; sea or tidal waters", to such extent as determined by the State Government. Pollution sewage effluent and trade effluent are also fairly comprehensively defined. The Act makes provisions for the composition of the central and state boards. These Boards are autonomous and they can sue and be sued. Section 3 (2) and Section 4 (2) of the Act deal with the Constitution of the Central State Boards. A provision was made to represent the interests of agriculture, fishery or industry or trade and also of the companies or coporations owned, controlled or managed by the Central and State governments respectively. A provision has been made for a full time chairman and a member-secretary to exercise the powers conferred, and to perform the functions assigned to that Board under this Act. Sections 16 and 17 elaborately deal with the functions of Central and State Boards. Besides advising the Central government on matters concerning prevention and control of water pollution the Central Board also acts as the State Board for all the Union Territories.

While exercising the powers conferred, the Central Board is bound by the directions of the Central

Government whereas the State Board is bound by the directions of both the Central and the State Boards. Where a direction given by the State Government is inconsistent with the direction given by the Central Board, the matter shall be referred to the Central Government for its direction.

The Act deals with the control of Pollution in two ways; One, pollution caused by industrial effluents from the existing industry, and two, threatened pollution by effluents from the industries yet to be installed. The former is controlled by the Water Boards by virtue of the powers vested in them under Section 26 of the Act, through the 'application for consent' to charge sewage or trade. The latter can be regulated by the Water Boards in two ways: By imposing restrictions under Section 25 of the Act on new outlets and new discharges of trade effluents and by advising the government concerned with respect to the location of any industry, the establishment of which is likely to pollute a stream or well under Section 17 (1) and (n) of the Act.

The framework of the Air Act follows the pattern set by the Water Act. With a view to have an integrated approach the Central and State Boards established under Water Act will also perform the functions of the Central and State Boards for the prevention Control of Air Pollution. As the Air Act is extended to the whole of India, in States where the Water Act is not in force, it is proposed to constitute separate Boards for the Prevention and Control of Air Pollution. However, one very distressing point that needs mentioning about the Air Act that though the Act has been brought into existence the rules under which the Act is to be implemented could be adopted only after 20 months of delay. Without the rules enforcement of the Act could not begin. The enforcement problems under the Water Act, however, can be stated as follows:

Though the Water Act expressly confers powers and functions on the Water Boards, it is silent on the matter of funds. It leaves the matter to the State Governments. As long as there is an inadequacy of funds and uncertainty about the amount, it is unfair to expect the State Boards to enforce the Act effectively. Keeping this in mind the government considered a proposal to impose a cess to meet the expenses of the Central and State Boards for the Prevention and Control of Water Prevention. An Act, The Water (Prevention and Control of Pollution) Cess Act, 1977, was passed to help augment the resources of the Water Boards for the Prevention and Control of Water Pollution.

The other important provisions that merit special attention include Section 24 (1) dealing with the prohibition on the use of streams or wells for the disposal of polluting matter, etc. Under Section 24 (1) it is an offence to *knowingly cause or permit* to enter into any matter which may tend, either directly or in combination with similar matter, to impede the proper flow of water of the stream in a manner leading or likely to lead to a substantial aggravation of pollution due to other causes or of its consequencies by any persons.

The expression "knowingly" qualified the words "cause" or "permit" thereby making it obligatory for the prosecution to prove in either case the existence of knowledge on the part of the polluter before he can be held responsible. The situation where a person permits polluting matter into any stream by negligence is not covered.

The water board has no authority to directly deal with the erring industries and is required to approach the judiciary for issuing directions. Even when found guilty, a management can be punished with imprisonment and fine, but there is no provision to enable a court to direct any industries to close down. The court's procedures are time consuming and the inherent delays prevent quick and corrective action.

It is true that Section 32 of the Water Act empowers the Board to take some emergency measures. But that is only where it appears to the State Board that any poisonous noxious or polluting matter is present in any stream or well...*due to any accident or other unforeseen act or event.* As such, the following steps which the Board is otherwise empowered to take under this section like "removing that matter from the stream or well, remedying or mitigating any pollution caused by its presence, issuing orders immediately restraining or prohibiting the person concerned from discharging any poisonous, noxious or polluting matter into the stream or well" cannot be taken.

Finally, section 49 (1) provides that "no court shall take cognizance of any offence under this Act except on a complaint made by, or with the previous sanction in writing of the State Board...". Had the right been given to the individual along with the Water Board, the implementation of the Act would have been much more effective. These are some of the anamolies in the Act which, when rectified, would further enhance its efficacy.

India does not lag behind many countries in adopting or proposing to adopt environmental legislation, or for that matter in taking effective administrative measures. But the effectiveness of such measures needs to be judged not by the organizational set up that the legal measures establish, but on the basis of its performance and specific priorities.

As shown in the case of the Water Act, certain provisions reduce the efficacy of the enactment. A common feature with the environmental legislations in India is that they exclude the participation of the people with any genuine direct interest in its implementation. The enterprises which profit at the expense of the environment are always well represented and their interests are always well protected. Too many legislations, even if each of them covers one seemingly distinct area, are counterproductive in the long run for the protection of the environment. Hence, the need of the hour is to start thinking afresh into the entire issue of environmental pollution as suggested in the very beginning of this note, and to develop a unified and comprehensive approach.

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Management of Airspace and Air Transport Environment, and Evironment Protection in India

DR. S. BHATT

In view of airspace being a vital resource for planning and development of modern cities, a new management concept is emerging wherein an integrated view is taken of airspace management. Factors like ecology of a geographical region, climate, prevailing winds, population and industrial development, are taken into consideration for human settlements policy so that airspace is put to optimum use for a certain area.

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Airspace is an important part of environment of man. Like land areas, waters and outer space, air space environment shapes life of man and global society. Airspace is a rich resource also. Though this medium man creates productivity for society in diverse ways. Airspace is used for modern communication, transportation, remote sensing of ground-located resources, and a host of other uses directly and indirectly for society. Management of airspace is therefore an important consideration for our progress. It may also be submitted that creative management of airspace is a challenging task for our scientists, lawyers, air transport specialists, airport and city planners, communication experts and those who are keen to see a stable and ecological society living in harmony with nature. An ecological view of airspace management in recent years has become necessary to secure the protection of airspace environment. Air pollution and noise is causing a lot of concern to our society.

2. A New Look on Airspace Management

In traditional notion of air law, airspace belonged to land-owner and it extended to unlimited height upto the heavens. Modern view of airspace ownership is of course that airspace is a public property. It is therefore a resource which is to be used and cared for by the public interest. Indeed the pollution of airspace around industrial cities is largely due to this tragedy of commons. No single person is responsible to keep air clean. Dumping of waste into airspace and release of discharge from industrial plants have polluted air to a large extent. Thus a common resource which

provides good life for man, is made degradable by indifference of man.

Besides, in view of airspace being a vital resource for planning and development of modern cities, a new management concept is emerging wherein an integrated view is taken of airspace management. Factors like ecology of a geographical region, climate, prevailing winds, population and industrial development, are taken into consideration for human settlements policy so that airspace is put to optimum use for a certain area.

3. Air Transport Management: Objectives

Since the beginning of Air Age in 1905 onwards, airspace environment is by and large synonymous with air transport environment. Of course the next likely revolution through airspace environment is the impact on global society of communication media such as television and telephones and other communication aids being now developed all over the world.

Air transport management's view of airspace is a much debated issue and will continue to be so long as air transport is used for carrying of passengers, mail and cargo, and other uses that aviation is put such as providing aid in distress like in floods, and flight undertaken for hospital purposes etc. Flying for joy-rider and sport is also quite interesting aspect of airspace management.

The question is then how do we manage airspace for purpose of air transport? How do national and international aviation function without harming airspace environment?

International Civil Aviation Organisation (ICAO)

The global aviation management is guided admirably by ICAO a specialised agency of United Nations. Objectives of this world organisation are, *inter alia*, as follows: to ensure safe and orderly development of civil aviation in the world; to encourage arts of aircraft design; encourage development of airports, airways; to meet needs of people for economic and safe air transport; to prevent economic waste caused by unreasonable competition, to ensure rights of states to engage in international air transportation with fair opportunity to all; and promote development of international civil aviation.[1]

The ICAO has various offices in different parts of world with its headquarters being in Montreal, Canada. It has an Assembly, a Council and a Secretariat. It also has Air Navigation Commission, Air Transport Committee, Legal Committee and Technical Assistance Bureau. By ICAO Assembly Resolution No. 21-17, it recognised that the growth of civil aviation can make an important contribution to the economic development of developing countries. By Resolution A 18-11 ICAO also made its position known to the environmental impact of air transport. The Resolution stated that "ICAO is conscious of the adverse environmental impacts that may be related to aircraft activity and of its responsibility and that of its member states to achieve maximum compatibility between the safe and orderly development of civil aviation and the quality of human environment."[2]

It must be stated in depth that airspace environment is not an unlimited entity. Most of airspace or atmospheric space extends upto approximately 10 miles vertically from ground. This fact looks to a laymen even alarming since this is roughly the average distance we traverse daily commuting to office one way. And in this airspace we look for all our answers as if airspace extends to the skies. This is the small area which human kind has been polluting with contempt. Even the carbon dioxide content of this region has increased which is bound to change world climates as scientists warn. An important study by Professor Carl Christol of California University reveals a lot of adverse impact on the stratosphere and the depletion of ozone layer as a result of hydro-carbons and oxides of nitrogen being discharged by aircraft and spacecraft.[3] Indeed for similar assaults on nature, the American Association for the Advancement of Science has warned that men's forces over nature and capacity to change nature have exceeded nature's forces themselves.

4. Environment Protection and Aviation Management

The UN Declaration in Stockholm in 1972 on human environment says in Section 2 that "the pro-

tection and improvement of the human environment is a major issue which affects the well-being of peoples and economic development throughout the world...."[4] In section 6 it further stresses that "discharge of toxic substances or of other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of environment to render them harmless, must be halted in order to ensure that serious or irreversible damage is not inflicted upon ecosystems. The first struggle of the peoples of all countries against pollution should be supported."

To safeguard airports, ICAO have drawn master planning manual for developing eco-systems around airports and for land-use planning so that airspace management is in equilibrium with nature's forces operating in an ecosystem.

The ICAO Airport Planning Manual (Doc 9184-AN/902 Part I and II of 1977) taken an integrated view of airport planning and considers relationship of large land areas needed to airspace necessary for aircraft operations p. 1-3. A systems approach is adopted for preparation of master plan. "The importance of balancing the respective capacities of the many elements and of ensuring flexibility and expansibility to meet changing needs are shown together with methods of achieving these objectives," says the Manual - p. 1-5. The gist of planning philosophy is summed up: "The most efficient plan for the airport as a whole is that which provides the required capacity for aircraft, passengers, cargo and vehicle movements, with maximum passenger, operator and staff convenience and at lowest capital and operating cost."—p. 1-5. Part II of the ICAO Planning Manuals with land-use planning in the vicinity of airports and environmental aspects as no standards have so far been made. In chapter 1, the Manual discusses airport and its environments. Then it analyses the need for environmental control and the need for land-use planning. The latter provides for land use for airport with minimum interference to the environment and public by locating residential areas away from traffic zones and noise level and by developing park lands.

Chapter 2 of above ICAO Manual touches upon ecological considerations of airport planning and use. Exhaust from turbo jets is accepted as lesser evil than from piston-engined aircraft. The study aims at protection of flora and fauna and maintenance of topography around airports and watershed patterns. Depletion of flora content, it says, is detrimental to ecological balance of airport eco-system. Also to avoid bird strikes, it stresses that airport should not be located along routes where birds migrate. Moreover, soil erosion should not be caused by aircraft jet blast. By far the most important environmental factor is to reduce aircraft noise from aircraft. Take-off and landing directions are to be planned so that they do not fall along inhabited and populated areas. Noise abatement measures are needed to control aircraft noise. On pollution by exhaust, much research is going on. Ground run-ups have been cut down considerably.

Lastly, land uses around airports are planned carefully to provide for agriculture for vacant land at airports, and establish recreational areas so that airports are made attractive and environment management improved.

5. Air Pollution Control Act 1981

For better preservation of airspace environment, measures have been taken in India to control pollution of air. Such acts for clean air have come up all over the world for protection of airspace environment. In India, Air (Prevention and Control of Pollution) Act 1981 provides for protection of airspace environment. The said act has been enacted in pursuance of U.N. Declaration on Human Environment in 1972. It defines air pollutant as any solid, liquid or gaseous substance which when in excess concentration becomes injurious to health. It establishes a Central Board for the prevention and control of pollution of air. The State Boards for prevention of water control are also to exercise power for air pollution control under this act. The Central Board may advise Central Government on matters for improving quality of air, plan a nation-wide programme for prevention and abatement of air pollution and co-ordinate the activities of state boards. The State Boards are to advise State Government on measures for prevention of air pollution. Under Section 19 of Act, State Governments can declare air pollution control areas for purposes of control of air pollution. The Act sets up State

laboratories for taking samples of air. It provides for penalties for certain acts which cause air pollution.

Thus we see an eco-system approach being evolved for management of airspace and even air transport environment.[5] As the Report of Committee of Department of Science and Technology for Environmental Protection has said in September 1980: The natural ecosystems may represent our only hope for finding the basic material for restoring the health of completely devastated landscapes...p. 18. It further says: "A basic and vital aspect of environmental conservation is that representative areas typical of the physical beauty and character of country, celebrated in the literary and oral culture from time immemorial, should be preserved"—p. 18.

An ecological view of air transport and airspace management does take all aspects of environment into considerations while we develop aviation for the economic use in the country. Indeed there has to be harmony between scientific concepts and management and legal concepts for eco-developments.[6]

6. Summary

Airspace and air transport management are a creative function of modern planners and scientists. In a crowded world, we have finite airspace. Hence it is our duty to preserve this rich resource base for our good health, our economic development, and live in harmony with nature. Even visual pollution of airspace presents unesthetic sight and clean airspace environment becomes necessary for better quality of life. Laws are there to control airspace pollution and aircraft noise. But what is now emerging as important thinking of man is; to promote an eco-system management ment of airspace around cities, around airports and the whole population settlement areas, so that our population centres manage airspace with an integrated view of other natural order of flora, fauna and water systems etc.

Airspace environment management is therefore a new challenge to those who believe in progress in a creative and finite scientific world of our times. Better management leads to better protection of airspace environment.

REFERENCES

1. See Article 44 of Chicago Convention on International Civil Aviation in S. Bhatt, *Aviation, Environment and World Order* (Radiant Publishers, New Delhi, 1980), p. 46.
2. See ibid., p. 47.
3. See "The international legal and institutional aspects of the stratosphere ozone problem", a report by Professor C.Q. Christol, 1975, pp. 132. For a review of above, see S. Bhatt, *Indian Journal of International Law*, Vol. 16, (1976), pp. 139-40.
4. See UN Doc. A/CONF. 48/14, 3 July 1972. Annex II, pp. 6-2.
5. For an excellent book on the eco-system concept, see *The Natural Resource Management*, G.M. Van Dyke, ed., Academic Press, New York, 1969, pp. 383.
6. See generally B.D. Nag Chaudhuri and S. Bhatt, "International Cooperation for Eco-development: Combining the Role of International Law and Global Science in contemporary World Society", *Journal of Scientific and Indusirial Research*, vol. 42, August 1983, pp. 421-24. Also see, B.D. Nag Chaudhuri and S. Bhatt, "Reflections on Environment Policy of India", *India Quarterly*, Vol 34. 1983, pp. 71-78. Also S. Bhatt, "Ecology and International Law", *Indian Journal of International Law*, Vol. 22, 1982, pp. 422-38.

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Management of Toxic Wastes

DR. C.R. KRISHNA MURTI

With the rapid growth and expansion of the chemical industry, in India, we are likely to face in the near future serious problems of hazardous waste management. It would be in our interest therefore to anticipate some of the problems in the light of the experience of highly industrialized countries. Although highly desirable, complete mechanization and automation of toxic waste disposal may not be feasible in our country.

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1. Introduction

Industrial development is invariably associated with the generation of huge quantities of hazardous wastes of a diverse type. The transport, handling and disposal of these wastes, besides being expensive, have inherent risks to human health. The conventional practice of dumping such waste in lands and sites away from human habitation is also no longer feasible for soon such land has to be pressed into service for some form of productive activity or establishment of industrial estates or housing colonies. This is very clearly borne out by the examples of Bandup and Deonar in Greater Bombay, Naraina in New Delhi or the MRC Nagar on the Adyar creek in Madras. Another serious problem posed by such dumps is the possibility of some of these sites being abandoned after some time and being taken or by private house bailing societies. The Love Canel episode had dramatised in recent times the macabre consequences of such a transformation. There was also wide publicity in mass media in August 1983 of an incidence in which a group of young pioneers in southern France discovered drums of debris collected from the serveso disaster site in Italy in 1975. The private agency which was entrusted with the task of the transport of the drums from Italy to France had to admit publicly that the debris represented all the scrubbings of reaction vessels which were used in the production of dioxins.

International Agencies have been deeply concerned about the inadequate state of our existing knowledge to cope with the many side problems posed by the management of toxic wastes. A joint programme

between UNEP and the Euro Regional office of WHO resulted in a publication entitled 'Hazardous Waste Management—Policy Guidelines and Code of Practice'. This paper attempts to present an overview of the problems of toxic waste management in the context of a developing economy.

2. Definitions

Anything that is not wanted at a given place and a given time and which has no current or future marketability may be called a waste. In view of the fact that even storage of waste by dumping may require space, waste is also something that adds to the capital cost of industries. All wastes are not necessarily hazardous. A waste becomes hazardous when it acquires or has inherent physical, chemical or biological characteristics with a potential to affect adversely human health or the environment. In order to avoid the above risks special handling and disposal techniques are called for in dealing with toxic wastes.

In deriving a definition for the term 'Hazardous wastes' the following criteria are used:

(a) Short-term acute hazards, acute toxicity by ingesation, inhalation or skin contact: corrosive effects on skin or on eyes or the risk of fire or explosion:

(b) Long term or chronic toxic effects upon prolonged or repeated exposure: ability to induce tumor formation which may be induced by an acute exposure but may be detected only after a long latent period, resistance to biotransformation within the body: and

(c) resistance to degradation in the environment: the potential to pollutants surface or underground water.

Wastes with the above properties may arise as bye-products, process residues, spent reaction media, contaminated plant or equipment or when the consumer has discarded them. A hazardous waste of special significance is toxic chemicals which become outdated or stocks of which have been declared surplus and have therefore to be disposed of or toxic chemicals which on transportation from the manufacturing site to the consumer site are involved in an accident or contaminate a cultivated farm land.

3. Criteria for Identification

In some cases, wastes have well defined dangerous properties and are unequivocally hazardous and arise by the use of commonly encountered toxic chemicals like corrosive acids, toxic chemicals like cynanide etc. The majority of wastes which one has to deal with in practice are, however, complex mixtures which do not lend themselves to chemical characterisation. From the point of view of waste management, the hazard characteristics mentioned in Section 2 are more relevant than the knowledge concerning their chemical composition.

Industrial wastes are potentially hazardous by virtue of the following:

— Substances known or unknown are present in the wastes and their concentration and the reactivity cannot be assured.

— the physical form in which the substances are present viz as solid, liquid, or gas can profoundly effect the target

— mobility and persistance of the chemical in the environment.

— targets available in the environment and their vulnerability to the chemical.

— availability of remedial measures and their cost effectiveness as related to benefits.

Ideally the individual components of a waste should be known to estimate the total hazard. In practice, when dealing with a toxic waste broad compositional data alone may be available. This may be adequate for immediate and pragmatic action. Taking waste cyanide heat treatment salts as an example the presence up to 5 percent cynamide in the waste is sufficient to decide as to which handling and disposal techniques are appropriate to the situation.

In general, liquids or sludge waste is more liable to cause water pollution problems than solid waste as inhalation hazard exists, in industries handling or processing asbestos, fibrous waste is inherently more

hazardous than matrix—bound asbestos waste such as asbestos cement.

Particle size of a solid waste is an important criterion. The presence of respirable size particles (less than 5 n m size) is more hazardous than large size particles of the same toxic chemical. Thus finally divided metals are accutely hazardous while the same material in large pieces may be safe. Solids for-med by cooling from the molten state are generally less hazardous. · Thus metal slags are considered relatively non hazardous in spite of their containing high concentrations of toxic metals.

Quantity of the waste is an important criterion. Thus the handling of a few hundred kg of a toxic waste demands a solution different from the one for handling tonnes of relatively non hazardous waste. To prescribe for administrative convenience that a minimum quantity must be present to be treated as a hazardous waste has, however, dangerous implications.

4. Exclusive and Inclusive Lists of Hazardous Wastes

When one draws up a list of known wastes which present no significant short-term handling or long-term environmental Hazards, hazardous wastes may be considered as those which have not to be listed. In the United Kingdom the principle of *exclusive listing* was practised for wastes for which notification of deposit was statutory requirement. An example of exclusive lists is given in Table I· Extra environmental safeguard was incorporated. The exteria of listed waste was mostly qualitative. The list is very simple. The qualitative and subjective criteria used bringing in a certain element of uncertainty.

Listings of hazardous waste with or without accompanying criteria are *inclusive lists* used currently in Belgium, Denmark, France, FRG, the Netherlands, Sweden, UK and USA. The lists comprise wastes from certain industries, wastes containing specific components or specific waste streams identified by the processes from which they orginate. There is substantial international agreement on the components of the wastes designated as hazardous. The inclusive list offers a greater degree of certainty but the disadvantage may be that the omitted items may be significantly hazardous.

5. Waste Hazard in the Management Cycle

The management sequence for any particular hazardous waste comprises

— its generation
— transport
— storage
— treatment and
— final disposal.

Many hazardous characteristics, e.g. corrosivity, foammability and high acute toxicity by ingestion, inhalation or skin absorbtion will be problems at all the above stages. In contrast, many wastes which offer no significant short term handling hazard may cause severe disposal problems based on their physical chemical properties.

6. Examples of Hazardons Wastes

(*a*) *Well defined regular hazardous wastes arising* from the chemical industry.

Currently about 20,000—30,000 chemicals are manufactured at amounts greater than 1 tonne per annum.

Based on the products Chemical industry can be divided broadly into:

— organic chemical industry
— inorganic chemical industry

Organic chemicals—are derived.

i. from oil, natural gas and coal in large scale continuous process plants.
ii. conversion of primary chemicals by chemical transformation into secondary and intermediary products going into diverse streams.
iii. downstream processing of intermediates into final products dyeshifts, cosmetics, pesticides, pharmaceuticals, fine chemicals, plastics, resins, synthetic fibres, elastiomers or detergents.

The majority of both alphetic and aromatic chemicals are today derived from the oil refining and petrochemical industries by distillation of crude oil, steam cracking and catalytic refining of selected fractions.

The continuous nature of the production processes based on a specified feedstock and on standard plant conditions, means that the residues generated from any

particular stream are reasonably constant in composition and properties. However, frequently extremely complex materials and residues occur as solids, liquids or gases.

In the downstream processing, both batch and continuous processes are involved. Chemical conversions are complex and residues may contain unreacted feedstock, byeproducts, tars, filter-cakes, precipitated materials, solvents and acids or alkalies, Residues from the organic chemical industry are usually mixtures of varying complexity, may be soluble, unsoluble, toxic, inert, corrosive, flammable and may contain suspected or known carcinogens.

Inorganic chemicals still dominate chemical industry. Traditional products are sulphuric acid, phosphoric and nitric acids, lime, ammonia, chlorine and alkali.

Worldwide 100 million tonnes of phosphate rock are mined annually for the production of various phosphate salts.

7. Waste Management

Waste management is the organized, systematic channelling of wastes through appropriate recovery or disposal routes consistent with acceptable public health and environmental safeguards.

Treatment:

All methods of treatment on the modification of the physical and/or chemical properties.

Volume reduction:

Precipitation
Dewatering
Immobilization
Detoxication

Physical methods include:

Phase Separation: By filtration or centrifugation

Solidification: Where the waste is fixed on an inert and inpervious matrix.

Chemical Treatment methods aim at complete breakdown of hazardous chemicals into non-hazardous products. Reduce water Solvability.

If it is acid, neutralize. If it is alkaline, oxidize.

Biological Treatment includes both detivated sludge treatment or use of microorganisms for bio degradation.

Disposal:

Landfill
Incineration
Dumping into sea
Underground disposal
Deepwell disposal

8. Environmental Considerations

As a basic principle, waste should be disposed of so that adverse effects are minimised such that

— human health is not threatened,
— livestock, game, non game species and fish are not threatened.
— Water bodies, soil and useful plants are not affected,
— harmful environmental effects are not produced,
— interest of nature conservation, landscape management and townplanning are protected and
— law and order are not disturbed.

9. Legislative and Legal Aspects

Enactment and enforcement of a law a is preprequsite for the development of a comprehensive system for the disposal of hazardous wastes. The first step towards this is the assessment of existing laws and regulations. Thus, legislation on pollution, production and transportation of goods, water and waste water management or health and safety at work might already include basic provisions for hazardous waste management which could be amended or extended in scope. Care is needed to ensure that specific hazardous waste legislation neither duplicates nor contradicts measures already in force. Legislation could be in the form of a law or issue of administrative procedures in accordance with the constitution of the country.

The following general principles may be taken into consideration while enunciating any frame work.

Legal provision

(1) Principles of waste management should be legally binding, the generation of waste should

be minimised, material recovery should be used wherever technically and economically feasible.

(2) Hazardous waste should be defined in a general but unambiguous manner leaving details to be described in administrative instructions.

(3) In the present state of knowledge, it may not be possible to regulate all disposal processes unless sufficient scientific evidence is available.

(4) Legislation should give due regard to predisposal options.

(5) Legislation on waste management can be part of a comprehensive law covering all aspects of hazardous substances, including import, processing and transport.

Regardless of who provides the waste disposal services, the legal responsibility for the disposal of waste should remain with the waste generator. In turn the waste generator should be committed to the following objectives:

— choice of appropriate transport and disposal methods

— avoiding minimizing, and recycling wastes as far as is technically feasible

— correct labelling and declaration

Hazardous waste management should be basically controlled by three different groups of measures:

(a) control of waste—at the level of generating process

(b) control at the level of licensing procedures for potentially hazardous activities.

(c) 'Cradle to grave' systems of notification of wastes.

10. Responsibilities of the Waste Generator

The Waste generator is responsible for:

Declaration of Wastes in Standard proforma to give details of handling, storage, transport and disposal.

The waste generator provides the necessary information on the nature, composition, consistency and the amount of waste and should enunciate clearly the consecutive steps of disposal.

Collection and storage

Empirical studies indicate that most accidents take place during transport. There should be a good licensing system to control contractors who undertake waste disposal.

Storage and Reception Centres

Storage within the manufacturing facility will be regulated by licensing the production activity. Storage outside the production premises and the establishment of reception centres should be regarded as a constituent part of the disposal process.

11 Accident Registers

Very useful guidelines can be evolved by Commissioning objective case study reports. In the United Kingdom, a survey of accidents that had occured on local authority landfill sites revealed that most of the accidents were unrelated to the toxic and flammable properties of the wastes but were more linked to safety aspects of manual and mechanical handling. The Annual Report of the Directorate General of Factory Inspectorate, Government of India gives the number of accidents and fatalities without essential details. The management of chemical industries should be encouraged to keep fully documented case histories of accidents and how they were handled. The National Safety council, and the National Productivity Council should jointly sponsor such studies.

12 Conclusion

With the rapid growth and expansion of the chemical industry, in India, we are likely to face in the near future serious problems of hazardous waste management. It would be in our interest therefore to anticipate some of the problems in the light of the experience of highly industrialized countries. Although highly desirable, complete mechanization and automation of toxic waste disposal may not be feasible in our country. Garbage disposal today is very much dependent upon the exploitation of unskilled labour. The sad state of the civic amenities of our major cities is reflected in the fast deteriorating living surroundings of our houses. When toxic chemical wastes will be loaded to this load, the burden may be too much for the existing system to bear.

Inventories of solid wastes to be handled by local authorities will have to be updated and supplemented with information on the nature of hazardous wastes dumped in landfills. Advanced Institutions of Technological Research and Education should be encouraged to take up extensive and intensive studies on problems of waste management, particularly, their recycling and disposal by non-polluting methods.

Health surveillance programmes on communities living in the proximity of major solid waste dumps should be undertaken to assess as to how far the core disease pattern already existing thanks to the poor environmental sanitation, is modified by the superimposition of chemical wastes.

Public sector undertakings including the Atomic Energy Establishment with a high potential for toxic waste generation set up systems for their safe handling which should be exemplary and a source of inspiration to other waste generators to emulate.

Table 1 Exclusive

Class I	Wastes normally arising in the use of premises for domestic purposes.
Class II	Wastes normally arising in the use of premises as an office, retail shop. etc.,
Class III	Other wastes—construction, repair maintenance or demolition of plant or buildings., launderying drycleaning—working of mines, dry cutting of metals, softening of water, sewage, breeding of livestock, brewing and fermentation.
Class IV	Listing by name of product. paper, cellulose, wood (including saw dust) oiled paper, tarred paper, and plaster board, plastics, clays, cermica, mica, abrasives iron, steel, aluminium, brass, copper, tin, zinc, coal, coke carbon, graphite, ash, clinker, slags, rubber, electrical fittings, cosmetics, sands, boils scales, cement concrete, cork, wool, cotton, soap and detergents, food wastes, vegetable matter. etc.,

Table II Examples of Hazardous Wastes

1. *Wastes from the manufacture of primary and intermediate organic chemicals*
   Acid tar from coal tar industry.
   Tarry wastes
   Waste from chlorinated aromatics.
2. *Wastes from mauufacture of primary pharmaceuticals*
   Mixed solvents
   Aqueous slurry
   Liquid wastes
   Phenols.
3. *Selected wastes from down stream processing;*
   Diphenylamine, aromatic intermediate of dyestuff industry.
   Aqueous wastes of biocides
   Filter press cakes
   Liquid tar
4. *Selected residues from inorganic industry*
   Arsenic
   Ammonia fluorides.
5. *Metal finishing*
   Fluroborates, cyanide, cadmiumum
   Miscellaneous:—Tanks, Storage wastes etc.,

Table III Example of an Inclusive List

List of hazardous substances requiring priority

1. Arsenic and compounds
2. Mercury and compounds
3. Cadmium and compounds
4. Thalium and compounds
5. Beryllium and compounds
6. Chromium compounds
7. Food and its components
8. Antimoni and its components
9. Phenol compounds
10. Isocyanates
11. Orgarohalogen compounds
12. Cyanide compounds
13. Chlorinated solvents
14. Organic solvents
15. Biocide phyico-pharmaceutical preparations.
16. Tarry materials from refining and tar residues from distillation
17. Pharmaceutical compounds
18. Peroxides, chlorates, perchlorates and azides.
19. Ether
20. Lab chemicals
21. Asbestos
22. Selenium and its compounds
23. Tellurium and its compounds
24. Polycyclic hydrocarbons.
25. Metal carbonyls
26. Soluble copper compounds
27. Acid and or basic substances usedf or surface treatment and finishing of metals.

Table IV

Cost of Disposal in West Europe as of 1979

Method	*Cost US$/Tonne*
Simple disposal to land	1-20
Disposal to a land via site lined with plastic sheet.	10-50
Underground disposal by dropping into old wells or mines.	20-150
Land disposal after encapsulation either by mixing waste with cement or by incarceration whole drums in cement	10-100
Coastal sea dumpings from ships barges	5-15
Deep ocean dumping beyond to continental shelf	10-150
Simple incineration without heat recovery	30-150
Incineration with alkaline stock scrubbing	100-350
Incineration on board ship at sea	50-350
All types of chemical treatment Destructions of cyanide by hypochlorate	300-350
Reduction of chromic acid	100-300
Destruction of cyanide	200-250

Select Bibliography

1. *Hazardous Waste Management*
   Health Aspects of Chemical Safety.
   Interim Document No. 7
   World Health Organization. Regional Office for Europe
   Copentagen.
   United Nations Environmental Programme. Nairobi. 1982.
2. Nelson. N. *Principles for Evaluating Chemicals in the Environment*
   National Academy of Sciences.
   Washington D 1975.
3. *Legal aspects of Transfrontia Pollution*
4. Engineering Hand book of Hazardous Waste Inc.
   Environment Protection Agency, USA, Washington DC 1980.

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Management of Hazardous Wastes The Case of Hongkong

M.J, STOKOE

During the past fifteen years a number of well publicised events have focused public attention on the risks that can result from the uncontrolled disposal of hazardous waste. The paper focusses on harmful effects of waste and also approaches to control waste disposal.

Mr. M.J. Stokoe, Environmental Protection Agency.

Introduction

In the Love Canal district of New York State the health of many people was seriously harmed by the effects of hazardous waste dumped several decades earlier. Similar instances have occurred in Europe, though without such serious effects, the cause in each case being the migration of organic material from uncontrolled hazardous waste dumps. In Japan the chronic diseases Itai-Itai and Minimata were eventuatly found to be caused by industrial waste discharges containing cadmium and mercury. Such serious incidents are fortunately rare but they do serve to illustrate the potential results of indiscriminate disposal of wastes containing toxic, or otherwise hazardous substances.

Much more common are incidents involving fly-tipping or illegal dumping which usually do not cause serious risk to large numbers of the public but which can cause death or serious injury to disposal site workers or disruption and pollution of water in supply systems, lakes and rivers and so on. Details of several incidents involving hazardous waste disposal are given in Table I.

Many forms of human activity produce waste which could be considered hazardous but in the case of waste from households, commercial establishments and the majority of industrial firms these hazardous materials comprise a very small fraction of the total quantity and present little risk to the publlc or the environment since suitable collection, transport and disposal methods have been developed through many years of experience.

However some industries and commercial establishments do produce waste which if handled in the same way as ordinary refuse or garbage could present serious risks to either employees engaged in waste collection and disposal or to the environment in the vicinity of the disposal site. These wastes have to be collected and handled separately and may require specialised treatment before finally being disposed of in controlled tips. In order to select the appropriate treatment and disposal method there must be available precise and accurate details of the composition and properties of the waste. This is achieved by legal controls requiring the waste disposal authorities to be notified of the intention to dispose of hazardous wastes.

Hazardous waste generation in Hong Kong

Hazardous waste arises mainly from the manufacturing sector with the heavy industries using primary raw materials being the largest producers. Light manufacturing industries, producing mainly consumer goods, predominate in Hong Kong there being very little primary production, and so the arisings of hazardous waste should be smaller in quantity and variety than in other industrialized countries.

In December 1980 there were a total of 45409 manufacturing establishments in Hong Kong employing 892140 persons [8]. Most of these establishments are quite small companies and two-thirds employ fewer than ten people each. The range of industry is very wide; from food and beverages through clothes and shoes to manufactured chemicals, consumer goods and machinery.

Before 1981 no systematic studies of the types and quantities of hazardous waste in Hong Kong had taken place. The information that was available to the Government had been obtained from small scale surveys to investigate specific problems or from companies which had approached the Government with proposals to set up new industrial processes or for help in disposing of especially hazardous or difficult wastes. In order properly to assess the need for facilities to dispose of hazardous waste a survey of industries producing hazardous waste was needed. At that time (early 1981) the Government's manpower resources in the environmental field were quite limited and so a local consultant, Pypun-Balfours, was commissioned to undertake the work. The study started in October 1981 and the completed report was delivered to the Government in February 1983.

With over 45000 potential hazardous waste producers it is clearly not feasible to interview each one to carry out a complete survey or even undertake a postal survey. A technique was employed therefore which allows the results of a survey of a smaller number of firms to be used to estimate the total. Previous work [9] has demonstrated that the waste production per employee is fairly uniform for each sector of industry, and so provided that the survey covers a statistically significant proportion of the workforce in each industrial category, this factor may be used as the basis for estimating the total arisings of hazardous waste from industry. The industrial survey was based on personal interviews with supplementary information obtained by postal questionnaires. Over 500 interviews were conducted with a bias towards those industries that are more likely to produce hazardous waste. Over 700 questionnaires were despatched, mainly to industries which would not normally produce hazardous waste. Around 140 replies to the postal questionnaires were received, a return rate of approximately 20 per cent.

The survey identified a total production of 16000 tonnes per annum of hazardous waste which can be scaled up on the basis discussed above to give an estimate of total production for Hong Kong of 37000 tonnes per annum. The major industrial sectors producing hazardous waste are non ferrous metal; fabricated metal products; electrical machinery; electroplating; transport equipment; transport and utilities (including oil storage); and professional, scientific and photographic equipment.

Most of the waste identified are liquids or pumpable sludges: oils, acids, alkalis, oil and water mixtures, metal salts, and chlorinated and non-chlorinated hydrocarbon solvents are the most significant. A large number of contaminated containers (250000) and waste dry batteries (2.5 million) are produced by firms covered in the survey. Both these commodities are so variable that they were assessed separately and are not included in the total tonnage. Table II shows the principal cate-

Table 1

Examples of the consequences of improper disposal of hazardous waste

Incident	Year	Country	Reference
Dumping of organic chemical wastes in Love Canal between 1930 and 1950. Chemicals migrated into house basements after unusually high groundwater levels in mid 1970s. Health effects attributed to this cause include spontaneous abortions, birth defects, nervous breakdown, asthma.	1976	USA	Glaubingar [2]
The driver of a road tanker mistakenly discharged five tonnes of waste sulphide liquor into a disposal sump which was reserved for acid waste. The driver of another tanker later discharged acidic waste into the sump and was killed by hydrogen sulphide evolved in the reaction of the two wastes.	1975	UK	Keen [4]
A chemical formulation and packaging company generated approximately forty 210 litre drums of waste as a result of a stocktaking exercise. Each drum contained miscellaneous chemical wastes, mostly floor sweepings. The containers were transported to a hazardous waste controlled tip where one of the drums exploded violently several minutes after being tipped.	1978	UK	Author's personal experience
A transport contractor illegaliy tipped drums of chemicals on a controlled tip. Several of the drums, which were damaged and rusty contained aluminium chloride which reacted with rain water causing clouds of corrosive hydrogen chloride to be emitted.	1980	UK	Author's personal experience

gories of waste identified in the survey and the estimated total production in Hong Kong for each category. Almost 70 per cent of the waste identified in the survey originated in Junk Bay, Tsuen Wan and Kwun Tong with the remainder spread fairly evenly among the other industrial centres in the urban areas, including the new towns.

Present methods of disposal

The survey of waste producing industries also examined the methods presently in use in Hong Kong for disposing of hazardous waste. Despite the wide variety of hazardous wastes produced, the methods of disposal used may be classified into five main types:

(*a*) *In-house liquid waste treatment*

The waste is treated at the factory by physical and or chemical processes in order to detoxify or concentrate it. The residues have then to be disposed of.

(*b*) *Discharge to sewer*

Waste liquids or sludges, are discharged, either directly or after treatment.

(*c*) *Controlled tipping*

Solid wastes or sludges are dumped with household and commercial wastes in landfill sites which are con-

Table II
Hazardous waste production in Hong Kong

Waste Category	*Waste Identified in Survey (t/a) (m^3/a in parentheses for liquids)*		*Estimated Total Waste Arisings for Hong Kong (t/a) (m^3/a in parentheses for liquids)*	
Acid wastes	1528	(1389)[1]	6490	(5901)[1]
Chromic acid (as Cr)	9*		66*	
Alkali wastes	5854	(5322)[1]	7810	(7099)[1]
Copper salts (as Cu)	8.3		28.6	
Zinc salts (as Zn)	0.2		1.1	
Nickel salts (as Ni)	8.4		57.5	
Other metal salts	135		300	
Toxic metals	I23		322	
Hazardous metal oxides	1404		1408	
Cyanide wastes	50.5	(50.5)[2]	141	(141)[2]
Oxidizing agents	4.9		7.9	
Halogenated solvents	475	(325)[3]	1558	(1066)[3]
Non-halogenated solvents	680	(849.5)[4]	3571	(4464)[4]
Phenols and derivatives	0.8		1.9	
Polymerization precursor and production wastes	35.5		40.3	
Mineral oils	1365	(1517)[5]	2950	(3278)[5]
Fuel oil	2015	(2239)[5]	2051	(2279)[5]
Oil/water mixtures	1161	(1161)[2]	7687	(7687)[2]
Pharmaceutical products	0.5		1.0	
Mixed organic compounds	37.5		88.9	
Mixed inorganic compounds	17.0		72.9	
Miscellaneous chemical waste	19.5		33.1	
Contaminated containers*	2.5×10^5		6.5×10^5	
Interceptor and treatment plant sludges	6.1		40.7	
Tank cleaning sludges	720		720	
Tar, asphalt, bitumen and pitch	136		136	
Tannery wastes	125		499	
Printing wastes	10.6		85	
Dyestuff wastes	8.5		36.4	
Plating bath sludges	66.3		114.6	
Paint wastes	187		442	
Waste catalysts	3.5		4.4	
Waste batteries*	26×10^6		3.1×10^6	
Total	16185		36699	

* Included in acid waste arisings
1. Based on specific gravity of 1.1
2. Based on specific gravity of unity
3. Basec on specific gravity of 1.46
4. Based on specific gravity of 0.8
5. Based on specific gravity of 0.9

* Quantities expressed in term of numbers of items. Density of all aqueous sludges assumed to be unity.

structed as layers of compacted waste separated by layers of soft fill material. This method is known as controlled tipping in the United Kingdom and as sanitary landfill in North America.

(*d*) *Incineration*

There are no generally available hazardous waste incinerators in Hong Kong but the Government operates three continuous municipal incinerators which are used occasionally for the disposal of small quantities of hazardous and difficult waste materials.

(*e*) *Recycling*

The recycling of waste materials is an importaut industry in Hong Kong and a significant export earner. Hazardous wastes which are recycled tend to be those which can be reused in place of standard raw materials without much additional processing.

Controls on hazardous waste

Hong Kong has not suffered the serious consequences of indiscriminate disposal of hazardous waste that

has affected some other industrialised countries [10]. The predominance of liquid hazardous wastes and the concentration of industry in coastal areas has allowed most hazardous wastes to be discharged into the sea where the relatively strong local currents have afforded rapid dilution and dispersion. Problems have occurred in localised areas from discharges of hazardous wastes to watercourses in the New Territories and surface water drains and culverts in the urban areas.

In the sixties and early seventies, studies of marine waters in Hong Kong established that the assimilation capacity of the harbour was rapidly being used up and that sewage treatment plants would be needed before 1991 to prevent widespread oxygen depletion [11]. The water in Tolo Harbour and Deep Bay are partially enclosed and require treatment plants to prevent serious pollution resulting from the rapidly increasing population of the new-town developments. Sewage treatment plants are under construction or at the design stage for all major urban areas in the New Territories and will eventually be provided for the urban areas which discharge to Victoria Harbour. Experience elsewhere [12] has shown that it is essential to control the discharge of many industrial wastes to sewage treatment works to prevent serious disruption to the biological treatment units and to limit the concentration of toxic materials in the sewage sludges. This is especally important where disposal of the sludge on the land or at sea is proposed. Control of industrial waste discharges is also required to protect sewer workers from toxic or corrosive fumes and to prevent the release to the receiving waters of harmful materials which are not removal by normal sewage treatment processes.

Control over discharges to sewerage systems will result in a significant increase in the transport to treatment or disposal facilities of both raw wastes and the sludges produced by preliminary treatment on factory premises. It is important to ensure that this does not lead to haphazard disposal or fly-tipping of hazardous wastes, and so proposals are being developed by the Government to establish specialised hazardous waste treatment and disposal facilities and new legislative controls to ensure that all hazardous wastes are stored, transported and disposed of in a safe manner.

Development of legislation

The UK in 1972 became the first country to institute comprehensive legislation to control the transport and disposal of hazardous waste when the Deposit of Poisonous Waste Act [14] was passed following public concern at the discovery of solid cyanide wastes fly-tipped on land used as a children's playground. During the following few years most of the industralised nations passed similar laws but with the difference that whilst the UK law defined hazardous waste by reference to a list of non hazardous wastes (i.e. those that are exempted from control) legislation elsewhere included reference to lists of hazardous wastes or to chemical criteria for defining hazardous wastes [3]. The original UK system which is based on what came to be known as the 'exclusive list' system was eventually replaced in 1981 by the Special Waste regulations [1] which are based on criteria for defining hazardous wastes in terms of their toxicity.

The attraction of the exclusive list system is that it can be drafted very quickly which is why it was chosen as the UK system when new legislation had to be rushed through parliament. However it is imprecise and leads in practice to control over many wastes which are not particularly hazardous. The development of an inclusive list system involves the consultation of lists of hazardous wastes, or of hazardous constitutents of wastes, and its operation frequently requires chemical analysis to establish the composition of the waste.

Any system of control of hazardous waste in Hong Kong has to be both precise and simple to operate. The proposed system would operate as a series of schedules beginning with lists of individual industrial wastes which cover most hazardous waste being produced on a regular basis. Other schedules are being developed to cover potential hazardous wastes from outside the manufacturing sector. Categories of waste which are being considered at present include:

(i) A list of individual hazardous wastes.

(ii) Waste dangerous goods as defined by the Dangerous Goods Ordinance subsidiary legislation.

(iii) Waste pesticides.

(iv) Waste solids, liquids and sludges arising from emission control processes.

(v) A list of hazardous constituents of waste with defined minimum concentrations of the constituents and medium quantities of the waste.

It is envisaged that the list would be run through as a series of screening tests; most hazardous wastes will be covered by the first four categories and chemical analysis will be required on relatively few occasions. Used containers which have held or are contaminated with hazardous wastes may be included in the overall proposals.

Any wastes which are included in the lists would be covered by Section 17 of the Waste Disposal Ordinance [7] which requires notification to the Director of Engineering Development of the intention to dispose of hazardous waste and prohibits disposal other than according to directions given by him. Since almost all waste disposal in Hong Kong is done by the Government, or by contractors on the Government's behalf, these directions will include details which would in other countries be included in the contract or agreement between waste producer and waste disposal contractor.

REFERENCES

1. Waste Management Paper No. 23: Special Wastes Dept. of the Environment UK—HMSO 1981.
2. R.S. Glaubinger, et al, Love Canal Aftermath Chem Engrng 86 No. 23 (1979) pp 86-92.
3. S.I. Friedland, The new Hazardous Waste Management System; Harvard Environmental Law Review Vol 5 (1981) pp. 89-129.
4. R.C. Keen, 'Disposal of Toxic Waste on Landfill sites', RSII Vol. 2 (1982).
5. 'Disposal Facilities for Toxic, Hazardous and Difficult Wastes', Report by Pypun-Balfours for Hong Kong Government (unpublished).
6. Water Pollution Control Ordinance (Cap 358) Hong Kong Government.
7. Waste Disposal Ordinance (Cap 354) Hong Kong Government.
8. Report of employment and vacancies statistics March 1981—Hong Kong Government.
9. Waste Management Paper No. 2—Waste Disposal Surveys—Department of the Environment UK—IIMSO 1976.
10. Hazardous Waste Disposal—the Hong Kong situation M.R.G. Taylor presented at Institution of Water Pollution Control Branch Meeting, Hong Kong 9th December 1982.
11. Marine Investigation into Sewage Discharges—Report by J.D. & D.M. Watson for Hong Kong Government, July 1971 (unpublished).
12. A.G. Cockburn, 'Technical Control of sewage sludge disposal to sea', Presented at IAWPR conference on Disposal of Sludge to Sea, October 1981 London.
13. K.J. Bratley, 'Proceedings of Symposium on Hazardous Wastes Inst Public Health Engineers', UK (1982).
14. Deposit of Poisonous Waste Act 1972, UK Government.

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The EIA System of the Philippines : In Search for Environmental Quality

AMADO S. TOLENTINO

This paper focuses on the Environmental Impact Assessment (EIA) system of the Philippines. It traces the evolution of the legal framework, describes the procedural flow and analyses the institutional set-up and methodology involved.

Despite its imperfections, the Philippine EIA system is one that contributes to good management and effective cooperation among agencies involved in environmental management. It can thus be of great value not only to the Philippines but also to other developing countries.

Mr. Amado S. Tolentino was educated at the University of the Philippines, the Universidad de Madrid (Spain) and the Academy of International Law, University of Taxas (USA). He is one of the elected young framers of the New Philippine Constitution, a consultant on environmental law to the UNEP, UN/ESCAP, WHO and the Philippines' National Environmental Protection Council and also a member of the International Council of Environmental Law (ICEL) and the International Union for Conservation of Nature and Natural Resources (IUCN) Commission on Environmental Policy, Law and Administration.

In developing countries like the Philippines, much of the eflort to raise the standard of living involves deliberately modifying the natural environment. Constructing roads, dams, airports, irrigation and sewage systems, power plants, and industrial facilities frequently result in ecological problems because the consequences on the environment were not adequately considered in project planning or implementation. Also, where adverse ecological consequences are forecast, effective steps to prevent or minimize the damage may sometimes not be taken because data on cost effective safeguards of project alternatives are inadequate.

Lately, however, there is evidence of a new movement in the modern world in the field of environmental protection. This involves the use of a new management tool referred to as environmental impact assessment (EIA). Environmental impact assessment is the study of all the environmental impacts of a project and a discussion of the direct and indirect consequences of all such impacts upon human welfare and ecological and environmental integrity. The documentation of the study is called environmental impact statement (EIS).

The Legal Framework

When President Ferdinand E. Marcos created the National Environmental Protection Council (NEPC) on April 18, 1917 through Presidential Decree (PD) 1121, environmentalists in the Philippines knew that the requirement for an EIS was forthcoming obviously because the decree listed as an NEPC function, among

determined that an EIS should be prepared, the proponent is instructed to conduct an EIA.

Once the assessment is done, the proponent submits the draft EIS to the NEPC which will publish a brief description of the same in a newspaper of general circulation and in an conspicuous place in the locality where the project is to be located. At the same time, comments from government agencies with expertise or regulatory power over the project as well as the lead agency and interested parties are elicited after which the NEPC Secretariat collates all the comments received. At this point, the NEPC Review Committee (RC) decides whether a public hearing should be held for a further and thorough solicitation of facts and materials concerning the proposal. The decision to conduct a public hearing may be based on any of the following: substantial environmental, social or economic impacts, the magnitude of the proposed project in terms of economic cost, the commitment of resources or geographic area; the wide response to the project as shown by the number of requests from government agencies and interested parties as well as strong manifestations by environmental defense groups or non-governmental organizations (NGOs).

Taking into consideration the outcome of the public hearing, the proponent prepares the final EIS and submits the same to the NEPC. The NEPC, through its Review Committee, finally determines if the EIS is approved or should be revised or should not proceed at all because of the tremendous adverse environmental impacts it will generate.

If approved, an Environmental Clearance Certificate (ECC) is issued to the proponent which gives him the authority to proceed with the implementation of the project. Said ECC contains conditions which the proponent is bound to comply with. One of these conditions may be related to the mitigating measures which should be incorporated in the project implementation like the installation of specified anti-pollution devices. Otherwise, the ECC could be suspended or cancelled and the project proponent subjected to a fine not to exceed Fifty-Thousand Pesos (P 50,000.00), Philippine currency, at the discretion of the NEPC.

Compliance with the mandate of EIS legislation is growing and this is not primarily due to the penalty provided for by law but because of the awareness granted by the public information program of the NEPC. Besides, inaction or non-compliance on the part of a proponent to file an EIS when required would entail either penalties in the form of such administrative sanctions as withholding of permits or licenses, court injunction and even prosecution for criminal and civil liabilities in case of damage to third parties or the environment for omssion to perform a legal duty.

An Analysis

As noted by environmental experts in Asia and the Pacific, the Philippines has the most comprehensive coverage in terms of environmental legislation in the region. These include general environmental legislations, laws on air and water quality, noise, land-use management, natural resources management and conservation, waste management and cultural environment.

Significantly, the EIS legislations are the ones being implemented and enforced to the best ability available. Without laws that require mandatory preparation and submission of EIS, impact studies will not be as comprehensive as they should be and will extend only up to the point that can be useful to protect proponents. They may not also include the mitigating measures to abate or minimize the adverse impact of the project on the environment. But paramount is whether the administrative processes are consistent with law and good administrative procedures. In this regard, most decisions are consistent insofar as substantial compliance is made with the policy laid down by legislations. Administrative difficulties in the implementation may cause some variation in decisions but are nevertheless done within the purview of the authorizing statutes. Besides, modifications and innovations are undertaken from time to time to simplify the system and make it operational the best it could. At the same time, the different agencies recognized, little by little, the mutual interdependencies between them which provide the basis for continuity of organizational structure.

To further ease the situation, the NEPC, in cooperation with the University of the Philippines Natural

Science Research Center embarked on a series of seminars for decision makers in the government and private sector of the 12 regions of the country from 1979-1981. The industrial sector showed particular interest and some, especially those coming from big companies, manifested the existence of, or plan to organize environmental divisions in their companies. NGOs are always in the list of participants.

These seminars on EIA are apart from the regular programs, seminars, workshops and publications to educate the public on environmental awareness sponsored by the NEPC Public Information and External Relations Office. The Philippines has even gone to the extent of legislation for the integration of environmental education in the curriculum of all school at all levels. Marked progress has been achieved in this regard.

Methodology

For EIA to be an effective tool, there must be a procedure which transfers the findings of the assessment to decision-makers and a program of implementation of environmental protection/enhancement/mitigation measures including the monitoring program. Since individuals involved in preparing an assessment are seldom involved in decision-making, it is important that they present their conclusions to decision-makers effectively.

The choice of methodology as well as guidelines/ criteria and the like are decided and updated through inter-agency consensus. This is done by regular meetings of various technical and legal committees of NEPC as well as the periodic updating made on the National Environmental Enhancement Program. Updating is made to reflect the policy shifts made in the different environment-oriented ministries, changes in the national multi-year development plan and upon directions made by the President of the Philippines.

About 300 EIS applications are processed each year of which roughly 60% are finally issued ECCs. The rest are usually required to provide additional information or more elaborate presentation of impacts. With a complete EIS documents, it takes 2 months, more or less, inclusive of processing time, visual inspection and comments, before an ECC is finally issued. As of 1980, the NEPC has issued a total of 154 ECCs to resource extractive projects (103 for mining, 29 for seaweeds culture pond and 12 for special commercial fishing), 5 to infrastructure projects and 5 clearances to projects classified as heavy industries.

Compliance with the conditions of the ECC is monitored through reports sent in by lead agencies and by the proponents themselves. From time to time, inspection teams are fielded to monitor actual operations usually with an NPCC representative.

Consultation and Comments

A very important part of the EIS system is the consultation and commenting stage. It is a feature which strengthens the linkage of government agencies to the central body charged with implementation of the EIS requisite and ensures continuous and efficient inter-organizational dialogue.

Effectiveness of the commenting portion of the process is best illustrated by an instance where the Ministry of Agrarian Reform, whose comments were sought, gave a written statement that a piece of riceland, through which the contested power line project of the National Power Corporation (NPC) will pass, is not a prime agricultural land and the alternative as presented by the NPC is the best compared to the one which will hit the public school and municipal building. In another application, the comment of the Laguna Lake Development Authority (LLDA) explained that the permit it issued to a battery processing factory is a temporary one, good for only 3 months and it does not intend to issue a permanent permit for failure to comply with LLDA requisites, led to the non-approval of the EIS because LLDA's permit is a condition precedent to the favourable consideration of the EIS.

Comments, however, may be solicited not only from lead agencies but also from pertinent government agencies and interested parties. Usually, the NEPC gives the proponent a chance to reply to comments received.

The Review Committee

The formal implementation of the EIA system in

the Philippines relies heavily on EIS Review Committee (RC). In accordance with the Rules, an EIS-RC was created by the NEPC Secretariat composed of experts from various fields whose main task is to assist the NEPC in evaluating EIS and other documents pursuant to the Rules. A representative of the NEPC sits all the time with the Review Committee.

Depending on the nature of the project under consideration, the RC is, at different times, composed of, among others, an ecologist, limnologist, physicist, environmental chemist, wildlife biologist, botanist, hydrologist, sociologist, environmental economist, marine ecologist, soil scientist, health expert, geologist, environmental engineer, historian/archaeologist and environmental lawyer. Resource persons acquainted with environmentally critical activities likely to be associated with the project are likewise invited at the committee meetings.

Due to the high degree of expertise demanded of the RC, most of the members are drawn from the ranks of the academe with a monthly honoraria depending on the number of meetings attended. Review meetings are called once a week with projects of the same nature taken up in one meeting, e.g. infrastructure projects. Committee members, are, however, provided copies of the EIS weeks in advance.

The RC is assisted in its work by the NEPC Secretariat, in particular, its EIS division. The latter makes perliminary studies of the EIS and conducts ocular inspection of the sites before a project's EIS is transmitted to the RC. At the meetings, Division Members who handled the preliminary studies and who made the inspection trips are always in attendance. Lead agency representatives, more often than not, attend RC meetings for their further information and thorough consideration of the proposed undertaking.

Public Hearing and Public Participation

Among the public hearings conducted by the NEPC, 3 stand out for their susposed extensive environmental, social and economic impacts. The first two are government road projects called Radial Road 10 and Circumferential Road 3, respectively, traversing portions of candy factories and middle and low income residential areas. The third one is a private quarrying and processing plant. A public hearing was decided on the road projects because of the magnitude of the same while the quarrying project was held on strong representation of subdivision residents near the project area assisted by an environmental group and the press.

All three public hearings were attended by numerous people. The road projects dealt mostly on the sociological aspect specifically the dislocation of residential owners while the quarrying project centered on the pollution aspect which accounts for the detonating tests conducted at the site using a modern system demonstrated by Swedish Consultants.

The government road projects were decided favourably after the expropriation law (with compensation) was sufficiently explained to the affected populace and the various alternatives and mitigating measures were discussed. The private quarrying and processing plant, on the other hand, was also granted an ECC subject to certain conditions as to noise and pollution levels.

Conclusion

One of the beneficial results of the campaign for a better environment has been to foster studies that will help to prevent, or at least minimize and rapidly correct, the environmental damage caused by industry. Clumsy and difficult to administer as it is, legislations that make it necessary to file a statement of "environmental impact" before undertaking any large-scale project is a first step in a direction that will certainly be followed in the future especially in developing countries. For one, the Philippines has embarked on an EIA system in its quest for environmental quality.

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Measurement of Divisional Performance— A Closer Look

DR. MALAY ROY

In this article an attempt has been made to highlight certain problems, which require serious attention, for the measurement of Performance of a Quasi-independent subsystem for a Semi-indepndent Period.

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Introduction

It is expected that any accounting system for a division must supply necessary information so that :—

(1) It can help the divisional manager in his decision making process.

(2) It can properly guide to evaluate the performance of a divisional manager.

(3) It can help in the appraisal of the performance of a division so as to guide top management in its decision relating to division.

So there is no ambiguity regarding our expectation from a divisionalized account. Though what is expected from a divisionalized account is clear, but the process by which this demand is to be fulfilled is clustered with a lot of controversy. An attempt is made in this article to resolve this controversy from a particular viewpoint, which requires a newer look towards each subsystem.

Division as a Quasi-independent subsystem

The meaurement of divisional performance would have been easier and many a controversy could have been avoided had each sub-system been identified as a completely independent one. But division as a part of the total system, must have to act within certain limitations imposed by the higher system, hence cannot be treated as a completely independent one. According

to David Solomon a division is (1) a company unit headed by a man fully responsible for the profitability of its operations, including planning, production, financial and accounting activities and who usually, although not always, has his own sales forces, (2) the division may be unit of parent company or it may be wholly or partially owned subsidiary.[1] The first part of the definition highlights the decisional autonomy that is to be granted to each division so far management, planning and controlling is concerned and this is the very essence of a divisional management. The second part of the definition draws our attention to the reason which necessitate curving of some decisional autonomy of each division. This section identified each division as apart of the whole. This bondage with the higher system that cannot be partioned automatically confers certain responsibilities that is to be discharged by each subsystem towards the whole and also towards the other subsystems that constitute the whole. This shows the limitation within which each division has to function and which curves the degree of independence of each division. That's why each subsystem can be treated as quasi-independent" that is independent in one sense and restricted in another sense.[2]

In order to measure the performance of a quasi independent system having a constant interaction with the higher system and also with other subsystems, serious attention should be given to develop a prudent accounting procedure for the transfer of goods and services among them.

Measurement for a semi-independent period

Here the attempt is to develop an accounting procedure for the measurement of divisional performance for a semi-independent time period. It is believed that only by this procedure an effective measurement system can be developed to evaluate the performance of a divisional manager, when he is in charge of a division for a sucessive period or when a new manager takes the responsibility of a division at the beginning of a period.

It is assumed that a manager accepts the responsibility to operate a segment of the firm at the beginning of semi-independent period. At the end of the period, on the basis of the past result, owners of the firm first of all have to decide whether it will be wise for them to operate the segment or not, and secondly depending on the previous decision they have to decide who will be entrusted with the responsibility of managing the segment. So it is believed that at the end of a semi-independent period the manager turns his segment in, for review and decision, and after that he or any another new manager gets the same segment back, but in a new period. If the same manager is in charge of the segment for the old and new period, he may be reluctant to transfer income among the periods, so long the transfer of income does not increase the present value of the future income stream. Again if new manager takes the charge of the subsystem, this idea of measurement for a semi independent period, will protect the accounting system from any good or bad result of the earlier period and help to measure the performance of a new manager independently.[3] But to maintain the sanctity of a semi-independent period, any accounting system for the measurement of divisional performance should give special care to the following points.

(1) Firstly the action of the period should not influence the result of another period. This, in essence, refers to the treatment of fixed overhead and valuation of stock.

There are two opposing ideas regarding alternative product costing method, commonly labelled as absorption costing and direct costing. Absorption treats fixed overhead as product cost, hence should be inventoried. On the other hand, Direct Costing treats fixed overhead as period cost, that's why should not be inventoried.[4]

1. For a detail discussion see David Solomon, "Divisional Performance : Measurement and Control", Financial Executive Research Foundation, 1965.
2. Yaqoor Goldschmidt, "Information for Management Decision" Cornel University Press, 1970, pp. 199-207.
3. Yaqoor Goldschmidt, "Information For Management Decision" Cornel University Press, 1970, pp. 199-207.
4. For an indepth discussion see David Solomon, "Divisional Performance, Measurement and Control" (Homewood III, Richard D. Irwin Inc, (1968, pp. 100-115. NAA Research Report No. 23, April 1953, entitled Direct Costing and

Under absorption costing, divisions are encouraged to accumulate inventory, since, by producing for stock they can charge off the inventory account a proportion of their fixed overhead, this increases the profit of the current year forwarding a large amount of stock and hence a portion of Fixed Overhead to the next period. Again efficiency of one period may affect the next period in another way. With the rise and fall of production, valuation of stock also changes accordingly under absorption costing, which is transferred to the next period. So the value of opening inventory will depend upon the performance of the previous year. This will obviously vitiate the sanctity of a semi-independent period.[5]

(2) Secondly, care is to be given to the inventories of previous year, the price of which has already gone up, but sold in the current year.

(3) Third attention is to be given to find out the cost of assets of a semi-independent period. It requires that all assets should be valued at their current price at the beginning and at the closing of the period and this difference would reveal the actual cost of the usage of assets of a semi-independent period. The conventional method of calculating depreciation based on formula of acquisition cost, will not help to measure the actual performance of a division for a semi-independent period.

Keeping in mind the above mentioned facts, an attempt has been made to draw a chart for the measurement of performance of a Quasi-independent sybsystem for a semi-independent period.[6]

A close scrutiny of the given chart will reveal that opportunity cost or shadow pricc has been taken into consideration at all the stages. Although consideration of opportunity cost indulges inclusion of subjective valuation in the domain of accounting, nevertheless it is the only appropriate way to measure the performance of a division for a semi-independent period. Here it is assumed that the manager accepts the responsibility to operate a segment of the firm at the beginning of a period. At that time he is assigned certain resources which are valued at the highest

No. 37 January 1961, Current Application of Direct Costing. Yuji IJiri, Robert K Jacdicke and John L. Livingstone "The Effect of Inventory Costing Methods on Full and Direct Costing" Journal of Accounting Research, Vol-III No-1, pp. 63-74. Sorter and C.T. Hornguen, "Asset recognition and Economic Attributes, The Relevant Costing Approach", The Accounting Review, Vol XXXVII No. 3.

5. This Problem can be solved if inventory is valued on the basis of "Normal Output". This in turn requires the recognition of volume variance, representing the over or under absorption of period costs, in the period of high or low output. This variance is treated wholly as a current expense or gain. No part of it is allowed to enter into inventory.

6. No attempt has been made in this article to develop a comprehensive idea about the measurement of divisional performance. For a detailed discussion on this topics, readers may go through the most valuable writing of David Solomon—"Divisional Performance, Measurement and Control", Richard D. Irwin, 1968.

EXHIBIT

		Rs.	Rs.
(7) Sales to outside customer	—	XXX	XXX
* Transfer to other division :—			
If Market Price exists at Market Price—			
If Market Price does not exist and Marginal Cost—			
If Market Price does not exist and the Production capacity of supplying division is limited at shadow price—			
If Market Price does not exist and the amount transferred is insignificant at Negotiated Price	—	XXX	XXX

7. *Notes* : There are many other alternatives which are not shown in this chart. Transfer pricing is one of the major problem for the measurement of the performance of a Quasi-independent subsystem. For a detailed discussion on this topics see David Solomon P.P.—160-232, John Dearden, "Cost Accounting and Financial Control" Addison Wesley publishing Company, 1973, P.P.—362-411, Harold Bierman Jr. "Topics in Cost Accounting", Mcgraw Hill, 1963, PP 93-101, Jack Hirslefier "Internal Pricing and Decentralized Decisions" in C. Bonini, R. Jaedicke and H. Wanger eds Management Controls, New Direction in Basic Research", New York, Mcgraw Hill, 1969, P. 30.

Less Variables charges of goods sold and transferred i.e Marginal Cost				Conventional Method of Calculating Marginal Cost	
(8) *Input purchased directly at Actual Cost of Mat. and inventories used* :—				—Actual Cost	
Inventories of Raw Mat. used—Replacement { *Current Cost*	—	XXX		(A) Acquisition Cost	
Intermediate goods at Market Price	—	XXX		—Cost of Product	
Goods in process at Market based value	—	XXX		—Cost of Production	
Other variable expenses *Marginal Cost*	—	—	XXX	—Actual Cost	XXX
Marginal Revenue			XXX		
Add (Deduct)					
Fixed charges made to (by) other division for transfers Not Prices at Market Value	—		XXX		
Less					
Controllable division O/H	—	XXX			
(9) *Dep. on controllable F. Asset* :—				Conventional Method	
For Durable liquid asset (Difference in the Market Values of asset between beginning and end of the period)	—	XXX		(B) Dep. based on formula of acquisition cost	XXX
Preperty taxes and Insurance on controllable F. Asset	—	XXX	XXX		
Controllable operating profit			XXX		
Add (Deduct)					
Non operating gains and losses (Realised Cost savings)	—		XXX←		
(Combination of the difference between A and B)					
Realised Profit			XXX		
Less					
Int. on controllable investment	—		XXX		
Controllable residual Income			XXX		
Less					
Non controllable divisional overhead	—	XXX	XXX		
Incremental central expenses chargeable to division	—	XXX	XXX		
Int. on Non-controllable investment	—	XXX	XXX		
Net Residual Income before tax			XXX		
Less Taxes on income			XXX		
Net Ineome after tax			XXX		

8. (a) Current cost of material used =

It is simply the quantity sold X weighted Average purchase price during the period. The value of the current cost of materials used determined by the above formula will be very close to the figure, if inventory is maintained by L.I.F.O. Method.

Realized cost savings = current cost of Material—Historic Cost (F.I.F.O. method) of material used.

(b) If a goods in process can be traded in the market, it should be considered as an intermediate good, and should be valued on the basis of its Market Price. When a market for a goods in process does not exist, a determined value must be used.

(c) If cost of material and inventries used are valued at current cost, different profit concept will be as follows :—

(1) Sales	—	XXX	
Less Cost of Material at (Current price) and other variable expense	—	XX	
Current Marginal operating Profit	—	XXX	
(2) Cost of material (at current cost)			XX
Less Cost of material (at historic cost)			XX
Realized cost savings			XXX

opportunity cost at that time. This figure represents the amount which the firm is consigning to the manager at the beginning of a period for use in promoting the firms' activities during the subsequent period. It can also be treated as the resources which the owners are risking in the short run. Manager uses the resources for the period in consideration, and if he is successful the opportunity cost of the resources at the end of the period will exceed the opportunity cost at the beginning of the period. If this gain exeeeds the interest on the opportunity cost of the firm's resources at the beginning of the period, the owners were wise to permit the business to operate during the period rather than discontinuing it at the beginning of the period. So, for the measurement of performance of a division for a semi-independent period recognition of opportunity cost is important.[10]

It is interesting to note that different cost and Revenue figures have been calculated in the divisionalized chart. The reason is one set of cost and revenue figures cannot satisfy all the informational need of managers in their decision making process, so with different types of adjustments different cost and revenue figures have been identified, so as to facilitate decision making function.

Use of Divisionalized data

There are different uses of divisionalized data. The above chart may be used :—

(1) *For short term decision making*—(use of Marginal cost figure)

(a) Make or buy decisions

(b) Pricing policy for the end product

(c) Output decisions etc.

(2) *For performance measurement* :—

(a) Measuring the performance of a divisional manager

(b) Measuring performance of a division

Divisionalized data for performance measurement

Sometime no distinction is drawn between the success of a Manager and his division. It means the success of one, can also be considered as the success of other. In fact two different income figures should be identified to measure their performance. In total five profit figures have been identified in the above chart. However, the question still remains which one should be used and for what purpose.

Marginal revenue which is being calculated by substracting the variable cost of goods sold from the revenue, cannot be used either for the measurement of managerial efficiency or divisional performance at least for a sufficiently independent division.

9. *Durable liquid assets* are those assets that can be sold with relative ease in an active (Second hand) market. Examples are vehicles, Land, Share etc.

The difference in the market value of the assets between the beginning and the end of the period should be debited (credited) to the user of the assets, as depreciation (appreciation). Note that the market price at the end of the period takes into account any increase in maintainance or obsolescence of the asset during accounting period and also the price level changes.

Durable non liquid Assets—most of the individual assets are not liquid. This is because an active market for the used, specialized facilities does not exist. In this case relevant index number may be used. In absence of relevant index number "appraisal" values may be used.

The annual charges for the assets service consist of the diference in the values at the beignning and at the end of period.

"Appraise" means to determine the value of a durable non-liquid assets depends on a systematic procedure that includes techical examination (by accountant) of the assets potential to render service compared to a new asset.

The most conventional method of calculating depreciation i.e. straight line or accelerated method has several disadvantages so far as measurement and control of divisional performance is concerned, for detail discussion (See Management Control System, Text and cases by R.N. Anthony and John Dearden, Richard D. Irwin, 1977, P.O. 335-344). Moreover the historical cost method does not help to find out the current cost of services received from a durable non liquid asset for a semi-independent period. That's why the appraised value has been chosen, and which we think is more objective than the historical method.

10. For a detailed discussion see 'Yaqoov goldschmidt, "information For Management Decision" Cornell University, 1970, pp. 199-207.

In a quasi-independent division, the divisional manager has the right to exercise substantial influence on the scale of division's operations. It implies the right to determine the optimum scale of operations, and he is to be provided with the necessary capital so long the cost of capital can be met. So a profit figure to be used for the purpose of evaluation of managerial efficiency, must consider the cost of using controllable investment.

After marginal revenue next profit figure identified in the chart is the controllable operating profit, which is the excess of the value of output sold and transferred over the resources used in producing and selling that output at the current cost. So, it seems controllable operating profit is a better yard stick to measure the efficiency of the manager, which considers not only variable cost but also the cost of using controllable investment. This is also not a perfect yardstick to measure the efficiency of the performance of a manager, though, it indicates to a very important factor, that is whether the current proceeds from the sale of a product are sufficient to cover the current cost.

In a sufficiently independent division having substantial control over the investment and composition of assets and inventories, realized cost savings must be considered to evaluate the efficiency of a manager. Realized cost savings is the excess of the current cost over historic cost in producing output sold. In the chart it has been shown by adding A and B. Controllable operating profit which is arising from operation plus Realized cost savings gives the total of *Realized Profit*. From this realized profit Int. on controllable investment is deducted to find out the *controllable residual income* before tax, and this figure can be used for appraising the performance of divisional management. It is to be noted that in appraising the performance of divisional management, no account has been taken of the factors which are beyond the control of division.

On the other hand *net residual income* which is being calculated after taking into consideration both controllable and non-controllable expenses i.e. total expenditure of the division, can be considered by the top management in its decision relating to a division, say new investment or withdrawal of funds from the division etc.

Conclusion

In this article each division is viewed as a quasi-independent subsystem and an attempt is made to develop an accounting procedure to measure the performance of such a division for a semi-independent period. We think this idea of developing an accounting procedure for a quasi-independent subsystem for a semi-independent period will be able to supply relevant information for :—

(1) Decision making, (2) Measurement of the performance of a divisional manager (3) To appraise the performance of the division as a whole.

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Salesmen Routing Problem—A Case Study

A.S. NARAG & AJAY PANDIT

This is a case study of application of integar linear programming.

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Introduction

Ganesh Electronics[1] Markets electrical motors, starters switchgears and panels all over India through its four regional offices, each headed by a Regional Sales Manager (RSM). The sales engineers, employed in each region, are assigned territories, which they are required to visit at regular intervals and thereafter submit a report to their respective RSMs.

The Northern India Sales Office of the Company is located in Delhi and is responsible for the sales and service of motors, starters, panels etc., in Delhi, Punjab, Haryana, Uttar Pradesh and Himachal Pradesh. The list of cities, a sales engineer is expected to visit is as follows:

City Number	*Name*
1.	Delhi (Starting and ending city of the tour)
2.	Amritsar
3.	Jullundur
4.	Hoshiarpur
5.	Ferozepur
6.	Ludhiana
7.	Phagwara
8.	Khanna
9.	Patiala
10.	Ambala

1. The name of the Company has been disguised.

$$\sum_{j} R_{1jk} = 1$$

$$\sum_{i} R_{i1n} = 1 \qquad \text{... (a)}$$

It must also be true that from any given city i, there is only one leg of the trip which begins at i, and terminates in some other city. Thus

$$\sum_{j,k} R_{ijk} = 1, \quad i = 2,.....n, \qquad \text{... (b)}$$

where in carrying out the summation we require that if $j = 1$, then $k = n$, and vice versa. The restriction for $i = 1$ is contained in (a). Similarly, it must be true that only one leg of the trip ends at city j. Consequently,

$$\sum_{i,k} R_{ijk} = 1, \quad j = 2,.....n, \qquad \text{... (c)}$$

where we require that if $i = 1$, then $k = 1$, and vice versa. The case of $j = 1$, is contained in (a). Finally, it must be true that if leg k ends in city j, then leg $k + 1$ must begin in city j. This implies that

$$\sum_{i} R_{ijk} = \sum_{j} R_{jj} : k + 1; \quad j = 2.....n; \quad k = 2,.....n-1,$$

$$R_{1j1} = \sum_{j} R_{jj} 2, \qquad \text{... (d)}$$

$$\sum_{i} R_{ij,\,n-1} = R_{j1n}.$$

The constraints (d) eliminate the possibility of disconnected trips such as that illustrated in Figure 1, for the case of seven cites.

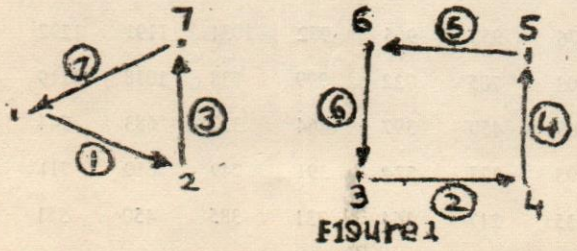

Fig. 1

We now have formulated all the constraints in the problem. It is unnecessary to include constraints $R_{ijk} \leqslant 1$, since (a) through (d) automatically ensures that no $R_{ijk} > 1$. We then wish to determine non-negative integers R_{ijk} satisfying (a) through (d) which minimize

$$Z = \sum_{i,j,k} d_{ij} R_{ijk}$$

where d_{ij} is the distance from city i to city j. The above formulation does not necessarily require that $d_{ij} = d_{ji}$.

Solution

The solution of the integer linear programming Model using the Branch—and-Bound Algorithm[3] gives the following optimal journey cycle.

From Delhi to Meerut to Agra Cant to Kanpur to Lucknow to Faizabad to Varanasi to Allahabad to Aligarh to Bareilly to Moradabad to Hardwar to Saharanpur to Simla to Chandgarh to Karnal to Ambala to Patiala to Khanna to Ludhiana to Phagwara to Jullundur to Hoshiarpur to Jammu Tawi to Pathankot to Amritsar to Ferozepur to Bhatinda to Hissar to Bhiwani to Delhi.

The total distance associated with the above cycle is 4608 kilometers.

Conclusion

The integer linear programming solution for the the above salesmen routing problem by using Branch and Bound algorithm ensures that the total distance travelled by a salesman is minimum. This is approximately 25% less as compared to the total distance associated with the journey cycles followed by the sales engineers and the RSM based on their experience and judgement.

In this problem the objective was to minimize the total distance travelled. However, one could encounter situations in which the objective may be to minimize total time and in that case same methodology could be followed by replacing the distance parameters with time parameters.

3. For details on the Branch-and-Bound Algorithms see reference Number 5.

ANNEX

Distances Between Various

From City No. ↓	To City 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	∝	447	368	412	386	311	347	269	251	198	255	123	484	585	166
2	447	∝	179	123	197	136	100	178	302	249	316	324	107	208	407
3	368	79	∝	43	118	57	21	99	219	166	233	245	116	217	328
4	412	123	43	∝	161	100	64	142	262	209	276	288	159	260	371
5	386	197	118	161	∝	125	161	167	237	238	305	313	234	335	305
6	311	136	57	100	125	∝	36	42	166	113	180	188	173	274	271
7	347	100	21	64	161	36	∝	78	202	149	216	224	137	238	307
8	269	178	99	142	167	42	78	∝	124	71	138	146	215	316	313
9	251	302	219	362	237	166	202	124	∝	53	120	128	339	340	366
10	198	249	166	209	238	113	149	71	53	∝	67	75	286	387	364
11	255	316	233	276	305	180	216	138	120	67	∝	142	353	454	331
12	123	324	245	288	313	188	224	146	128	75	142	∝	361	462	289
13	484	107	116	159	234	173	137	215	339	286	353	361	∝	101	444
14	585	208	217	260	335	274	238	316	340	387	454	462	101	∝	545
15	166	407	328	371	305	271	307	313	366	364	331	289	444	545	∝
16	226	347	268	311	245	211	247	253	317	324	391	349	384	485	60
17	298	451	368	411	88	311	347	353	149	202	269	277	484	585	217
18	590	641	558	601	626	505	537	459	445	392	125	467	674	775	756
19	72	437	358	401	426	301	337	259	241	188	245	195	474	574	238
20	181	324	245	288	313	188	224	146	128	75	142	150	361	462	347
21	161	525	446	489	314	189	225	147	321	276	343	284	562	663	327
22	252	615	536	579	604	479	515	437	419	366	433	375	652	753	418
23	487	853	774	817	842	717	753	675	657	604	671	610	890	991	653
24	432	925	846	889	914	789	825	747	729	676	743	555	962	1063	598
25	625	1117	1038	1081	1106	981	1017	939	921	868	935	748	1154	1255	791
26	788	1154	1075	1118	1143	1018	1064	976	958	965	972	1034	1191	1292	954
27	615	981	902	945	970	845	881	803	785	732	799	738	1018	1119	781
28	199	646	567	610	635	510	546	468	450	397	464	322	683	744	365
29	126	573	494	537	562	437	473	395	377	324	391	249	610	711	292
30	262	413	334	377	402	277	313	235	217	164	231	385	450	551	428

URE

Cities (in Kilometers)

No.														
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
226	298	590	72	181	161	252	487	432	625	788	615	199	126	262
347	451	641	437	324	525	615	853	925	117	1154	981	646	573	413
268	368	558	358	245	446	536	774	846	1038	1075	902	567	494	334
311	411	601	401	288	489	579	817	889	1081	1118	945	610	537	372
245	88	626	426	313	314	604	842	914	1106	1143	970	635	562	40
211	311	505	301	188	189	479	717	789	891	1018	845	510	437	277
247	347	537	337	224	225	515	753	825	1017	1064	881	546	473	313
253	353	459	259	146	147	437	675	747	939	976	803	468	395	235
317	149	445	241	128	329	419	757	729	921	958	785	450	377	217
324	202	392	188	75	276	366	604	676	868	905	732	397	324	164
391	269	125	245	142	343	433	671	743	935	972	799	464	391	231
349	277	467	195	150	284	375	610	555	748	1034	738	322	249	385
384	484	674	474	361	562	652	890	962	1154	1191	1018	683	610	450
485	585	775	574	462	663	753	991	1063	1255	1292	1119	774	711	551
60	217	756	238	347	327	418	653	598	791	954	781	365	292	428
∞	157	816	298	407	387	478	713	658	851	1014	841	425	352	488
157	∝	594	372	277	461	551	787	732	925	1088	915	499	426	562
816	594	∝	574	467	668	758	999	1068	1260	1297	1124	789	716	556
298	372	574	∝	114	193	283	519	464	657	720	647	271	158	208
407	277	467	114	∝	194	284	519	591	783	820	647	380	267	94
387	461	668	193	194	∝	90	325	397	589	626	453	360	247	168
478	552	758	283	284	90	∝	235	307	499	436	363	451	137	378
713	787	996	519	519	325	235	∝	72	364	301	128	486	381	541
658	732	1068	464	591	397	307	72	∝	192	373	200	415	309	613
851	925	1260	657	783	589	499	364	192	∝	170	157	608	501	805
1014	1088	1297	720	820	626	436	301	373	170	∝	166	589	582	842
841	915	1124	647	647	453	363	128	200	157	196	∝	614	509	669
425	499	789	271	380	360	451	486	415	608	589	614	∝	325	461
352	426	716	158	267	247	167	381	309	501	582	509	325	∝	361
488	562	556	208	94	168	378	541	613	805	842	669	461	361	∝

REFERENCES

Balinski, M.L., "Integer Programming: Methods, Uses, Computation," Management Science, 12, No. 3, 253-313 (1965).

Beale, E.M.L., "Survey of Integer Programming," Operational Research Quarterly, 16 No. 2, 219-228 (1965).

Dantzig, George B., "Linear Programming and Extensions," Princeton University Press, Princeton, N. J, 1963, Chap. 26.

Gomory, Ralph E., "An Algorithm for Integer Solutions to Linear Programmes," in R.L. Graves and P. Wolfe (eds.) Recent Advances in Mathematical Programming, McGraw-Hill, New York, 1963, pp. 269-302. First issued in 1958.

Lawler, E.L., and Wood, D.E. "Branch-and-Bound Methods: "A Survey", Operations Research, 14, No. 4, 669-719 (1966).

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Design of Storage System for Rural Areas

B.K. ARORA

Storage and post harvest care is an important component of agricultural production system. The function is performed by farmers, traders and several government and quasi-governmental agencies. The paper focusses on the emerging scenario of the storage system for rural areas.

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Introduction

Storage and post harvest care is an important component of agricultural production system. The function is performed by farmers, traders and several government and quasi-governmental agencies. Farmers store foodgrains and other agricultural commodities produced by them partly to meet their years' consumption requirements in the household including the payment in kind, to meet requirements of seeds for the next crop, and partly to hold back some of their marketable surplus of produce in the hope of getting better prices in the lean period. During the harvest period also, when a part of the produce has been harvested, threshed and cleaned, and the farmer is busy in completing these operations on the rest of the crop, he requires temporary storage till he can carry the entire marketable surplus of produce in one lot for sale in the market. Apart from this, farmer may need to store fertilizers for certain periods to ensure that this is available with him at the time when it to be applied to the crop.

Storage Needs

The storage requirements of an individual farmer for various purposes may vary with the size of operational holding, tenure on land, size of his family, the capacity to hold back his produce and extent of reliability he can place on the nearest fertilizer sale point for getting the requisite type of fertilizer at right time etc. etc. It is very difficult to give the

influence of each of these factors individually or jointly on the storage capacity with the farmers. It is, however, generally observed that small and marginal farmers, of whom, a large number may be share croppers, have very little to dispose during lean periods and thereby take advantage of off-season prices. Their storage requirements are limited to the foodgrains needed for household consumption or seeds for the next crop season. Sometimes, even these requirements may not be met from the stored stocks as many of them are perpetually in debt with the village shopkeepers, landlords, commission agents in the nearby markets etc., who realise their loans mainly at harvests by pre-empting bulk of the produce of borrowers immediately after harvest. Even if there is some marketable surplus available with such individuals, they have very little retention power and usually sell their marketable surplus immediately after harvest to meet their household and crop needs. They also have no liquid funds of their own for purchasing fertilizers in advance and thus may not need storage space for same. Thus, the storage needs of the small and marginal farmers are limited to the requirements for storing their produce to meet the family needs and seeds for sowing the next crop.

Even in case of large and well-to-do farmers, retention of produce largely depends on the differences between the peak and lean season prices of market arrivals. The farmers shall have the tendency to store if they speculate a rise in prices more than the cost they will have to incur on storage of their produce and losses in storage. The immediate monetary needs of the farmers also affect the quantum of storage with them. The stabilisation of farm production and procurement of farm produce at a fixed price by public agencies has substantially reduced the fluctuation in the prices of major foodgrains. This has tempted even the medium and large farmers to sell their marketable surplus immediately after harvest. In the absence of data based on scientific studies, it is very difficult to identify the storage needs of different categories of farmers for the foodgrains stored for the purpose of off-season sales. However, it is known that on aggregate level, 70—75 per cent of the produce harvested is retained in the village and stored for the purpose of household consumption, lean season sales send to meet the seed requirements for the next crop.

Rural Storage Structures

For the storage of foodgrains and other agricultural commodities of household and farm consumption, the farmers, since generations, have built up and used various types of storage structures. In past, these structures were built using local materials and stored produce preserved with the help of herbs and other plant materials. The structures were built both underground and above-ground depending upon the climate, materials of construction and length of storage. Of late, metallic drums and bins of different sizes and capacities have also come into use. These bins are certainly safer than the traditional structures as these are moisture proof, insect-proof and rodent proof. Besides, various insecticides and fumigants are used for prevention and control of insect pests of stored grains. In certain states, subsidies are also being given for purchase of these metallic bins. But these structures have not become very popular in rural areas because of high initial cost.

Farmers in rural areas store their surplus grains and other materials in the part of their residential buildings. Often a part of the room, or verandah, is used for storing grains in bags or bulk and the remaining part serves as living space for the family, Due to limitation of space, fertilizers and other farm inventories are also stored in the same room. In case of well-to-do farmers, sometimes a separate room is earmarked for storage of agricultural commodities. These structures are rarely moisture proof, insect-free or rat-proof. These are difficult to seal and may prove to be health hazard if adequate precautions are not taken after fumigation. Proper storage therefore, requires a separate room which can be adequately sealed after fumigation. Besides, the facility has to be made leak-proof and grains inaccessible to rodents. Unless, these measures are taken, the returns from the retention of produce, may even be lower than the same from sale at the harvest time.

Need For a New System

Although large number of innovations have been

made to introduce improvements in storage at farmer's level, there is not much response from the farmers to adopt these. Scope for improvements by farmers themselves seems to be rather limited owing to economic constraints. Small farmers do not have land and funds to own independent scientific storage facilities. They have little surplus for disposal in the lean season. In many cases they are dependent upon the local traders for disposal of their surplus which leaves them with hardly any incentive for storage. They are so pressed for liquid cash that, in many cases, they have to resort to distress sale of their produce. Therefore, there is need for an agency at the national level which can provide institutional credit facilities to increase the holding capacity of the farmers as well as provide scientific storage facilities to the farmers.

With a view to provide above facilities and avoid distress sales, the need for licensed warehousing was realised as early as 1928 by Royal Commission on Agriculture. Specific recommendations in this regard were made in 1945 by Agricultural Finance Sub-Committee (Gadgil Committee). In 1951, the Reserve Bank of India took up a detailed survey on Rural Credit Structure in the country. The All India Rural Credit Survey Committee fully endorsed the views of Gadgil Committee and made important observations and recommendations in its report dated 28.12 1954. The recommendations of the committee paved the way for enactment of Agricultural Produce (Development & Warehousing) Corporations Act, 1956 (since replaced by Warehousing Corporations Act, 1962) and establishing of Central and State Warehousing Corporations.

Warehousing—Fast Perspective

Warehousing envisaged a three tier system. Under the scheme, centres of All India Importance are served by Central Warehousing Corporations, centres of secondary markets and district levels are to be served by the State Warehousing Corporations, while the village and community levels are to be looked after by the cooperatives. The broad objectives for public warehousing have been derived from the Rural Credit Survey Committee Report 1954. These objectives as given in the Public Undertaking Committee Report 1967-68 are :

(i) Creation of negotiable paper to provide an instrument for expansion of credit through Commercial Banks for the benefit of producers, dealers and others.

(ii) Adding to the nation's real income by reducing wastage and losses in storage; and promoting and developing warehousing for scientific storage facilities.

(iii) Assistance in orderly marketing by introduction of standard grade specifications and the Warehouse Receipt.

(iv) Training of personnel to manage and run modern warehouses ; and

(v) Assistance to Government and Government sponsored organisations in their scheme of price support and price control.

To achieve the broad objectives, functions as were identified in the warehousing corporations Act 1962 are :

(i) To acquire and build warehouses at such suitable places in India as it thinks fit.

(ii) To run warehouses for storage of agricultural produce, seeds, manures, fertilizers, agricultural implements and notified commodities offered by individuals, cooperative societies and other institutions.

(iii) To arrange facilities for the transport of agricultural produce, seeds, manures, fertilizers, agricultural implements and other notified commodities to and from the warehouses.

(iv) To subscribe to the share capital of State Warehousing Corporations.

(v) To act as an agent of the Government for the purpose of purchase, sale, and distribution of agricultural produce, seeds, manures, fertilizers, agricultural and notified commodities.

(vi) To undertake disinfestation service at its discretion and at the request of the parties outside owned warehouses in respect of agricultural and notified commodities ; and

(vii) To carry such other functions as may be prescribed.

During the two and half decade of its working Central Warehousing Corporation has made a remarkable progress. It has already built up storage capacity 3,692 thousand metric tonnes spread over 317 warehouses as on 30.4.1981. It has also set up 16 State Warehousing Corporations which own 1035 warehouses with a storage capacity 4,883 thousand m. tonnes as on 30.4.1981. Thus CWC and SWC have a combined storage capacity of 8.6 million tonnes at 1352 centres. The warehouses are manned by trained and qualified persons. The storage facilities are scientific and ensure minimum loss of foodgrains and other materials.

However, the above facilities have been of little assistance to the farmers as far as storage of their surplus produce is concerned. The number of warehouse is very small and distances, in many cases, are so large from the village that the producers do not have induction to deposit their goods in the warehouses. These warehouses are mainly used by the government, public agencies, private traders and cooperatives. The warehousing chain in the country has greatly assisted the procurement, storage and distribution of agricultural commodities and fertilizers but it has been of little assistance in mitigating the storage problems of the farming household. The farming community has still to hold its surplus in the household premises where losses are very high and he cannot get any loan against the materials held by him.

Emerging Scenraio

One of the solutions to the above problems could have been the establishment of third tier storage at the village and cooperative level. The primary agricultural credit societies in the villages can construct modern godowns capable of offering scientific storage to cater the needs of its member farmers for stocking their marketable surplus far as long as they desire. The village societies can also take up distribution of fertilizers as well as other essential commodities needed by the village community. These can also advance short term loans against the pledge of stock kept by them. Arrangements for marketing can also be made by societies without moving the stocks from godowns with the prior consent or on request from the farmers. In fact, the village societies are already engaged in these functions.

Realising the role that these cooperatives have essentially to play in improving the lot of village communities in general and the agricultural economy in particular, a lot of stress has recently been laid in reorganising and strengthening the village societies. They have been provided managerial subsidy to enable them to engage trained and competent managers. They have been provided state participation in share capital to strengthen their capital base. This has helped a large number of societies to take up new activities. The rural godowns have been set up with the loan assistance from state government. Even international funds are being made available to cooperatives for construction of godowns in the rural areas. So wherever, the cooperatives have been strengthened and are performing satisfactory, the role of building and operating rural warehouses can be entrusted to them. This will help in linking credit with marketing and storage ; so necessary for the development of rural areas and success of any rural storage programme.

Some Alternatives

Where cooperatives have not taken firm roots, the role of rural storage agency can be given to the Regional Rural Banks. These banks can be provided a storage godown alongwith their office building. The farmers can pledge their grains with the bank and get the loan against this. The maintenance of stocks in the bank godowns should be entrusted to a trained persons so that stocks kept in its custody do not deteriorate. A nominal charge can be levied to the farmers against the services provided by the bank in storing his grains. This will not only help in linking credit with storage and marketing, but will also make both rural banks and rural storage together viable which if operated independently may not be viable due to their small size of operations. The combination of the functions can be helpful both for the rural banks in expanding their credit base as well as godowns in widening their network.

In the alternate scheme of operation, the small godowns or steel storage bins can be constructed/ fabricated and kept with the farmers themselves. The loans can be advanced by rural or scheduled banks against the stocks kept in these bins, pledged to the bank. A schedule of periodic inspection and disinfestation may be adopted for maintaining the quality of stocks. Loans and subsidy may be provided for building up these storage structures on farmers premises. Only the stocks kept in specific types of structure should be accepted for pledging by the banks. The bank person should be present whenever the stock are to be fumigated and he should periodically satisfy himself with the quality of the grains. In this arrangement, while the responsibility of storage lies with the farmer, he can continuously guided by the visiting bank expert and maintenance and marketing of holds stocks. The disadvantage with the system will be high investments on construction for storage by individual farm household. The farmer may require separate construction for the stocks to be pledged to the bank and the stocks kept under his own custody. However, the system has the potential to mutually benefit rural bankers and the farmers.

The facilities for collective storage can also be built up with the other village agencies such as Gram Panchayat or a Voluntary Agency operating in the rural areas. A part of the storage facility should be pledged to the bank whereas the other part should be held free by the storage agency. To make the facility viable at the level of its operation, it should combine the functions of distribution of farm inputs and essential commodities, the collection and forwarding of farm produce such as milk, vegetable, processing of agricultural raw materials such as atta chakki etc. etc. The pilot storage godowns may have to be set up initially to establish the feasibility of such multipurpose rural commercial complexes.

Design of System

Whatever may be agency for construction and management of rural godowns, the system must meet the following requirements :

(i) The storage structure must conform to the scientific designs. It should use the local materials, as far as possible, for its construction and maintenance.

(ii) It should not be far off from the rural settlement and, as far as possible, controlled by the local people.

(iii) It should be operated and maintained or supervised by well trained and qualified staff.

(iv) Facilities for loan should be available to the depositors against the stocks kept by them.

(v) The activities of the rural storage complex should be commercially viable. The services should be available at reasonable charges to the users.

Besides the implementing agency, which has to necessarily enjoy the confidence of the rural people, there are many other details which have to be worked out for designing a viable system. The location, size and capacity, design (materials, methods of construction and structural arrangement) of the godown financing of construction, training of personnel etc., have to be given serious consideration for designing a viable rural storage system. Vast information and infrastructure is available in the country to meet these requirements. However, the crucial question remains—who should take up the responsibility and provide the much needed facility in the rural areas ? Single agency may not deliver goods in all regions of the country. Innovations will have to be made and applied to design an appropriate storage system which can fit best in the existing agro-economic structure of the area.

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PERT Based Penality/Incentive Clause in Civil Construction Contracts

K. P. SINHA

In civil Engineering contracts, the compensation for delay is being fixed arbitrarily, mostly based upon the past practices of the individual organisation. In many of the cases there is no provision in the agreement for incentive or bonus clause. In this paper an attempt has been made to develop an penality incentive clause based on the net work analysis of construction projects. Calculations of compensation for delay and incentive have been derived and illustrated by analysing two projects executed in Central Coalfields Limited, Ranchi.

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Introduction

It is customary to penalise contractors for delaying projects. In fact penality clause has been incorporated in contacts just to act as deterrent to the contractors so that they should try to complete project in estimated time. The compensation for delay or liquidated damage or penalty for delay, is the compensation paid by the contractor, if he fails to maintain the required progress as specified or complete the work before the contractural date of completion, on account of such breach of contract. The compensation amount will be as stipulated in the agreement and agreed upon by both the parties. The prevalent practice for the calculation of compensation and as recommended by the Bureau of Public Enterprises is as follows :

Completion period (As originally) stipulated)	*Compensation in terms of contact value per week*	*Maximum amount of the compensation in terms of the contract value*
(a) Not exceeding 6 months	@ 1% per weak	10 %
(b) Exceeding 6 months and not exceeding 2 years	@ $\frac{1}{2}$% per weak	$7\frac{1}{2}$ %
(c) Exceeding 2 years	@ $\frac{1}{4}$% per week	5 %

In fact the amount charged as penalty is always much less than the actual loss incurred by the management due to delay in completion of the project. This loss broadly consists of opportunity loss and cost of supervision for increased number of days. Some times the project cost might increase due to increase in prices of resources which is normally taken care of by the escalation clause of the contract. Thus instead of this negative approach if some sort of incentive clause is incorporated in the contract, that may prove to be more motivating to the contractors. This may result in lot of saving to the management by getting the projects completed early, if not then at least in estimated time.

Time Standard

The main pre-requisites for implementing any sort of compensation for delay-*cum*-incentive clause is the establishment of time standard and the development of time standard for a project is a problem to Industrial Engineers because of different complexities involved in any project. From its inception, work measurement centered mainly on repetitive work, which were seemingly easy to measure and control. This paper presents a new approach based on PERT to develop time standards for projects. Now a days as it has become common practice to prepare project reports based on PERT, the method suggested would not be difficult to use.

PERT Network and Time Analysis

To start with the three time estimates is the optimistic time estimate t_o, the pessimistic time estimate t_p and the most likely time estimate t_1 are made for individual activities. As per the 'beta distribution' the average time t_E (mean expected time) for the activities are given by

$$t_E = \frac{t_o + 4t_1 + t_p}{6}$$

and the standard deviation σ is given by

$$\sigma = \frac{(t_p - t_o)}{6}.$$

The average time indicates that there is a fifty-fifty chance of getting the activity completed within that time. Based on the average time (mean expected time) t_E for the individual activities, the net work for the whole project is drawn and critical path and the time for critical path is found out. The standard deviation σ for the project is found by summing up the variances (σ^2) of the activities along the critical path and taking the square root of the sum.

Theory

In general a project consisting of several activities will have a normal distribution, that is for the project as a whole, the distribution curve will be a normal curve and the probability of completing the project in time equal to the mean value of the normal curve T_E is 50%. In all fairness, the average time T_E is to be considered as the normal time and the earliest project completion time should be $T_E - 3\sigma$ and latest project completion time should be $T_E + 3\sigma$ as shown in Figure 1. It is logical from the distribution that no penalty should be charged unless and until the project completion time exceeds the latest completion time ($T_E + 3\sigma$). Similarly no incentive should be paid unless and until the project completion time is less than earliest completion time ($T_E - 3\sigma$). However for computing the amount of delay the delay should be counted from T_E and the amount of early finish should be counted from $T_E + 3\sigma$ so that even if the contractor keeps up the standard performance he gets

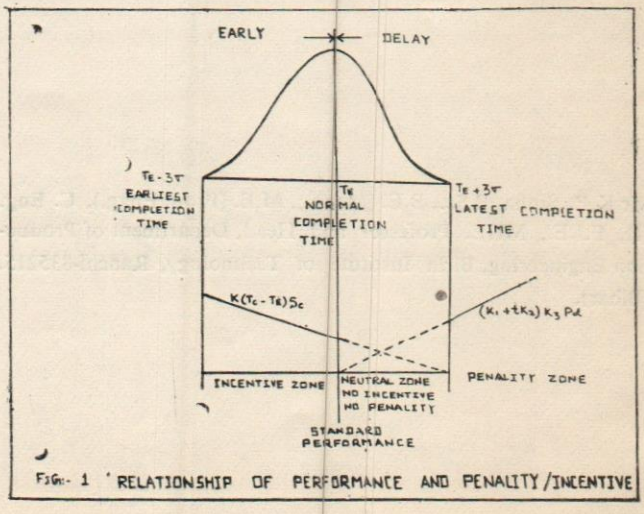

Fig. 1 RELATIONSHIP OF PERFORMANCE AND PENALITY/INCENTIVE

some benefit. Neither Incentive to be paid nor penalty to be charged, if the project completion time falls in neutral zone.

Penality Clause

No penalty should be charged from the contractor till the completion time (T_c) is less than or equal to $T_E + 3\sigma$, as shown in figure 1. Incase the completion time is more than $T + 3\sigma$ then suitable penalty proportional to the percentage delay

$$P_d = \frac{T_C - T_E}{T_E}$$

be made. Where T_c is the actual completion time and T_E is expected completion time as per the PERT network.

The net penalty to be charged on the contractor should be a function of the percentage delay (P_d), Earnest money deposit (K_1), Equal instalment amount of balance security deposited deducted from the running account bills (K_2) and a constant to control the total percentage delay with in which the full penalty is to be recovered (K_3).

Thus the net penalty $= (K_1 + tk_2)\, K_3\, P_d$ (1)

As per the departmental procedure, the EMD is received during the tendering of the work and it is converted into security deposit. The balance security deposit is recovered in 4 equal instalments in the running bills. So, in the formulae,

K_1 = Earnest money deposit

K_2 = Equal instalment amount of balance security deposit deducted from the running on Account bills.

t = 1, 2, 3, 4 which represents the number of bills paid at the time of consideration.

P_d = Percentage of delay.

k_3 = A constant watch can be assigned any value depending upon the total percentage of delay within which the full penalty is to be recovered. $K_3 = 1$, indicates that at 100 per cent of delay of the project the penalty will be recovered in full and for the percentage of delay less than 100 per cent, the penalty will be proportionate. $K_3 = 2$ indicates that at 50 percent of delay of the project the penalty will be recovered in full and for the percentage of delay less than 50 per cent of the penalty will be proportionate. That is for 30 per cent of delay the penalty will be 60 per cent of the total penalty.

In the formulae suggested, if the contractor fails to take up the work, the penalty will be equal to EMD. That is the EMD will be for-feited. After doing some work, if the contractor abandons the work, then the penalty will be the EMD plus the instalments of the security deposit so far deducted from the running bills. That is the security deposit on hand will be for-feited. The percentage of delay in this case will be taken as 100% as it is uncertain to say when the project will be taken up further, after fixing up another agency.

Illustrations

To illustrate the formulae suggested, the following project has been analysed.

This project deals with the construction of a shed for office accommodation, costing amount Rs. 1 lakh. The contract was on item rate contract and the completion period was 3 months. Even though in the initial stages the progress was very good, in the finishing stage the progress was delayed very much and the percentage of delay was 125 per cent. A token penalty of Rs. 200/- was imposed in this case.

The various activities involved in the project, the three time estimates the expected time and the standard deviation of the activities etc. are given in Table 1 and the PERT Net work shown in Figure 2. The security deposit which was 10 per cent of the value of the work is Rs. 9,736/-. k_3 has been assumed as 1. The delay in completion of the project was 115 days. On this work, there was a direct delay of 55 days on the part of the department in the issue of materials, A.C. sheets, cutting of the trees which was on the site etc. So, the delay on the part of contractor was 60 days and the percentage of delay is 70 per cent.

Table 1

Activity Details and Time Analysis

Sl.	Activity Code	Activity Details	Three Time Estimates			Expected Time	σ
1.	A	Receiving approved Drawings & Setting the site office	4	6	8	6	0.67
2.	B	Earth work, concrete Brick Work upto Plinth	12	15	24	16	2.00
3.	C	Refilling the Foundation and Plinth	4	7	10	7	1.0
4.	D	Providing Damp Proof Course	1	2	3	2	0.33
5.	E	Brick Work upto Lintel Level	6	10	20	11	2.33
6.	F	Lintels, Sunshade	4	6	8	6	0.67
7.	G	Brick work above Lintel Level, bed blocks and Holding down bolts	14	18	30	18	2.67
8.	H	Manufacturing doors and windows	14	25	30	24	2.67
9.	I	Fixing doors and windows	5	7	12	7.5	1.17
10.	J	Plastering and Skirting	6	8	13	8.5	1.17
1.	K	Manufacturing tubular Trusses	20	30	40	30	3.33
12.	L	Erection of tubular Trusses and Painting	5	7	12	7.5	1.17
13.	M	Supplying A.C. Sheets	15	21	33	32	3.00
14.	N	Laying of A.C. Sheets	4	6	8	6	0.67
15.	O	Flooring	8	10	15	10.5	1.17
16.	P	White washing & colour washing	4	6	8	6	0.67
17.	Q	Procurement of w/s sanitary and Electrification Materials	20	25	30	25	1.67
18.	R	Fixing w/s Sanitary & Electrification Fittings	8	15	22	15	2.33
19.	S	Procuring Materials for False Ceiling	15	21	33	22	3.0
20.	T	Fixing False Ceilinig	5	8	14	8.5	1.5
21.	U	Plinth protection, Drains Finishing & site clearance	7	12	22	12.83	2.5
		Critical Path				88	3.0

So the net penalty

$= (K_1 + t\,K_2)\,K_3\,P_d$

$= 9736 \times 1 \times 0.7 =$ Rs. 6815.5

Whereas the penalty imposed was only Rs. 200/-.

Incentive Clause

It is logical that when the contractor is expected to pay the penalty for delay he should be given bonus or incentive for early completion of the project and the incentive clause should also be on the similar lines that of penalty clause.

The total time saved due to early completion of the project is equal to (Latest allowable time—Actual time) and if the average cost incurred per day by the management in terms of supervision and opportunity cost over the total span of project execution than the total saving by early completion of the project can be calculated as follows :

Total saving = (Latest allowable − Actual time) × (Average cost per day). If the incentive to be paid as K per cent of the total saving than Incentive to be

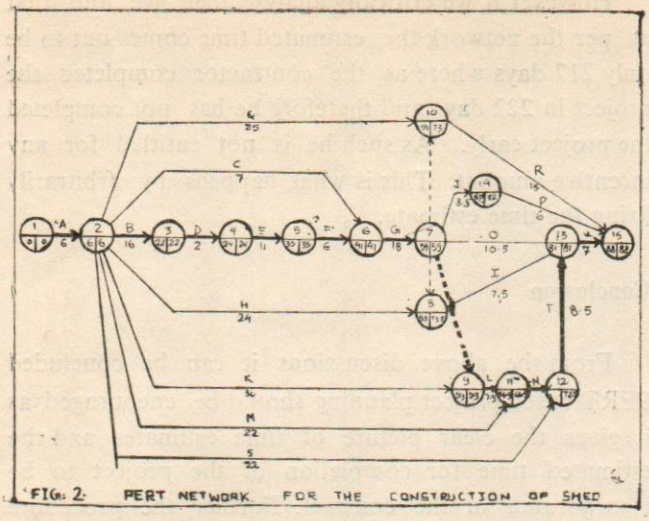

FIG. 2. PERT NETWORK FOR THE CONSTRUCTION OF SHED

paid = K (Latest allowable time − Actual time) × (Average cost − per day)

$$= K (T_E + 3\sigma) - Tc \times (\text{Average cost per day})$$

As it is practically not possible to complete the project in less than $(T_E - 3\sigma)$ days thus the maximum incentive is limited to K × 3 σ × Average cost per day (Fig. 1) and incentive for standard performance will be K × 3σ × Average cost per day.

Illustration

To illustrate the use of formula suggested above, the following project has been analysed.

This project relates to construction of a water tank and was a lump sum contract for Rs. 1.30 lakhs. The contract was inclusive of the contractors own design and the estimated completion time of the project was 270 days. The project was completed in all respects within 222 days. The various activities involved in the project, the three time estimates, the expected time and the standard deviations of the activities etc. are given in Table 2 and the PERT network shown in Figure 3. From the network the critical path time (Normal time)

Table 2

Activity Details and Time Analysis

Sl.	Activity Code	Activity Details	Three Time Estimates			Exp. Time	σ
1.	A	Getting the Drgs. APPD.	5	10	21	11	2.67
2.	B	Setting site office	4	9	20	10	2.67
3.	C	Foundation R.C.C. upto G.L.	25	45	65	45	6.67
4.	D	R.C.C. Shaft	24	45	54	43	6.33
5.	E	Bottom dome slant wall Bottom Ring Beam	10	24	38	24	4.67
6.	F	Wall and Top Ring Beam	20	40	60	40	6.67
7.	G	Top Domes & Ventilation	9	14	25	15	2.67
8.	H	Providing M.S. Ladder & Manhole Collars	10	18	32	19	3.67
9.	I	Supplying C.I. Pipes	6	10	14	10	1.25
10.	J	Supplying C.I. Specials	6	10	14	10	1.25
11.	K	Fixing C.I. Specials & Pipes	10	12	14	12	0.67
12.	L	Supplying Sluice Valves	6	10	14	10	1.25
13.	M	Fixing Sluice Valve and Chamber	1	2	3	2	0.33
14.	N	Providing & Fixing Lightening Arresters	6	8	16	9	1.67
15.	O	Supplying Water Level Indicator	10	15	20	15	1.67
16.	P	Fixing Water Level Indicator	1	2	3	2	0.33
17.	Q	Site Clearance, Testing, Finishing	12	18	36	20	4.00
		Critical Path				217	14.00

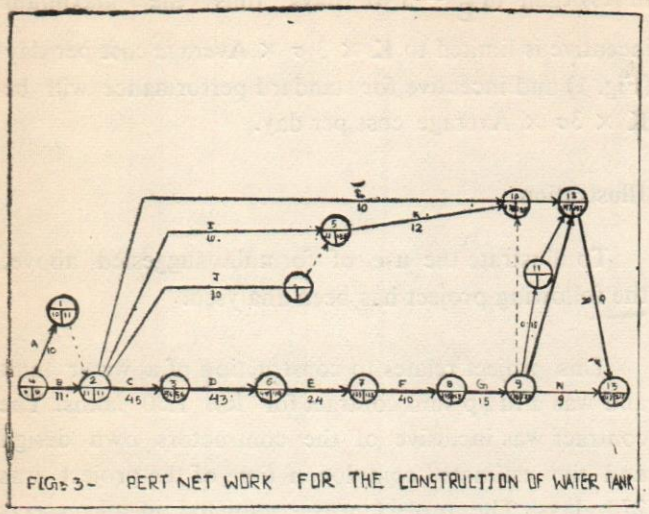

FIG: 3- PERT NET WORK FOR THE CONSTRUCTION OF WATER TANK

comes out to be 217 days and the latest allowable $(T_E + 3\sigma)$ becomes equal $(217 + 3 \times 14) = 259$ days. The average expenses per day incurred by the management in terms of supervision over the span of project duration was estimated to be Rs. 100/- per day. Assuming the value of $K = \frac{1}{2}$ the Incentive can be calculated as follows :—

$$\text{Incentive} = \tfrac{1}{2} \text{ (Latest allowable time} - \text{Actual time)} \times \text{(Average Expenses—per day)}$$

$$= \tfrac{1}{2} (259 - 222) (100)$$

$$= \text{Rs. } 1850$$

No incentive was paid to the contractor where as he should have been paid Rs. 1850/- as per the estimated time given in the contract.

However if we critically analyse then we find that as per the network the estimated time comes out to be only 217 days where as the contractor completed the project in 222 days and therefore he has not completed the project early. As such he is not entitled for any incentive amount. This is what happens by arbitrarily fixing the time estimate.

Conclusion

From the above discussions it can be concluded PERT based project planning should be encouraged as it gives the clear picture of time estimates and the estimated time for completion of the project to be incorporated in the contract. Further the procedure and the formula suggested for the calculation of penalty and incentive may greatly help in rationalising the various procedures presently adopted.

Acknowledgement

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BIBLIOGRAPHY

Sinha, K.P. "Performance of Contract System of Execution of Construction Projects" Productivity, April—June, 1981, Vol. XXII, No. 1.

Productivity
1984 XXIV, 4, 511-517

A Van Scheduling Problem

A.D. GUPTA & B.K. GUPTA

In this paper, an attempt has been made to present a case study which was conducted in Eastern Railways to determine the minimum time consuming van routes for distribution of the items stocked at a depot to various demand centres engaged in the maintenance of the rolling stock. The shortest route model suggested by Hillier and Liebermann has been used, which fans out from the origin successively identifying the shortest routes in terms of time taken to each of the nodes of the network in the ascending order of their (shortest) distances until the destination is reached. The paper presents the design of one of the van routes.

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Introduction

The problem aims at finding out the minimum time consuming van routes for the distribution of items stocked at a depot in a large public sector transport undertaking. This depot caters to the demands of various consumers at different locations engaged in the maintenance and operation of rolling stock.

The depot despatches the items by delivery vans attached with available goods or passenger trains. The vans are detached at stations where the train terminates or where the items demanded are so many that waiting of the whole train for unloading may be economical. The vans after issuing all the materials return to the parent depot.

At present, delay arises due to improper planning of the schedule of despatches and routes adopted. The other factors contributing towards delay are nonavailability of trains, bottlenecks in the marshalling yards, etc. The queuing of vans occurs at the depot awaiting loading due to restriction of manpower and other facilities available.

Mathematically, the problem can be stated as :—

Let $P_1, P_2, P_3 \ldots\ldots, P_m$ be the delivery points (set of consumers) with $Q_1, Q_2, Q_3 \ldots\ldots Q_m$ as the demands. All the interpair shortest timings are represented by t_{ij} $(i, j = 1, 2, \ldots\ldots m)$ and the available capacity by C_i $(i = 1, 2, \ldots\ldots, n)$. $X_{ij} = X_{ji} = 1$ means that the points P_i and P_j are adjacent and $X_{ij} = X_{ji} = 0$ means that the points are not adjacent in any tour.

The problem is to find out those values of X_{ij} which make total time

$$T = \sum_{i,j=1}^{m} t_{ij} X_{ij}$$

a minimum subject to conditions and constraints specified below :

$$\text{Max } C_i \ (i=1, n) \leq \sum_{j=1}^{m} Q_j$$

$$\sum_{i=1}^{n} C_i > \sum_{j=1}^{m} Q_j, \text{ Po being the terminal point.}$$

Model formulation

Shortest route problem by Hillier and Liebermann [1] fans out from the origin successively identifying the shortest route in terms of time to each of the nodes of the network in the ascending order of their (shortest) distances until the destination is reached.

The given points P_j (j = 1, 2, 3, 4, ... , m) are divided into N groups. Further subgrouping has been done depending upon the number of indentors served and the deliveries to be made at a point. Time taken between two stations of a subgroup is found out as shown in Fig. 1.

Let,

T = Cumulative time

X = Starting station

Y = Next station of subgroup

T_d = Departure Time of train from Station X

T_j = Journey time from Station X to Station Y

T_s = Sorting Time at Station Y

T_a = Arrival Time at Station Z

T_r = Time at which Van is ready for despatch to next station.

It should be our effort to reach the starting station of a group in a shortest possible time. Upto starting station of a group, the van need not be stopped

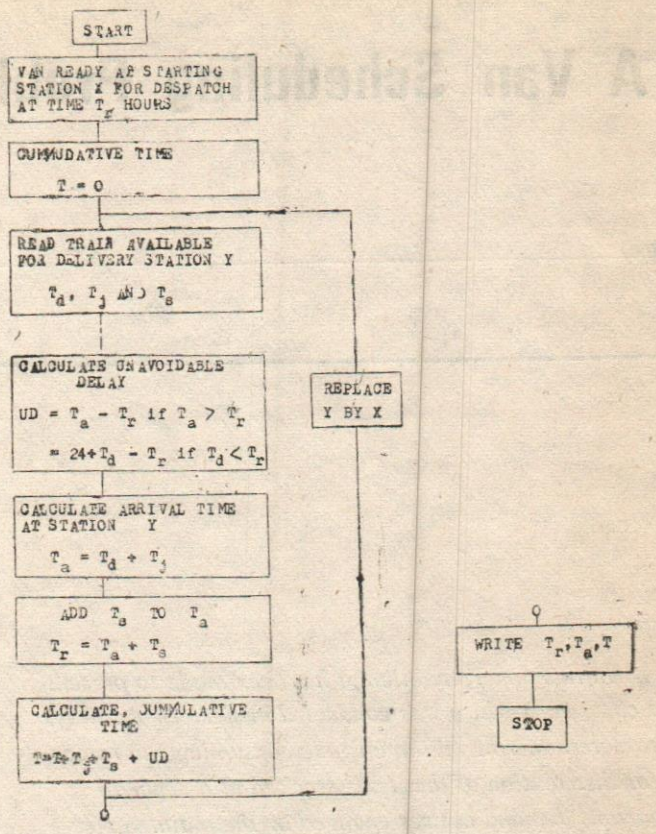

Fig. 1

or detached since it will not deliver material to any station from source to starting point of a group. But due to termination of a train before reaching the starting station of a group, the van has to be detached in the yard and has to be stored out for despatch. Therefore we find a number of alternatives available for reaching the starting station of a Group. Following example will clarify the method of finding out the shortest route (Fig. 2).

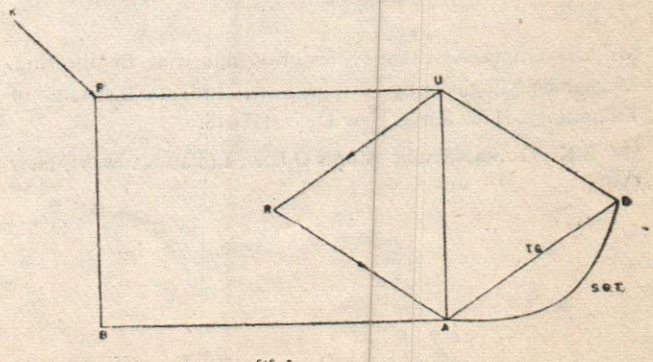

FIG 2

(i) A, B, D, K, P, R, U are the different stations.

(ii) Arrow indicates that the train is available only for that direction.

(iii) T.G. means Through Goods Train which stops only at terminal station.

(iv) S.Q.T. means Small Quick Transit Train which stops at road side stations to load/unload the items for those stations.

Determination of the Shortest Route

The shortest route for reaching from Station K to Station D can be found out as under :—

3.1 *STEP = 1*

T = 0

T_r = 1000

K	P	B	U	R	A	D
t_d = 1000	0400	0845	0820	1030	0600	
T = 39,15	PU-96,30	BP-40,30	UR-24,00	RA-52,20	AD_s-39,30	
T_r = 0115	0430	0115	0820	1450	2130	
		—	—		—	
	1910	—	—		—	
	PB-68,30	BA-79,05	UA-76,50		AD_t-41,20	
	1540	—	—		—	
			1000		—	
			UP-42,30		AB-85,15	
			0430		—	

Solution for Shortest Route

3.2 *STEP = 2*

T = 0 39, 15

t_r = 1000, 0115

K^x	P	B	U	R	A	D
t_d = 1000	0400	0845	0820	1030	0600	
KP-T = 39,15	PU-99,15	BP-40,30	UR-24,00	RA-52,20	AD_s-63,30	
T_r = 0115	0430	0115	0820	1450	2130	
	1910	—	—		—	
—	PB-86,25	BA-79,05	UA-76,50		AD_T -41,20	
	1540	—	—	—	—	
			1000		—	
			UP-42,30		AB-85,15	
			0430		—	

PU = 39, 15 + 99, 15 = 138, 30

PB = 39, 15 + 86, 25 = 125, 40 (Selected)

Solution for Shortest Route

3.3 *STEP : 3*

T = 0 39,15 125,40
t_r = 1000 0115 1540

K	P	B	U	R	A	D
t_d = 100	0400	0845	0820	1030	0600	
KP-T = 39,15	PU-39,15	BP-40,30	UR-24,00	RA-52,20	AD_S-39,30	
t_r = 0115	0430	0115	0820	1450	0430	
	1910	—	—		—	
	PB-86,25	BA-79,05	UA-76,50		AD_T-41,20	
	15,40	—	—		—	
			1000		—	
			UP-42,30		AB-85,15	
			0430		—	

Solution for Shortest Route

3.4 *STEP : 4*

T = 0 39,15 125,40 138,30
t_r = 1000 0115 1540 04,30

K^x	P^x	B	U	R	A	D
1000	0400	0845	0820	1030		
KP-39,15	PU-99,15	BP-40, 30	UR-27,50	RA-52, 20		
0115	0430	0115	0820	1450		
	1910	—	—	—	—	
	PB-86,25	BA-78,05	UA-76,50		AD_T-41,20	
	1540	—	—	—	—	
			1000		—	
			UP-42,30		AB-85,15	
			0430		—	
					0600	
					AD_S-39,30	
					2130	

Solution for Shortest Route

3.5 *STEP* : *5*

T = 0	39,15	125,40	138,30	166,20
t_T = 1000	0115	1540	0430	0820

X^x	P^x	B	U	R	A	D
1000	0400	4845	0820	1030		
KP-39,15	PU-99,15	BP-40,30	UR-22,50	RA-54,30		
0115	0430	0115	0820	1450		
	1910	—	—		0600	
	PB-86,25	BA-79,05	UA-76,50		AD_B-33,30	
	1540	—	—		21,30	
			1000		—	
			UP-42,30		AD_T-41,20	
			0430		—	
					AB-85,15	

BA = 204, 45 (Chosen)
UA = 215, 20
RA = 220, 50

Solution for Shortest Route

3.6 *STEP* : *6*

T = 0	39,15	125,40	138,30	166,20	204,45
t_T = 1000	0115	1540	0430	0820	2245

K^x	P^x	B^x	U^x	R^x	A	D
1000	0400	0845	0820	1030	0600	
KP-39,15	PU-99,15	BP-40,30	UR-27,50	RA-54,30	AD_B-46,55	
0115	0430	0115	0820	1450	2130	
	1910	—	—		—	
	PB-86,25	BA-79,05	UA-76,50		AD_T-41,20	
	1540	—	—		—	
			1000		—	
			UP-42,30		AB-85,15	
			0430		—	

Shortest Route D_T – A – B – P – K
Tracing Backwards K – P – B – A – D_T

T = 246,05
T_T = 1605

ANNEXURE I

Oil Van Route No. 1

Route : KAN UDL IRH ASN DHN

Time : 1247 Hour 45 Minutes

Station	ARR/DEP.	Train No.	Time hrs.	Day	Cum. Time Hrs. Mins.
1	2	3	4	5	6
Working Stations :					
KAN	D	DGR Pilot	1000	1st	—
PAN	A	-do-	1245	1st	2-45
	D	IOC Pilot	0400	5th	90-00
UDL	A	-do-	1000	5th	96-00
	D	Jamuria Pt.	1230	19th	434-30
IRH	A	-do-	1700	19th	440-00
	D	Tapsi Pt.	1900	20th	465-00
UDL	A	-do-	2330	20th	469-00
	D	RNJ-Pilot	0820	25th	574-20
RNJ	A	-do-	0920	25th	575-20
	D	RNJ-Pilot	0815	28th	646-15
ASN	A	-do-	0940	28th	647-40
	D	1165 UP	0600	40th	932-00
BRR	A	-do-	0800	40th	934-00
	D	1165 UP	0840	43th	1006-40
DHN	A	-do-	1540	43th	1013-40
	D	365 DN Pgr.	0507	50th	1171-07
Return Journey :					
BWN	A	-do-	0828	50th	1174-28
	D	DGR Pilot	0845	53th	1246-45
KAN	A	-do-	0945	53th	1247-45

Now the various routes formed are merged together with the feeding groups with the help of an algorithm shown in Fig. 3.

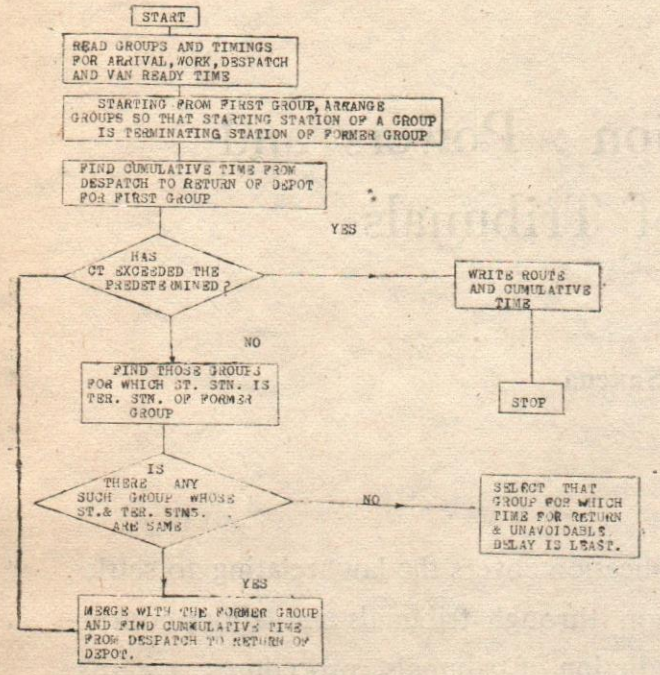

FIG. 3

ALGORITHM FOR MERGING OF ROUTES

Results

40 Groups and 129 subgroups have been formed. The delivery and travelling times have been calculated. Then the Groups have been merged to find out the routes till the arranged list of all the feasible groups exhausts. No van is allowed to remain out of depot for more than 60 days. 11 optimum routes have thus been formed. The various routes and total time taken from and to the Depot, for delivering the items to consumers along the routes, have been formed [2]. One of such routes is shown in Annexure—I.

Drawbacks and Limitations

The model is based upon the availability of trains and their timings of arrival and departure. In case some train is cancelled due to unforeseen reason or its timings are changed, the routes will be affected. Thus the route may have to be redesigned. A huge amount of computational effort is required to find out the combination of trains to reach the starting station of a group and to return from the terminal station of the group. Though the efforts are made to minimize the total time for deliveries, the routes formed may not be optimum. However, the model at present applied to the distribution of various types of oils can be extended to other items as well with certain mdifications.

REFERENCES

1. Hillier, F.S. and G.J. Lieberman, "Introduction to Operations Research", Holden-Day Inc., 1972.
2. Gupta, B.K., "Scheduling of Stores Delivery Vans in Eastern Railway", Unpublished M. Tech. Thesis submitted to Indian Institute of Technology, Delhi, June, 1978.
3. Clark, G. and J.W. Wright, "Scheduling of Vehicles from a Central Depot to a number of Delivery Points", Operations Research, Vol. 12, 1964, p. 568.

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Impact of Mixed Farming on Productivity

RACHHPAL SINGH & J.L. KAUL

An attempt has been made in this paper :

(i) *to work out the economics of different alternatives of mixed farming in Punjab Agriculture ;*

(ii) *to study the impact of mixed farming on human labour employment ; and*

(iii) *to estimate the credit needs at dlfferent levels of mixed farming on these farms.*

M/s Rachhpal Singh and J.L. Kaul are Research Associate & Associate Professor of Economics respectively at Deptt. of Economics & Sociology, P.A.U., Ludhiana.

The economy of Punjab is heavily dependent upon agriculture. Besides providing employment to about 80% of its population, it contributes more than 50 per cent towards the gross state domestic product. Thus to run the economy of state on sound lines an overall development in the field of agriculture is a must. Punjab agriculture is currently faced with a problem of adjusting to changing conditions of technology. Production practices, market demand and other factors are continually changing,

The Green Revolution

The green revolution has resulted into a sharp increase in the area under plough and production of cereals. The area under pulses, oilseeds and other crops has experienced a significant decline. Table below shows the index of production of various crops for 1978-79.

Crop	Index for 1978-79 (Triemium ending 1961-62=100)
Wheat	452.3
Paddy	1331.6
Cereals	487.9
Pulses	42.3
Oilseeds	158.2

The table provides enough evidence to suggest that the green revolution favoured the production of cereals in general and paddy-wheat combination in particular. No other crop but vegetable could compete with "paddy-wheat" rotation at current level of prices and technology. Increase in the area under vegetables will bring prices down to an unprofitable level. As a result, the Punjab farmers have specialised in "paddy-wheat" rotation.

Specialization involves a high degree of risk and uncertainty. The flow of income is also uneven. As such the need to adopt mixed farming in agriculture is necessitated for many reasons. Firstly for a smooth functioning of the farm, regular flow of income is required throughout the year. Secondly, the uncertainty attached with specialization is reduced. Thirdly, any addition in income is likely to be spent towards improving the quality of food rather than quantity. This is so because income elasticity of demand for food-grains in Punjab is very low. Consequently, the demand for milk, meat and eggs is expected to increase manifold. By introducing mixed farming we can make an effort to meet the increased demand of these product.

The degree and extent of mixed farming depends upon the financial position of the farmer, and his degree of risk aversion. It is also affected by the availability of credit facilities. The marketing becomes a major bottleneck in the adoption of poultry, dairy and vegetable farming. In view of the lack of transport, cold storage facilities and incompetetive rates of existing cold storages the situation seems to be worse. A well planned and timely action in this direction is required so that the farmers are not caught unaware.

An attempt has, therefore, been made in this paper—

(i) to work out the economics of different alternatives of mixed farming in Punjab Agriculture ;

(ii) to study the impact of mixed farming on human labour employment ; and

(iii) to estimate the credit needs at different levels of mixed farming on these farms.

Methodology

Sultanpur Lodhi Block of Kapurthala District was selected purposively for this study. In this area most of the farmers follow "paddy-wheat" rotation. This block serves as a model for typical situation, as paddy and wheat crops cover most of the area during *kharif* and *rabi* seasons, respectively. Out of total villages in the block, eight villages were randomly selected. A complete list of all operational holdings of farmers of selected villages was prepared with the help of village *patwaries* and other village leaders. The farm holdings were then arranged in ascending order of their operational size. Cumulative cube root method of stratification was used to stratify the holdings into three groups. The range of operational farm size of these groups was as follows :

Group- I	Upto 7.52 acres
Group- II	7.52 to 15.04 acres
Group-III	Above 15.04 acres.

From these groups, 150 farmers were randomly selected, fifty from each group. The average operational size of the holding was worked out to be 5.81, 11.02 and 21.65 acres for groups-I, II and III respectively (Here after called small, medium and large). The data regarding fixed farm resources, and land use capabilities for the year 1980-81 for all the 150 farm holdings was collected through a specially structured schedule.

Model Used

The profit maximizing model of linear programming as stated below was used to obtain normative plans which would maximize returns to fixed farm resources :

$$\text{Maximize : } Z = \sum_{j=1}^{n} C_j X_j \; (j = 1, 2, \ldots\ldots, n)$$

$$\text{Subject to : } \sum_{j=i}^{n} a_{ij} X_j \leqslant b_i \; (i = 1, \ldots n)$$

$$b_i \geqslant 0; \; X_j \geqslant 0 \; \forall \; j \text{ and } i$$

Where,

- a_{ij} are input-out coefficients
- C_j return over variable costs
- X_j real activities, and
- b_i resource restrictions

Constraints used

Land: Land and capital are the most limiting resources in farm production. There are certain periods in the year, when the family labour becomes inadequate to cope with the farm operations. Therefore, the supply of family labour during critical periods was also considered as restriction. Again, some land is invariably set apart by the farmers for raising fodders for meeting the requirements of livestock maintained on their farms. The requirement of land per animal for *kharif* and *rabi* fodders was restricted to 0.30 and 0.20 acres respectively and this was considered as fixed activity. Though sugarcane is a highly profitable crop, the area under this crop was restricted to 0.50, 1.00 and 1.50 acres on small, medium and large farms respectively, depending upon the limited crushing capacity at the farm as there is no sugar mill in the area.

Human labour: The human labour resource restrictions were examined by assessing the available permanent labour resource comprising of family labour and permanent hired labour on these farms. The labour required for fixed farm activities such as tending of livestock and for production of fixed farm activities was deducted from total available man hours to arrive at the net man hours available for farm operations for the important labour peak periods during an agricultural year. This was done under the assumption that each worker contributed his labour for eight hours a day.

The following peak periods were included as constraints in the analysis.

	Period	*Important operations*
1	Mid-April to end of May	Wheat harvesting and threshing, nursery raising for paddy and sugarcane hoeing
2	7th June to end of July	Maize and Arhar sowing, paddy transplanting, maize, Arhar and sugarcane hoeing
3	10th October to end of October	Maize harvesting and threshing
4	Beginning of November to end of December	Paddy harvesting and threshing, wheat sowing, Arhar harvesting
5	Beginning of January to end of January	Sugarcane crushing and wheat hoeing

The work load being lighter in remaining periods, there was no shortage of labour during this period of the year.

Capital: Capital availability is one of the major bottlenecks in Indian agriculture. Capital was, therefore, introduced as a constraint for both *kharif* and *rabi* periods separately. The existing working capital was estimated by including the capital inputs used as working expenses during both the seasons in existing plans, and was taken as capital availability for the two respective periods.

Credit requirements: Short term credit requirements were worked out by deducting the cash expenses in the optional plans from cash expenses in the existing plan. The long term credit requirements, however, depended upon the additional costs incurred on implements, buildings, etc.

Input-output Coefficients

Input-output coefficients were developed for each crop per unit of area for different enterprises under different situations. These coefficients at the improved level of technology were based on the recommendations of various subject matter specialists of Punjab Agricultural University, Ludhiana. The input-output coefficients regarding dairy, poultry and piggery were

developed with the help of respective experts. These coefficients were reduced to one year period, so that these could be compared with crop enterprises for the purpose of analysis. As labour hiring activity was introduced as a separate activity, so the co-efficients developed for various enterprises did not include the expenses on labour.

Activities Used

The activities used for the present study are mentioned as under :

Real activities : These include production activities at the sample farms and the hiring in activities for scarce resources. Individual crop was taken as a separate activity.

Labour hiring activity : It was used for peak periods as described earlier. The capital requirement for wages per unit of hired labour were taken care of. The cost of hiring labour was assumed as Rs. 1.25 per man hour.

Capital borrowing activity : The capital borrowing activities for both *kharif* and *rabi* seasons were used to supply additional capital as working expenses. Interest plus principal was charged as cost of borrowing.

Results and Discussion

Annual total labour availability on the small, medium and large farms was 517.89, 291.56 and 241.70 manhour per acre respectively. This shows that small farms are labour intensive. But the permanently hired labour on small farm was much less as compared to the medium and large farms (Table 1). Bullocks were the main source of power on small and medium farms. Even on large farms bullocks were kept as a second line of defence. The average bullock units available on small, medium and large farms were 2.00, 2.00 and 1.00 respectively. Buffalos are the most popular milch animals kept for milk consumption by the farmers.

Impact of Improved Technology on Farm Income

An analysis of the existing resource use pattern

TABLE 1

Availability of different resources, minimum and maximum constraints on different farm situations

Particulars	Small	medium	Large
Draft power (bullock units)	2.00	2.00	1.00
Crop maximum (acres)			
sugarcane	0.50	1.00	1.50
Farm size (acres)	5.81	11.02	21.65
Labour availability (Man hours)			
Family	496.19	208.62	130.53
Hired	21.70	82.94	111.17
Total	517.89	291.56	241.70
Livestock minimum (at existing prices)			
Dairy (Cross-bred cows)	3	5	10
Piggery (rows)	1	2	5
Poultry (birds)	100	100	500

in the existing plans revealed that yield level of the crops were below the potential. In order to know the extent to which the farmers were operating below potential, the existing plans with improved technology were developed. It was found that the farm incomes could be increased considerably if recommended level of fertilizers, proper time of sowing and adequate plant protection measures were adopted. The use of recommended farm practices increased the returns to fixed farms resources by 19.19, 15.96 and 11.67 per cent over the existing farm situation on small, medium and large, farms respectively (Table 2). The analysis indicated that small farmers had a fairly good scope for increasing farm income and productivity by adopting improved technology compared to medium and large farmers.

Impact of Mixed Farming on Farm Income

At the existing level of prices the cropping pattern of the farm did not change. This indicated that the "paddy-wheat" rotation was most paying at the existing level of technology, except for sugarcane, which can not be cultivated commercially.

With milk sale price at Rs. 1.60 per litre, dairy

TABLE 2

Per acre return to fixed farm resources on small, medium and large farms, Sultanpur Lodhi (Kapurthala) (Rupees)

Plan	Small	Medium	Large
1. Existing plan	2586.95	2915.00	3044.36
2. Existing plan with improved technology	3083.53 (19.19)	3380.37 (15.96)	3399.92 (11.67)
3. Existing plan with improved technology and 0.50 acres of sugarcane	3430.94 (32.62)	3692.74 (26.68)	3568.08 (17.20)
4. Optimal plan with dairy milk @ Rs. 2.20 per litre	3447.10 (33.24)	3708.76 (27.23)	—
5. Optimal plan with dairy milk @ Rs. 2.40 per litre	4568.84 (76.61)	4913.13 (68.54)	—
6. Optimal plan with dairy milk @ Rs. 2.60 per litre with minimum restrictions	5807.45 (124.49)	6544.65 (124.51)	6399.69 (110.21)
7. Dairy (3,5, and 10 cows) on S. M. and L. farm	2566.84 (−0.77)	2846.14 (−2.36)	2716.00 (−10.78)
8. Poultry (100,200 and 500 evids on S.,M., and L. farm)	2566.88 (−0.77)	2751.13 (−5.62)	2386.76 (−21.60)
9. Piggery (1,2, and 5 sous. on S.M. and L. farm)	2736.45 (5.77)	2425.43 (−16.79)	2703.18 (−11.20)

Figures in the parentheses indicate the percentage increase over the existing plan.

enterprise did not enter the optimal plan in any of the three farm situations. The price variable programming was adopted to find a price at which the dairy would find a place in the cropping pattern. It was only at the milk sale price at Rs. 2.20 per litre that three dairy cows entered on each of the small, medium and large farms respectively. The net farm income per acre increased by 33.24 and 27.23 per cent in the respective situation. With a further increase in the sale price of milk to Rs. 2.40 and Rs. 2.60 per litre, 12 cows entered the optimal plan of small farms. The increase experienced in net farm income was 76.61 and 124.49 per cent for the respective prices. Twenty-nine dairy cows entered the optimal plan of medium farms for the milk prices mentioned earlier. The increase in net farm income was calculated at 68.54 and 124.51 per cent. The number of dairy animals on the small and medium farms did not change with change in prices from Rs. 2.40 to Rs. 2.60 per litre because land acted as a constraint, since whole of the available area in kharif season came under fodders. One of the peculiar features of the study was that even at milk sale price of Rs. 2.40 per litre dairy enterprise did not find a place in the optimal plans of large farms. This can be explained from the fact that the large farmers were at a higher place on the production curve and even at a higher price of milk, dairy did not favour their plans. But when the sale price of milk was increased to Rs. 2.60 per litre, 58 dairy heads entered the optional plan increasing the net farm income by 110.02 per cent (Table 2).

Piggery and poultry enterprise were also included in the programme matrix as activities. But even a large increase in the prices of their products could not make them enter the optimal plans of the farmers.

The above explanation clearly suggests that apart from increasing the prices of these products a lot needs to be done to increase the productivity of these products so that they can find a place in the farm plans.

Impact on Working Capital and Credit Requirements

There is a marked increase in working capital as well as credit requirements when improved level of technology and livestock entered the optimal plans of all the categories of the farms. A perusal of Table 3 and 4 together shows that per acre working capital requirements increased by 8.97, 13.69 and 17.60 per cent over the existing plan on small, medium and large farms respectively when improved technology was introduced. The per acre short term credit requirements associated with this situation were Rs. 161.41, Rs. 284.96 and Rs. 354.58. The entry of 0.5, 1.00 and 1.5 acres of sugarcane increased the per acre working capital by 14.14, 17.75 and 17.87 per cent on the above mentioned situations. The short term credit requirements associated with this were calculated at Rs. 254.49, Rs. 347.82 and Rs. 423.36 respectively. The working capital as well as credit requirements increased when the dairy enterprise entered the optimal plans as a result of increase in sale price of milk. Table shows that when piggery

TABLE 3

Per acre working capital requirements on small, medium and large farms, Sultanpur Lodhi (Kapurthala) (Rupees)

	Small	Medium	Large
1. Existing plan	1799.34	1958.91	2010.36
2. Existing plan with improved technology	1960.75 (8.97)	2227.25 (13.69)	2364.95 (17.63)
3. Existing plan with improved technology and 0.50, 1.00 and 1.50 acres of sugarcane on small, medium and large farm repectively	2053.94 (14.14)	2306.78 (17.75)	2369.79 (17.87)
4. Optimal plan with dairy milk @ Rs. 2.20 per litre	3324.63 (84.76)	2510.32 (28.14)	—
5. Optimal plan with dairy milk @ Rs. 2.40 per litre	7385.38 (310.44)	9068.04 (362.91)	—
6. Optimal plan with dairy milk @ Rs. 2.60 per litre	7385.38 (310.44)	10432.05 (432.54)	9312.87 (363.24)
With minimum constraints			
7. Dairy (3, 5, and 10 cross-breed cows on small, medium and large farms respectively)	3373.70 (87.49)	3441.89 (75.70)	3538.18 (75.79)
8. Poultry (100, 200 and 500 birds on small, medium and large farms)	3125.13 (73.68)	3419.68 (74.57)	3788.34 (88.44)
9. Piggery (1,2, and 5 sous on small, medium and large farms)	3949.90 (119.51)	3737.80 (90.81)	3579.58 (78.05)

Figures in the parentheses indicate the percentage increase in working capital requirements.

and poultry entered the plans by setting minimum restrictions, the working capital and credit requirements on all the farm situations increased sharply. This shows that livestock is highly capital intensive and requires outside source of finance.

Impact of Mixed Farming on Employment

One of the objectives of the study was to examine the impact of various levels of mixed farming on labour use on different farm situations. This aspect of the study is analysed and is presented in Table 5. An addition of 0.50, 1.00 and 1.50 acres of sugarcane increased the per acre labour use by 4.50, 20.37 and 24.73 per cent on small, medium and large farms respectively. The labour use went up by 23.33 and 31.52 per cent on small and medium farms when 3 dairy cows entered the optimal plan as a result of sale price increase of milk to Rs. 2.20 per litre. When the price of milk was further raised beyond Rs. 2.40 per litre, the number of dairy animals on

TABLE 4

Credit requirements per acre on small, medium and large farms, Sultanpur Lodhi (Kapurthala) (Rupees)

	Small	Medium	Large
1. Existing plan	—	—	—
2. Existing plan with improved technology	161.41	284.96	354.58
3. Existing plan with improved technology and sugarcane (0.50, 1.00 and 1.50 acres on small, medium and large farms)	254.49	347.82	423.36
4. Optimal plan with dairy milk @ Rs. 2.20 per litre	1539.66 (420.82)	549.80 (221.80)	—
5. Optimal plan with dairy milk @ Rs. 2.40 per litre	5556.86 (1680.30)	7083.74 (2144.73)	—
6. Optimal plan with dairy milk @ Rs. 2.60 per litre	5556.86 (1680.30)	7083.84 (2144.73)	7276.35 (2183.37)
With minimum restrictions			
7. Dairy (3,5,10 cows on small, medium and large farms respectively)	1574.35 (420.82)	1482.93 (369.70)	1527.81 (376.44)
8. Poultry (100, 200 and 500 birds on small, medium and large farms respectively)	1325.63 (1035.75)	1460.70 (1110.07)	1777.97 (1412.50)
9. Piggery (1, 2, and 5 sous on small medium & large farms respectively)	1164.45 (464.71)	17778.83 (490.01)	1569.22 (623.55)

Figures in the brackets represent long run credit and without brackets represent short term credit requirements.

TABLE 5

Per acre labour use on small, medium and large farms, Sultanpur Lodhi (Kapurthala), Man-hours

	Small	Medium	Large
1. Existing plan	423.30	354.80	355.69
2. Existing plan with improved technology	423.20	354.80	355.69
3. Existing plan improved (with 0.50, 1.00 and 1.50 acres of sugarcane on small, medium and large farms)	442.24 (4.50)	427.08 (20.37)	443.67 (24.73)
4. Optimal plan with milk @ Rs. 2.20 per litre	591.92 (23.33)	466.62 (31.52)	—
5. Optimal plan with milk @ Rs. 2.40 per litre	790.30 (86.74)	994.16 (180.20)	—
6. Optimal plan with milk @ Rs. 2.60 per litre	790.30 (56.74)	994.16 (180.20)	241.71 (4.88)
With minimum restrictions			
7. Dairy (3, 5, 10 cows on small, medium and large farms)	526.66 (24.45)	518.50 (46.14)	231.58 (7.19)
8. Poultry (100, 200 and 500 birds on small, medium and large farm)	450.48 (6.45)	465.31 (31.15)	231.58 (7.19)
9. Piggery (1. 2, and 5 sous on small, medium and large farms)	439.75 (3.91)	447.67 (26.17)	218.00 (0.91)

Figures in parentheses indicate percentage increase in labour requirement over existing plan.

the small and medium farms remained at 12 and 29 heads for the respective situations. The increase in labour employment experienced was 86.74 and 180.20 per cent respectively. When sale price of milk was raised to Rs. 2.60, 50 dairy cows entered the optimal plan of the large farms. The labour use went up by 183.27 per cent as a result of inclusion of livestock.

Further Dairy cows, poultry and piggery were included in the plan by setting up minimum constraints at the existing level of prices (Table 5). It was observed that labour use went up on all the three farm situations for all the livestock enterprises. This was a clear indication that livestock can provide gainful employment, provided it finds a place in the production plan of the farmer.

Conclusion

At present one is caught in peculiar situation. On the one hand large quantities of foodgrains are imported to meet the home demand. On the other hand the consumption of milk and milk products, meat and vegetables by an average Indian is far below the requirement. This necessitates that along with foodgrains production, the production of milk and milk products, meat, vegetables and fruits should be stepped up. This testifies the urgency in adoption of mixed farming. Because of limited scope of increasing area under the plough, the only alternative left is by increasing the yield potentials of all the agricultural enterprises.

There is much scope for increasing the farm productivity and income when improved technology is adopted by the farmers. The working capital increased significantly when livestock entered the optimal plans of the farms. The mixed farming can also increase the labour employment on all the farms. However, large amount of credit is required for the adoption of mixed farming. It can be concluded that at the existing level of prices and technology the adoption of livestock on the farms is not economic. Similar studies should be carried out in other parts of the state from time to time so as to help the farmers, financial institutions and policy makers.

REFERENCES

1. Dhawan, K.C. and S.S. Johl, 1968. An economic analysis of diary enterprise vis-a-vis crop cultivation in Punjab—A case study—Indian Jour. Agril. Econ. XXIV (i) : 53-72.
2. Dhawan, K.C. and A.S Kahlon, 1974. Diversification of Punjab Agriculture, Jour. Res. PAU, XI (3) : 304-13.
3. Fukazawa, H. 1974, Proc. of a Symp. on "Diversification and development of agriculture with special reference to Asian developing nations" held on 16th to 18th January, 1974 at Tokyo.
4. Garg, J.S. and S.S. Bisla, 1961. Economics of mixed farming in India. Indian Jour. Agril Econ., XVI (2): 171-74.

5. Johl, S.S., A.S. Kahlon and K.C. Dhawan, 1965. Economics of dairy buffaloes in sub-urban area of Punjab—A case study. Jour. Res. PAU, II (3) : 231-37.

6. Randhawa, M.S. 1971. Fifth All India Oilseed Workshop held on 5th April, 1971 at PAU, Ludhiana.

7. Raut, K.C. and K.K. Chugh, 1971. Productivity of different systems of farming. Indian Dairyman, XX (20): 37-39.

8. Singh, H.S. 1961, Economics of mixed farming in western U.P. and Punjab regions. Indian Jour. Agril. Econ. XVI (2): 122-31.

9. Singh, Karam and P.S. Sidhu, 1979. Analysis of impact of diversification on productivity, income and employment on different category of farms in Punjab. Financing Agriculture, XI (1): 40-47.

10. Statistical Abstract of Punjab, Economic and Statistical Advisor to Govt. of Punjab, Economic and Statistical Publication, 1979-80.

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EXECUTIVE READINGS

Small Farmers Development Programme

S.M. Pandey

J.S. Sodhi

Shri Ram Centre for Industrial Relations and Human Resources New Delhi, 1981

Reviewed by

B.K. Arora

Dy. Director, National Productivity Council

The study carried out by Shri Ram Centre for Industrial Relations and Human Resources is an economic analysis of the Small Farmers' Development Programme in Budaun, Fatehpur and Rae Bareli districts of Uttar Pradesh. It examines the pattern of assistances utilisation by the participants of the scheme and its impact upon their economic status. The authors have made a comparative analysis of the participants and non-participants in terms of income, employment, expenditure pattern and debt position. The study has also highlighted the deficiencies in the working of the programme.

The observations made by the authors are pertinent to any rural development programme. The practices of setting high targets without ensuring infrastructure and funds, evaluation of the programme on the basis of fund utilisation rather than physical achievements, modifications in the activities and targets to match the achievements are some of the usual facets of these programmes. The book also highlights the field level problems and malpractices that engulf these programmes. The vested interests, lack of motivation for field staff, lack of facilities and proper guidelines, inadequate training, all combine to dilute the spirit of the programme.

But whatever may be the bottlenecks, the study signifies the change that has taken place among the weaker sections of the rural people. The participants of the programme were found to be economically better than the non-participants.

The authors have also made suggestions for improving the implementation of the Small Farmers Development Programme. Although, the programme is no more in existence, the suggestions made are equally true for the implementation of Integrated Rural Development Programme. Significant policy decisions and guidelines can be framed on the basis of the observations made by the authors.

Besides all above, the book provides a simple and interesting reading for all.

Emerging Profile of Finance Function

The Nature and Scope of the Finance Function—Past, Present and Future

G. Murthy

Published by : Lalalajpatrai Research Centre
Price : Not mentioned
PP : 29

Reviewed by: Dr. Badar Alam Iqbal, Lecturer, Faculty of Commerce, A.M.U., Aligarh

It has been rightly said by an eminent classical economist that 'finance is the oil of the wheels, the

marrow of the bones, the blood in the veins and spirit of all trade, commerce and industry'. As a result, finance function has become a vital aspect of modern management and the success of an enterprise depends upon the efficiency with which the funds are managed. Although funds management is the joint responsibility of all the business managers, the financial manager has to play a cardinal role in performing the most difficult tasks of modern management in effective and efficient manner.

The present small monograph captioned 'The Nature and Scope of the Finance Function' is a comprehensive and analytical study providing a systematic and balanced treatment of theory and practice. The monograph takes off, from historical perspective of the subject and goes ahead with the discussion on past, present and future roles of finance manager in a business organisation.

At the very out set, the author has rightly opined that 'a redeeming feature of the 20th century corporate scene is the emergence of financial management, as a distinct discipline at the level of the individual enterprise. In the past, financial management of business was considered as a part of the wider discipline of the economics. As a result, it was very difficult to identify an independent function of and scope for finance in business'. But with passage of time this notion has gone a radical change and became one of the most important tasks of modern management.

After highlighting the functions of the finance manager in the past (traditional functions) and the present (managerial functions), the author goes further and points out the emerging profile of the finance manager. According to him, the changing functions of the finance manager, in the past, have been influenced by the pressures of the external environment like past of technological advancement, squeeze on profits margins, greater opportunities for enterpreneurial activities and the growing size of the modern corporations. Therefore, there has been a shift of emphasis in the finance function which in turn has contributed to a change in the role of the finance manager. The discussion on the emerging role of finance manager is worth reading and provides a basis for further research.

The monograph is written in simple and lucid style, avoids unnecessary mathematics. It is a welcome addition to the existing literature and will provide a deep insight to all those who are concerned with the subject.

Promod K. Batra

Think . . .

There must be a better way

Pub. by : Promod K. Batra

C-28, Nizammuddin West, New Delhi-110 013 India

Ed : August, 1982

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Reviewed by : Shri M.S. Rao
NAVS & SIGS School, Begumpet
Secunderabad

"Thinking is the hardest work that is, which is the probable reason, why so few engage in it".—Henry Ford. This is an action research report, that focusses on the thinking that is needed, for office-cost reduction and paper work simplification.

Batra is right, when he says 'Ideas are rupee a dozen.' "And therefore while flipping the pages of this report, you may feel that some of the ideas are very ordinary—what we may at times call common sense," Just the same, Batra deserves to be congratulated for he has taken care to compile several ideas together and who knows what good effects this book might have in the various offices, this book reaches."

The most important thing about this book is that it is inspiring. It is bound to generate ideas. The book, in eighteen chapters discusses, as to how to do a job in a better way—the Miser way *M* erge it with other works, *I* mprove it, *S* implify it, *E* liminate it and *R* educe it., whether it be concerned with the Mail room, correspondence, Telephone, Telex, records management, business and government forms, stationary, accounting, insurance claims, stores, packing, order processing or any office pracedure. Some ideas, that the book mentions—

—prepunching of forms at the printing stage itself,

--pre addressed envelopes,

—depending upon the value, bill rounded off to nearest Rs. 10/- or Rs. 100/- to facilitate cash handling,

—packing charges not based on packing case size, but charged as a percentage of value of goods,

—elimination of mail receipt and despatch registers. The franking machine becomes a record of monies spent on mailing,

—reduction of typing strokes—side address consists of name and station only. Rs. 25000/- only is written as Rs. 25,000 and so on (window envelopes eliminate typing address on envelope, Mr. Batra !)

Mr. Batra is very right when he says "Germination takes place when the earth is loose enough and there is moisture and the right temperature. An idea is like a seed. Once you have prepared your field and the seed is planted, you are on the track to increased productivity. This write up, is to help prepare the "field'."

Illustrations by Roma Chakravarthy make the reading attractive and easy. A must for all executives. More so in government organisations This can certainly enhance our national productivity.

Industrial Organisation & Management

Awate D.G. Chunawala S.A.
Patel D.R. Bhandarkar B.G.

Vrinda Publications, 1982
Jalgaon
pp : 451
Rs. 40

Reviewed by :
Dr. (Ms.) Mani K. Madala
Dy. Director, National Productivity Council

Study of industrial organisation and its various facets is an imperative for anyone who enters industry, be it a person from engineering, costing, management or commerce. The present book is an attempt to facilitate such study. Planned in four parts, the book covers a wide ground, starting from how to start an enterprise to how to keep the people in the organisation motivated. The first part deals with nature and forms of business, building of a factory and the plant lay out of a factory. The second part titled as production and materials management presents an elementary treatment of manucturing process, production planning and control and maintenance of the plant and also a comprehensive treatment of marketing management, product promotion, methods of distribution, advertising, sales promotion, management of salesmen and market research in that order. One wonders what is the logic of that order.

The third part is devoted to human resource management. It is a fairly comprehensive treatment and also includes a brief note on legislative framework, focussing on important Acts, with their latest amendments.

While the whole book is fairly unorganised, the fourth part presening the various management techniques is most stunningly unorganised. Performance appraisal preceeds job analysis, Linear programming (p. 129-136) is followed by Break even analysis, EDP etc. then by queing theory (p.247-252) and then followed by capital budgeting, SQC, Industrial productivity (Is productivity a technique ?) which in turn is followed by assignment movement (p. 289-297). There is tremendous scope for improvement organisation. While the material by itself was well prepared, with illustrations, the presentation leave smuch to be desired. Typographical errors are one too many. In a book meant for students, care about the language is a must. (e.g. complexibilities p. 23 manyfold p. 37). There is a lot of mispaging. Quality of paper needs improvement. Fairly priced.

Form IV

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A. AIR POLLUTION

Aggarwal, R K & Lahiri, A N : Evaluation of environmental pollution from Ionic Composition of raw-material received over Rajasthan. *Development Policy and Administration Review*, 5 (1-2), Jan-Dec. 1979, 1-10 pp.

Arceivala, S L I : Industrial air pollution control strategies. *Commerce* (Suppl.), 145 (3708), 3 July 1982, XIII-XV. pp.

Ashar, N G : Air pollution control practices. *Commerce* (Suppl.), 141 (3611), 6 Sept., 1980, 17-18 pp.

Bhargava, Akshay & Maheswari, Ashok : Air Pollution : Its historical perspective, *Civic Affairs*. (Annual Number), 28 (1), Aug. 1980, 115-21 pp.

Bhatnagar, V S : The national needs for air pollution monitoring instruments and their production. *Electronics Information & Planning*, 9 (7), 1981-82, 358-62 pp.

Bower, B T & Others : Benefit-cost analysis in air quality management : the case for less developed countries. *Journal of Environmental Management*, 14 (3), 1982, 265-82 pp.

Dwivedi, R C : Air pollution : causes, consquences and control. *Civic Affairs*, 28 (11), June 1981, 93-107 pp.

Fisher, Anthony, C : Economic Efficiency and air-pollution control. East West Environment and Policy Institute, East West Centre Hawaii, 1981, pp. 74.

Gajendragadkar, S K : Effect of air pollution on monuments. *Quality Journal of the Local Self Government Institute*, 52 (2), October-December 1981, pp. 125-28.

Giplin, Allan & Hartmann, Hanns : Air pollution and energy in Australia : Economic and Policy Implications. East West Environment and Policy Institute, East West Centre, Hawaii, 1981, pp. 89.

Goetze, D : The shaping of environmental attitudes in air pollution control agencies *Public Administration Reviews*, 41 (4), 1981, pp.423-30.

Gorham, E : What to do about acid rain, *Technology Review*, 86 (7), 1982, pp. 59-70.

Guha, A : Low cost equipment for air pollution control. *Commerce* (*Suppl.*), 143 (3670). 17 Oct. 1981, pp. 13-17.

Hashimoto, A & Kimura, Y : Determining the optimal scheme of zoned efficient changes for the control of Air-pollution. *Socio-Economic Planning Sciences*, 14 (5), 1980, pp. 197-208.

Jhala, H I : Air pollution : editorial. *Journal of the Gujarat Research Society*, 41 (2), Aug. 1979. pp, 1-2.

Joshi, J A : Motor vehicle air pollution. *Civic Affairs*, 29 (11), June, 1982, pp. 103-107.

Kanan, V & Natarajan, R: Air pollution : Technologies to choose from. *Commerce* (Suppl.), 145 (3708), 3 July 1982, pp. X-XIII.

Linier, S H & Suchandek : A second best mechanism for marketing emissions reductions, *Policy Sciences*, 13 (2), 1981, pp. 195-203.

Magcgill, S M : Liquified energy gases in the U K : what price public safety ? *Environment & Planning*, 13 (3), 1981, pp. 339-54.

Madden, R A & Ramanathan, V : Detecting climate change due to increasing cardon-di-oxide. *Science*, 209 (4452), 1980, pp. 763-68.

Marshall. E : Air Pollution clouds U S—Canadian relations. *Science*, 217 (4565), 1982, pp. 1118-19.

Mathur, M L & Agarwal, P C : Airpollutiom, causes, sources and effects on human health. *Invention Intelligence*, 16 (11), 1981, pp. 482-86.

Mishra, Ranganath : Air Pollution, *Rural India*, 43 (12), Dec. 1980, pp. 262-65.

Perl, L J & Dunbar, F C : Cost effectiveness and cost benefit analysis of air quality regulations. *American Economic Review*, 72 (2), 1982, pp. 208-13.

Shah, Ashok J : Present status of air pollution in Gujarat. *Civic Affairs*, 29(5) December 1981, 9-16 pp.

Shirokar, V B : Air pollution in Chembur-Trombay region. *Bombay Civic Journal*, 26(9), Nov. 1979, pp. 19-24.

Shirvikar, V V : Air pollution control : Role of industry. *Commerce* (Suppl.) 143(3670), 17 Oct. 1981. pp. 1-3.

Tayal, S C : Air pollution : causes & consequences. *Civic Affairs* (Annual-Number), 1981, pp. 113-19.

Thala, H I : Air pollution : editional. *Journal of the Gujarat Research Society*, 41(2), Aug. 1979. pp. 1-1.

—— : Air pollution survey in Maharashtra. *Economic Times*, 26 May, 1980, 5 : 7-8.

——: The Air (Prevention and control of pollution) act, 1981. *Indian Journal of International Law*, 21(4), October-December 1981, pp. 615-41.

B. ENVIRONMENT

Bhattacharya, P : Protection of environment—the Soviet experience. *Science and Culture*, 47(b), 1981, pp. 196-200.

Biswas, D K : Environmental assessment of hydel power projects. *Bhagirath*, 27(4) 1980, pp. 155-58.

Biswas, M R & Biswas, A K : Environment and sustained development in the Third World ; a review of the past decade. *Third World Quartenly*., 4(3), 1982, pp. 479-91

Bodily, S E & Gable, H L : A new job for business men : managing the company's enviromental resource. *Sloan Management Review*, 23(4), 1982, pp. 3-18.

Bowonder, B : Environmental risk assessment issues in the third World. *Technological Forecasting & Social Change*, 19(1), 1981, pp. 99-127.

Carpenter, Richard A : Balancing economic and environmentnl objectives : The question is still, how ? *Environmental Impact Assessment Review*, 2(2), June, 1981, pp. 175-188.

Carpenter, Richard A, : Using ecological knowledge for development planning. *Environmenial Management*, 4(1), 1980, pp. 13-20.

Chakravarty, Abhijit : Environmental hazards in Hoongly estuary, *Capital*, 187(4671), 24 Aug. 1981, p. 3.

Chakravarty, M M : Impact of chemical industry on environment. *Science and Culture*, 47(2), 1981, pp. 50-54.

Elington, J : The environmental pressure. *Management To-day*, January 1980, pp. 62-65.

Hetzel, N K : Environmental co-operation among industralized countries. *Mazingira*, 7(1), 1983, pp. 38-47.

Hufschmidt, Maynard M & Hyman, Eric L, : Economic approaches to natural resource and environmental & quality analysis. Tyecoly International Publishing Ltd., Dublin, 1982.

Hufschmidt, Maynard M Etc. : Environment, natural systems and development : An economic valuation guide. The John Hopkins University Press, 1983.

Kaushik, Azad K : Healthy environment for a brighter tomorrow. *Haryana Review*, 14(12). Jan.-Feb, 1981, pp. 21-22.

Keshwani, G H : Man & his environment : All is contained in each. *The Times of India*, 5 June 1980, 6: p. 3-5.

Koren V, Leonaid : Ecological situation in the Soviet Union. *Bombay Civic Jonrnal*, 27(4), June 1980, pp. 13-14.

Kothari, Rajni : Environmental and alternative development. *Alternatives* January 1980, pp. 427-76.

Kushivir, T : Skylab effect—psychological reactions to a human-mad environment hazard. *Environment & Behaviour*, 14(1), 1982, pp. 84-93.

Lalvani, G H : Environmental goals. *Economic Times* (Suppl.), 5 June 1982, 11 : p. 1-4.

Lewis, T : Energy vs. Environment. *Journal of Environmental Economics and Management*, 8(1), 1981 pp. 59-71.

Lincoln, D R & Rubin E S : Cross media environmental impacts of coal fired power plants—an approach using multi-attribute utility theory. *IEEE Transactions on Systems, Man & Cybernatics*. 9(5), 1979, pp. 285-89.

M A, Laurence J C & Noble, A G : Environment : Chinese and American views : methnen, 1981.

Madeley, J : Tobacco : a nuisance in every respect ? *Mazingira*, 7(1), 1983, pp. 58-67.

Malhan, P N : Media and environment. *Vidura*, 19(3), June 1982, pp. 133-35.

Masih, S : Review of researches environmental education. *Quest in education*, 19(3), 1982, pp. 238-45.

Mathew, Thomas, : Gross roots environment. *Vidura*, 19(3), 1982, pp. 145-46.

Matthews, William H : Moving beyond the environmental rhetone, *Mazingira*, 4(2), 1980, pp. 6-15.

Nemetz, P N & Others : Toxic Chemical regulation in Canada : Preliminary : estimates of costs and benefits. *Canadian Public Administration*, 25(3), 1982 pp. 405-19.

Nigam, Raghuvir Sahay : Environment and health. Education Review, 86(10), Oct.. 1980, pp. 190-93.

Nigam, Raghuvir Sahay : Environmental education, *Indian Review*, 75(5), August 1979, pp. 25-27.

Nimtz, G : Environmental influences of microwares on human beings ? *Results of Biological Research, Universities*, 22(4), 1980, pp. 315-18.

Pal, S P & Roy, C R : Environmental implications and economic evaluation of large scale irrigation projects—some methodological issues, *Margin*, 14(4), 1982, pp. 29-40.

Pearce, F : Menace of acid rain. *New Scientists*, 95(1318), 1982, pp. 419-24.

Prabha A & Others : Growth and environment. *Economic Times*, 28 March 1981, pp. XI-XIII.

Prabha, Arun : Projects and environment. *Economic Times* (Suppl.), 28 March, 1981, p. 1 : 1-5.

Rama : The environmental band-wagon. *Economic Times*, 25th July 1982, pp. 4 : 1-8.

Seth, S C : Society and environment. *Southern Economists*, 20(8), 15 Aug. 1981, pp. 23-24.

Seth, S C : Society and environment tomorrows needs. *Assam Information*, 33, Aug. 1981, pp. 33-36.

Sharma, Ravi : Environment : of green picture in Asia. *Indian Express*, 18 June, 1982, p. 6.

Singh, B K : Environment, man & society, *Yojna*, September, 1982, pp. 19-32.

Subrahmanyan, KV: The ecology-environment dilemma, *Financial Fxpress*, 25 March, 1982, p. 6.

Sundaresan, B B & Subramaniyam, P V R : Indian scenario of hazardons wastes. *Yojana*, 27(10), 1983-84, pp. 4-6.

Suri, Surinder : India must develop own ecology. *Times of India*, 8 Oct. 1981, pp. 8 : 7-8.

Szekely, F : The chemical industry and its impact on the Latin American environment. *Mazingira*, 7(1), 1983, pp. 26-37.

Szekely, F : Environmental impact of large hydro-electric projects on tropical countries. *Water Supply & Management*, 6(3), 1982, pp. 233-42.

Vijayaraghavan, R : Traffic and the environment. *Indian High Ways*, 9(8), August, 1981, pp. 16-22.

Vohra, B B : Environment for Survival. *Eastern Economist*, 13th June 1982, pp. 13-23.

——A clean view of populated world. *Times of India*, 6 June 1980, pp. 3 : 2-5.

——Deteriorating environment. *Times of India*, 19 November 1979, pp. 8 : 1-2.

—— : Guarding the environment. *Financial Express*, 9 February, 1982, 4 p.

—— : Has environmentalism been worth it ? *Design*, 23 (7), July, 1979 24-28. ; 23 (6). Aug. 1979, pp. 27-29.

——Man in environment. *Vidura*, 19(3), June, 1982, p. 131.

—— : The state of our environment in the 1970's *Civtc Affairs* (Annual number), 28(1), Aug. 1980, pp. 105-13.

C. ENVIRONMENTAL MANAGEMENT

Bowonder, B : Management of urban environment in India. *Journal of Environmental System*, 12 (3), 1982-83, pp. 199-217.

Chandrashekara, CS : Environmental priorities in human settlements. *Urban India*, 1(2), December 1981, pp. 15-18.

Forster, BA : Separability, functional structure and aggregation for a class of models in environmental economics. *Journal of Environmental Economics & Management*, 8(2), 1981. pp. 118-33.

Hollick, M : Environmental impact assessment is a planning tool. *Journal of Environmental Management*, 12(1), 1981, pp. 79-90.

Hollick, M : Role of quantitative decision making methods in environmental impact assessment. *Journal of Environmental Management*, 12(1), 1981, pp. 65-78.

Johnston, Douglas M : Environmental Management in the South China Sea : Legal and Institutional Developments. East-West Environment and Policy Institute, East-West Centre, Hawaii, 1982, p. 114.

Lewis, TR : Markets and environmental management with a storable pollutant. *Journal of Environmental Economics and Management*, 8(1), 1981, pp. 11-18.

Lorrain, Smith R : The nature of environmental manament. *Journal of Environmental Management*, 14(3), 1982, pp. 229-36.

Matthews, William H : Criteria for selecting appropriate methods for environmental assessment, *Journal of the Japan Society of Air Pollution*, 15(1), 1980, pp. 9-12.

Nair, NP : The emerging dimensions of environmental management (editional). *Indian Manager*, 11(2), 1980, pp. 101-105.

Hichols, Robert & Haymon, ERIC : Evaluation of Environmental assessments methods. *Journal of the Water Resources Planning and Management Division*, 108 (WRI), March 1982, pp. 87-105.

Nigam, Raghuvir Sahay : Environmental education. *Indian Review*, 75(5), August 1979, pp. 25-27.

Singh, B : Environmental education. *Education Quarterly*, 34(3), 1982, pp. 9-11.

Singh, D : Chemical industries : environmental management. *Economic Times*, 5 June, 1982, p. 7 : 1-8.

Singh, Digvijay : Need for an environment department. *Yojana*, 24(21), 16 Nov. 1980, pp. 11-12.

Singh, Duleep : Chemical industries : Environmental management. *Economic Times* (Suppl), 5 June, 1982, p. 11 : 5-8.

Singh, Sampat P : Environmental analysis for long-range planing. *Prajnam*, 11(2), April-June 1982, pp. 101-15.

Samil V : Ecological mismanagement in China. *Bulletin of the Atomic Scientists*, 38(8), 1982, pp. 18-23.

Talbot, JJ : Bio-ecological basis of environmental management. *Impact of Science of Society*, 30(4), 1980, pp. 261-68.

Vimal, OP : Environmental education : scope & problems. *Financial Express*, 4 April, 1982, p. 6 : 1-8 & also 10 April 1982, p. 4 : 1-8.

Wang, LK & Wang, MH : Predicting the dispersion of airborne effluents for environmental management. *Journal of Environmental Management*, 12(3), 1981, pp. 247-70.

D. ENVIRONMENTAL PROBLEMS POLICY

Anderson, Federick R : Environment improvement through economic incentive. Bathmove, John Hopkins University Press, 1977.

Bailey, MJ : Risks, costs and benefits of flucrocarbon regulation. *American Economic Review*, 72(2), 1982, pp. 247-50.

Barkley, DL & Cory, DC : On the superiority of liability rules in environmental legislation. *Journal of Environmental Systems*, 12(3). 1982-83, pp. 185-98.

Bhargava, G : Environmental pollution and law. *Economic Times*, 5 June, 1982, p. 7.

Chaudhuri, BD Nag : An environmental view of development. *Man and development*, 2(4), Dec. 1980. pp. 89-92.

Christainsen, GB & Haveman, RH : Contribution of environmental regulations to the Slow down in productivity growth. *Journal of Environmental Economics & Management*, 8(4), 1981, pp. 381-90.

Clingan, TA : Environmental problems and the new order of the Oceans. *Columbia Journal of World Business*, 15(4), 1980, pp. 45-51.

Daneke, GA : The future of environmental protection : reflections on the difference between planning and regulating. *Public Administration Review*, 42(3), 1982, pp. 227-33.

Day, RA : New directions in Australian environmental planning : some pointer from the UK structure planning experience. *Australian Journal of Public Administration*. 40(4), 1981, pp. 281-92.

Delton, DE Silva : Tackling environmental problems. *Commerce*, 142 (3641), 28 March, 1981, pp. 673-74.

Deoras, PJ : Environmental problems in India, *Economic Times*, 5 June, 1982, p. 5.

Downing, PB : Political economy model of implementing pollution law. *Journal of Environmental Economics & Management*, 8(3), 1981, pp. 225-71.

Ghiselin, J : Reaching environmental decisions : makind subjective and objective judgements. *Environmental Management*, 6(2), 1981, pp. 103-108.

Hafkamp, W & Nijkamp, multiobjective modelling for economic environmental policies. *Environment & Management*, 13,(1) 1981, pp. 7-18.

Hahn, RW : On the applicability of market solutions to environmental problems. *Journal of Environmentals Managemeni*, 14(2), 1982, pp. 161-71.

Holiday, John C : Design for environment : Social Change and the need for new approach in planning. Charles Knight, 1977.

Hornberger, GM & Spear, RC : In approach to the preliminary analysis of environmental systems. *Journal of Environmental Management*, 12(1), 1981, pp. 7-18.

Ichiro, Kota & Others Ed. : Environmental Law and Policy in the Pacific Basin Area. University of Tokyo Press, Tokyo, 1981 pp. 229.

John, TE Gilbert : Environmental planning guidlines for off shore oil and gas development. University Press of Hawaii, Honolnlue, 1982, pp. 64.

Karan, Pradyumna Prasad : Public awareness of environmental problems in Calcutta Metropolitan area. *National Geographical Journal of India*, 26(1-2), March 1980, pp. 29-34.

Krishnamurthy, CR : Environmental health plan for developing Society. *Mainstream* (Annual Number), 19(1-5), 1980, pp. 77-80).

Krishnamurthy, CR. R & D Challenges of environment management. *Mainstream* (Annual Number), 20(1-5). 1981, pp. 135-39.

Krishnaswamy, S : Environmental problems in rural India. *Madras Institute of Development Studies Bulletin*, 10(12), 1980, pp. 5122-26.

Lowe, J & Lewis, D : Energy usage and the economics of environmental control. *Energy Policy*, 9(1), 1981, pp. 25-31.

Maggiotto, MA & Browman, A : Policy orientations and environmental regulations a case study of Florida's Legislators. *Environment and Behaviour*, 14(2), 1982 pp. 155-59.

Mathew, T : A view of governments role in environmental protection in India, *Society and Science*. 5(3), 1982, pp. 7-15.

Matthews, William H : Environmental analysis and policy planning. *Bioscience*, 29(1), 1979, pp. 23-25.

Matthews, William H & Siddique, TA : Energy and environmental issues in the developing countries. Energy and Environment in the Developing Countries, edited by Manas Chatterjee, John Willey & Sons Ltd., 1981, pp. 53-67.

Miller, A : Environmental problem-solving : psychosocial factors. *Environmental Management*, 6(6), 1982, pp. 535-41.

Morgan, MG & MC Michael, FC : A characterization and critical discussion of models and their use in environmental policy. *Policy Sciences*, 13(3), 1981, pp. 345-70.

Morse, CW : Environmental regulation in the United States : the coming changes. *Journal of General Management*, 6(3), 1981, pp. 62-71.

Mrema, Ellis : Environmental Policy and Law : a review article. *Indian Quartely*, 37(4), October-December 1981. pp. 599-602.

Nichols, AL : Importance of exposure in evaluating and designing environmental regulations : a case study. *American Economy Review*, 72(2), 1982, pp. 214-19.

Pal, BP : A national policy on environment. *Indian Horizons*, 29(4), 1980, pp. 19-30.

Pal, BP : Environment control norms assailed. *Financial Express*, 28 April, 1981, p. 4.

Prestre, P : France's administration of its environment. *International Sciences*, 47(1), 1981, pp. 42-50.

Rajaendran & Reich, MR : Environmental health in Malaysia. *Bulletin of the Atomic Scientists*, 37(4), 1981, pp. 30-35.

Rao, VKRV : Environment and economic development. *Commerce*, 139(3564) 6 Oct. 1979, p. 656.

Rapoport, A : Approach to designing third world environments. *Third World Planning Review*, 1(1), 1979, pp. 23-40.

Rudel, TK : Activities, agencies and the division of labour in environmental protection. *Journal of Environmental Management*, 15(3), 1982, pp. 205-11.

Ryan, DR : Environmental regulations : a new approach. *Environmental Management*, 6(2), 1981, pp. 95-100.

Sankar, R : Imperatives in environmental Planning. *Indian Architect*, 24(9), September 1982, pp. 123-76.

Sardar, Z : The fight to save Malaysia. *New Scientists*, 87(1217), 1980, pp. 700-703.

Sherman, DJ & Gares, PA : Environmental strategies : a case study of systematic evaluation. *Environmental Management*, 6(5), 1982, pp. 421-30.

Siebert, H : Economic canses of environmen tal problem from a scientific view points. *Universities*, 21(2), 1979, pp. 19-32.

Singh, BK : Environment, Man & Society. *Yojana*, 16(30). Sept. 1982, pp. 19-32.

Singh, RN & Kumar, Awadesh : Environmental perception, human behaviour and development planning. *National Geographer*, 16(2), Dec. 1981, pp. 91-98.

Singh, Sampat P : Environmental analysis for longrange planning. *Prajnan*, 11 (2), April-June 1981, pp. 101-15.

Sinha, Subrata : Citizen and environmental. *Planning Prashashika*, 7(3-4), July-Dec. 1978, pp. 112-17.

Sinha, Subrata : Land resources and environmental planning. *Mainstream*, 17(18), 30 Dec., 1978, pp. 16-18.

Thompson, RW & Harding, CF : The environmental regulator and industrial development. *Environmental Management*, 6(1), 1982, pp. 27-33.

Vimal OP : Recent trends in environmental conservation. *Financial Express*, 25 July, 1982, 6 : 1-8 ; also 1 August 1982, 6 : 1-8.

Weerakoon, Gamini : Sri Lanka's environment : Some unsolved riddles. *Southern Economist*, 18(7), 1 Aug. 1979, pp. 26-28.

—— : Ecological and environmental problems in Rajasthan. *Changing Villages*, July-August. 1972, pp. 32-36.

—— : Environmental guidelines for developing coastal tourism. *Design*, 23 (ii), Nov. 1979, pp. 19-22.

—— : Environmental policy : editorial. *Economic Times*, 8 Oct., 1980, 5 : 1-2.

—— : Environmental protection in Federal Republic of Germany. *Bombay Civic Journal*, 27(3), May 1980, p. 911.

—— : Environmental protection law of the people's Republic of China. *Journal of Environmental Management*, 5(3), 1982, pp. 279-85.

—— : High level Centre Committee for Environmental Policy. *Bombay Civic Journal*, 27(4), June 1980, p. 12.

—— : How IPCL takes problem of environmental pollution. *Southern Economist*, 18(7), 1 August 1979, p. 16.

—— : How the chemical industry guards the environmental. *British Industrial News*, 131, 1981, pp. 23-27.

—— : New warnings on global environment : *Southern Economist*, 18(7), 1 August 1979, pp. 19-20.

—— : Wanted : A new policy for environment : editorial. *Southern Economist*, 18(7), 1 Aug. 1979, pp. 17-18.

E. ENVIRONMENTAL POLLUTION

Aggarwal, PK & Lahiri, AN : Evaluation of environmental pollution from ionic composition of rain waterreceived our Rajasthan. *Development Policy & Administration Review*, 5(1-2), 1979, pp. 1-10.

Ali, SA : Technology and environment. *Economic Affairs*, 24(1-4), Jan-April 1979, pp. 92-103.

Alamgir, M : Programs of environmental improvement at the community level. *Economic Bulletin for Asia and the Pacific*, 32(1), 1981, pp. 56-64.

Anand, RP : Development and Environment : The case of the developing countries. *Indian Journal of International Law*, 20(1), Jan.-March 1980, pp. 19.

Ashish, SM : In the area of environment. *Seminar*, 269. 1982 (Annual), pp. 12-4.

Azad, Harman Singh : Environmental pollution in India. *Civic Affairs* (Annual Number), 27(1), Aug. 1979, pp. 29-31.

Azad, Harnam Singh : New dimensions of environmental degradation. *Civic Affairs*, 28(11), June 1981, pp. 187-89.

Bala, Madhu : Menace of environmental pollution. *Khadi Gramodyog*, 26(4), Jan 1980, pp. 173-76.

Bhargava, G : Environmental pollution and law : *Economic Times*, 5 June 1982, p. 7 : 1-8.

Bishnoi, OP : Protection of environment *Civic Affairs*, 28(11), June 1981, pp. 25-29.

Bolzern, P & Fronza, G : Cost-effectiveness analysis of real-time control of sulphur dioxide emission from a power plant. *Journal of Environmental Management*, 14(3), 1982, pp. 253-63.

Chandra, Rakesh : Environmental pollution in Urban areas. *Indian Architect*, 22(10), Oct. 1980, p. 190.

Cherunilam, Francis : Hazards of environmental pollution. *Kurukshetra*, 29(17), 1 June 1981, pp. 17-19.

D' Arge, RC & Others : Carbondioxide and intergenerational choice. *American Economic Review*, 72(2), 1982, pp. 251-56.

Davos, CA : Emission abatement induced value changes. *Socio-Economic Planning Sciences*, 15(2), 1981, pp. 75-82.

Deoras, PJ , Environment : Environmental problems in India. *Economic Times* (Suppl.), 5 June, 1982, p. 1.

Deoras, PJ : Environment the backbone is broken. *Economic Times*, 25 July, 1982, p. 4.

Diaion, John A : Coal use and environment in the Asia-Pacific Region. *Materials and Society*, 6(4), 1982, pp. 431-440.

Guldmann, JM : Urban-land use allocation and environmental pollution control—an intertunporsal optimization approach. *Socio-Economic Planning Sciences*, 13(2), 1979, pp. 71-86.

Halder, A : Ecology : Environmental pollution control cost analysis—an overview. *Chemical Age of India*: Nov. 1981, pp. 987-996.

Hanson, Arthur, J : Environmental Consideration in Foreign Dover-Supported Projects : Some experience in Indonesia. East-West Environment and Policy Institute, East-West Centre, Hawaii, 1981, vi, p. 54.

Kumar, VK : Environmental pollution and human health : A geographical study of Kanpur City. *National Geographical Journal of India*, 26(1-2), March-June, 1980, 60-69.

Kurup, VSP : Environmental pollution : Our noisy civilisation, *Swarajya*, 24(1), 1 July, 1979, pp. 4-8.

Lewis, T R : Markets and environmental management, with a Storable polltant ; *Journal of Environment Economics and Management*, 8(i), 1981, pp. 11-18.

Ramanathan. N L : Environmental appraisal of industrial projects : policy concepts and practical considerations. *Chemical Industry News*, 26(1), 1981, pp. 23-32.

Ramanathan, N L & Biswas, D K : Environmental Protection : the tasks ahead. *Indian and Foreign Review*, 18(1), 15 Oct. 1980, pp. 18-20.

Rao, Nina : Environmental pollution : seamy side of Indian tourism, *Southeru Economist*, 18(7), 1 Aug. 1979, pp. 24-25.

Rao, K S & Others : Short term pollution threat of Mathura refinery at the Taj and its environments. *Chemical Age of India*, 30(10) 1979, pp. 903-907.

Rao, T Shivaji : The Taj Mahal. *Seminar*, 237, May 1979, pp. 14-20.

Sardar, Z : The fight to save Malaysia. *New Scientist*, 87(1217), 1980, pp. 700-703.

Sengupta, R : The Taj Mahal is sick. *Indian Express*, 23 July 1979, p. 9.

Sengupta, R. : How the Taj is saved from pollution ? *Southern Economist*, 18(7), 1 August 1979, pp. 25-26.

Sharma, A K : Environmental pollution in India. *Mazingira*, 7(1), 1983, pp. 2-13.

Siddiqui, Toufiq A & James, David : Coal use in Asia and the pacific: some environmental considerations. *Energy, The Industrial Journal*, 7(3), March 1982, pp. 281-300.

Sinha, S K : Impact of carbon-dioxide on agriculture in developing countries. *Impact of Science Society*, 32(3), 1982, pp. 311-23.

Thiagarajan, K : Environmental control and quality of life. *Financial Express*, 23 March 1982, p. 4.

Unkowitz, A G & Laessic, R E : Assessing the believability of research results reported in the environmental health matrix. *Public Administration Review*, 42(5), 1982, pp. 427-38.

Vohra, B B : Environment for survival. *Eastern Economist*, 13 June, 1982 pp. 13-23.

Vohra, B B : Environmental for survival. *Vidura*, 19(3) June 1982, pp. 143-44.

Vohra, K G : Environmental and health aspects of future energy planning in India. *Society and Sciences*, 5(2), 1982, pp. 9-20.

—— : Delhi : Environmental Pollution *Link*, 22(5), 9 June 1979, pp. 27-28.

—— : Environment Pollution : A health hazard. *Bombay Civic Journal*, 28(4), June, 1982, pp. 5-8.

—— : Environmental pollution is nobody concern. *Southern Economist*, 18(3), 1 June, 1979 p. 6.

—— : Environmental pollution : A health hazard. *Bombay Civic Journal*, 28(4), June 1982, pp. 5-8.

—— : How IPCL tackles problem of environmental pollution. *Southern Economist*, 18(7), 1 August 1979 p. 16.

F. NOISE POLLUTION

Briggs, D J & France, J : Mapping noise pollution from road traffic for regional environmental planning. *Journal of Environmental Management*, 14(2), 1982, pp. 173-79.

Bickerstafee, G : Muffling the impact of industrial noise. *International Management*, 35(10), 1980, pp. 48-52.

Dhar, A : Noise, the neglected hazard, *Business Standard*, 13 Aug. 1979, pp. 3-6.

Garg, R B L : Manace of noise pollution. *Management Accountant*, 15(3), March 1980 p. 111.

Ikedas & Winterfeldt, D V : Standards against noise pollution; the case of Shinkansen trains in Japan *Journal of Environment Management*, 14(1), 1982, pp. 3-16.

Nigam, J P : Noise pollution, *Civic Affairs*, 28(11), June 1981, pp. 169-77.

Oke, Y T : Noise pollution : a silent killer. *Bomay Civic Journal*, 28(4), June 1981, pp. 11-12.

Prasad, Kasi : Noise and its effects. *Civic Affairs* (Annual number), 28(1), Aug. 1980, pp. 123-25.

Rai, Usha : The decibel inferno, *Social Welfare*, 28(3), June 1981, pp. 31-34.

—— : Danger : noises around. *Times of India* (Editorial), 20 May 1976, p. 6.

G. POLLUTION

Aravindhshan, C M : Killer pollution. *Economic Times*, (Suppl.), 28 March 1981, p. 1 : 6-8.

Bassow, Whitman : Changing attitudes towards pollution. *Economic Times*, 9 Jan., 1981, pp. 5 : 7-8.

Bhattacharyya, P C : Combating industry's mercury pollution. *Business Standard*, 8 Feb 1980, pp. 5 ; 3-8.

Bhoota, B V : Pollution control in chemical industry. *Commerce* (*Suppl.*) 141 (3624), 6 Dec. 1980, pp. 27-29.

Castleman, BI & Others : Industrial hazards exported to India. *Economic and Political Weekly*, 16(24), 1981, pp. 1057-58.

Chandra, Rakesh : Environment pollution in urban. areas. *Indian Architect*, 22(10), Oct. 1980, p. 190.

Char, S V : Pollution abatement costs. *Economic Times* (*Suppl.*), 28 March 1981, pp. 11 : 1-4.

Chatterjee, L M : Need for common standards. *Commerce* (*Suppl.*), 143 (3670), 17 Oct. 1981, pp. 19-20.

Choubey, Kailash : Pollution and health. *Madhya Bharat* ; (H) 22-23 (22-23), 1974-75, (Part I, Section A) pp. 29-32.

Highton, N H & Webb, M G : Sulphur-di-oxide from electricity generation : policy options for pollution control. *Energy Policy*, 8(1), 1980, pp. 61-76.

Garg, RBL : Apathy to pollution control *Capital*, 182(4562), 18 June 1979, pp. 2-4.

Futehally, Zafar : Birds as indicators of pollution. *Indian Express* : 21 June 1979, 6 : 7-8.

Falk, I & Shechter, M : Computing Pigour-Vian Taxes for pollution abatement. *Journal of Environmental Management*, 13(2), 1981, pp. 187-94.

Endres, A : Taxing the monopolistic pollution : a reconsideration. *Nebraske Journal of Economics Business*, 21(3), 1982, pp. 15-26.

Dogra, Bharat : The Tehri Disaster, *Seminar* 257, May 1979, pp. 29-33.

Courant, P N : A verting expenditure and the cost of pollution. *Journal of Environmental Economics & Management*, 8(4), 1981, pp. 321-29.

Clark, G M & Ranganathan, A N : A resource allocation algorithm (ALCOT) for controlling mine drainage pollution. *Operations Research*, 28(4), 1980, pp. 867-88.

Holkar, Shivaji Rao : The problem. *Seminar*, 237, May 1979, pp. 10-13.

Highton, N H & Webb, M G : Electricity supply and pollution control. *Resource & Energy*, 4(3), 1982, pp. 265-80.

Jayaraman, K E : Why the world is warning up ? *Yojana* 24(12), 1 July 1980, pp. 6-7.

Jha, S : Energy sector; some critical environmental issues. *Energy Management*, 5(4), 1981, pp. 277-83.

Jha, S : Energy system and pollution : *Financial Express*, 3 September, 1980, p. 7.

Kothari, Rajni : The longer question. *Seminar*, 237, May 1979, pp. 34-40.

Mody, Navroz : Chembur's terrible: *Seminar*, 237, May 1979, pp. 21-25.

Mutakar, L K : Urban pollution and industrial disposal. *Economic Times*, 12 May 1980, p. 4.

Nayeem, A & Rahman, A N E : Industrial wastes and pollution-some scientific and social aspects *Khadi Gramodyog*, 26(7), 1980, pp. 303-07.

Rajadhyaksh, V G : A price tag too nature. *Eastern Economists*, 76(22), 29 March 1981, pp. 1308-69.

Rao, K S & Others : Short term pollution threat of Mathura refinery at the Taj and it environs. *Chemical Age of India*, 30(10), 1979, pp. 903-907.

Royston, M G : Making pollution prevention pay. *Havard Business Review*, 58(6), 1980, pp. 6-22.

Timberlake, L : Poland the most polluted country in the world ? *New Scients*, 92(1276), pp. 248-50.

—— : Deadly hazards of pollution, *Economic Times*, May 1981, 3 : 1-4.

—— : Endangered environment. *Eastern Economist*, 75(13), 26 Sept. 1980, pp. 730-31.

——Fact shows the way for pollution control. *Yojana*, 24(8), 1 May 1980, pp. 15-16.

—— : Growing menace : editorial. *Financial Express*, 7 Aug. 1979, 4 : 1-2.

—— : Polluted industrialisation. *Ecanomics Times* (*Suppl.*) 28 March 1981, 1 : 6-8.

—— : Pollution—A Threat to mankind. *Southern Economist*, 18 (22), 15 March 1980, p. 22.

—— : Pollution and protection of India's environment. *Monthly Commentory on Indian Economic Conditions*, 1981 (Annual).

—— : Pollution from projects. *Economic Times* (*Suppl.*) 21 March 1981, pp. 111 : 1-5.

—— : Pollution hazards, *Link* 21 (41), 20 May 1979, pp. 35-36.

—— : Population, poverty and pollution, *Population Review* 21 (1-2), Jan.-Dec. 1977, pp. 131-33.

—— : Tentacles of contamination everywhere. *Capital*, 181 (562), 18 June 1979, p. 5.

—— : The State of our environment in the 1970's. *Civic Affairs* (*Annual Number*) 28 (1), Aug. 1980, pp. 105-13.

—— : Two views on pollution. *Civic Affairs*, 26 (5), Dec. 1978, pp. 5-7.

H. POLLUTION CONTROL

Char, S V : Pollution abatement costs. *Economic Times* (Suppl.), 28 March 1981, 11 : 1-4.

Deoras, P J : Pollution control : How and why ? *Commerce* (Suppl.), 143 (3670), pp. 4-7.

Desai, R B : An integrated approach to pollution control and waste products utilisation. *Industrial Engineering and Management*, Jan.-March 1980, p. 33.

Gajra, P K & Gajra. B : Pollution threat-legislation not enough. *Business Standard*, 23 October, 1982, p. 5.

Krishnamacharyulo, C S G & Rai, H L : Pollution control by public enterprises. *Lok Udyog*, 15 (10), 1982, pp. 49-53.

Mandal, P K : Social audit to assess pollution control. *Financial Express*, 28 January 1981, p. 4.

Muthukumar, G & Others : Pollution control in fertilizer industry—approach towards an ideal solution, *Fertilizer News*, 27 (6), 1982, pp. 43-47.

Sell, Nancy, J : Industrial pollution Control issues and techniques. Van Nostrand Reinhold, 1981.

Sharma, S N : Case for anti-pollution levy, *Economic Times* (Suppl.), 28 March 1981, 11 : 5-8.

Shirvajkar, VV & Others : Pollution Control—a survey, *Commerce*, 143 (3670), 1981, 1-20 (suppl).

Vashi, N V : Pollution control in dyestuff industries. *Civic Affairs*, 28 (ii), June 1981, pp. 208-40.

Venu, S : International pollution control in developing societies. *Commerce*, 139 (3561), 15 Sept. 1979, pp. 540.

—— : Controlling pollution—a survey. *Commerce* (Suppl.) 145 (3708), 1982, i—xvi.

I. WATER POLLUTION

Ardar, H C & Others : The pollution of Gauhati River, *Civic Affairs* (Annual Number), 28 (ii), June 1981, pp. 109-27.

Bishnoi, O P : Prevention of contamination of drinking water. *Civic Affairs*, 27 (ii), June 1980. pp. 27-33.

Burmaster, D E : The new pollution : ground-water contamination. *Environment*, 24 (2), 1982, pp. 6-13

Capoor, D N : Prevention of water pollution : Co-operation by industry. *Commerce* (Suppl.), 143 (3670), 17 Oct., 1981, pp. 8-12.

Dwivedi, R C : Prevention and control of water pollution. *Journal of Institute of Public Administration*, 1 (3), 1980, pp. 11-14.

Dwivedi, R C : Water pollution prevention and control *Civic Affairs*, 27 (11), June 1980, pp. 45-48.

Fiacco, A V & Ghaemi, A : Sensitivity Analysis of a nonlinear water pollution control model using an upper Hudson River data base. *Operational Research*, 30 (1), 1982, pp. 1-28.

Garg, R B L : Health hazards of water pollution *Eastern Economists*, 73 (2), 13 July 1979, p. 91-92.

Green Berg, M R & William, P G : Planning with great uncertainity : a review and case study of the safe drinking water controversy. *Socio-Economic Planning Sciences*, 15 (2), 1981, pp. 65-74.

Haraprasad, V : Water pollution—A national problem. *Yojana*, 24 (10), 2 June 1980, pp. 17-18.

Jain, Mallinath : Short term and long term proposals to make river Yamuna in Delhi pollution free. *Civic Affairs*, 27 (ii), June 1980, pp. 49-51.

Kaul, Rupa : Water pollution. *Economic Times*, 7 Sept. 1981, pp. 6 : 6-8.

Khodaiji, B J : Important aspects of water pollution control law. *Civic Affairs* (Annual Number) 28 (1), Aug. 1980, pp.95-99.

Kiratrai, R : Life and death of Oceans. *Economic Times*, 5 June 1982, 6 : 5-8.

Kshirsagar, S R : Environmental sainitation and safe drinking water. *Southern Economist*, 18 (7), 1 Aug., 1979, pp. 20-21.

Lalvani, G H : Impact of water pollution control measures in Maharashtra. *Yojana*, 24 (8), 1 May 1980, pp. 17-18.

Mahajan, R K : What man's role in water pollution monitoring. *Civic Affairs*, (Annual Number) 28 (i), Aug., 1980, pp. 101-03.

Maudgal, S : Environment and river valley development projects. *Yojana*, 25 (10), 1981, pp. 5-6.

Misra, S P & Shukla, K K : Water pollution and prevention : A Kanpur case study. *Civic Affairs* 28 (ii), June 1981, pp. 129-43.

Mohan, I : The Yamuna and the people of Delhi. *Design*, 25 (3), July-Sept. 1981, pp. 29-36.

Ozounder, & Perkins, W R : Nash feedback approach to control of river pollution. IEEE *Transactions on Systems, Man and Cybernetics*, 9 (5), 1979, pp. 209-92.

Padmanaban, R : Debunking the holy image. *Economic Times*, 17 May 1981, pp. 4 : 1-8.

Remedios, A P : Ecological balance in Goa. Water supply and sanitation. *Goa Today*, 15 (6), January 1981, p. 13+

Roy, B K : Problems of water pollution *Yojana*, 24 (8), 1 May 1980, pp. 10-14.

Srinivasan, D : Identification and treatment of liquid wastes of man-made fibre industry. *Synthetic Fibres*, 10 (3) July-September 1981, pp. 25-28.

Sundaresan, B B & Subramniyam, P V R : Indian scenarios of hazardons wastes. *Yojana*, 27 (10), 1983-84, pp. 4-6.

Trivedi, R K : Water pollution control laws and legislation in India. *Chemical and Petro-Chemical Journal*, 11 (11), Nov. 1980, pp. 3-12.

—— : Haryana water pollution rules need changes. *Economic Times*, 7 April, 1980, 8 : 5-8.

—— : Maharashtra water pollution Warsens. *Economic Times* 2 Feb., 1980, 7 : 5-8.

—— : Official apathy over river pollution. *Indian Express* 29 June 1979, pp. 1 : 3-6.

—— : Water pollution acute in Rajasthan. *Economic Times*. 7 Oct. 1979, 3 : 2-4.

—— : Water pollution in Audhna. *The Times of India*, 24 April 1980, 4 :2-4.

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