PRODUCTIVITY

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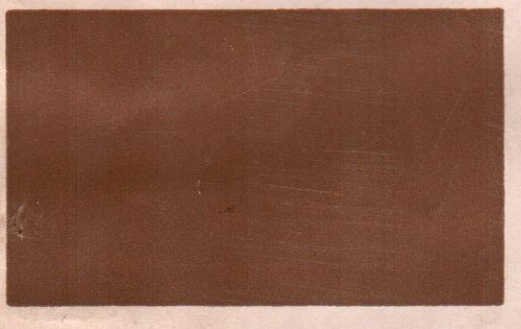

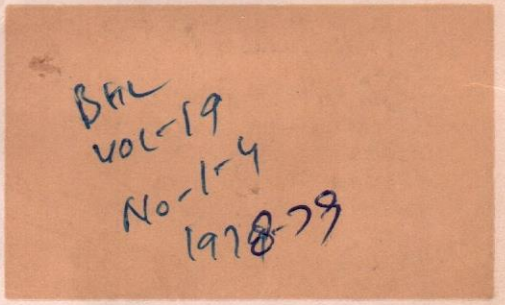

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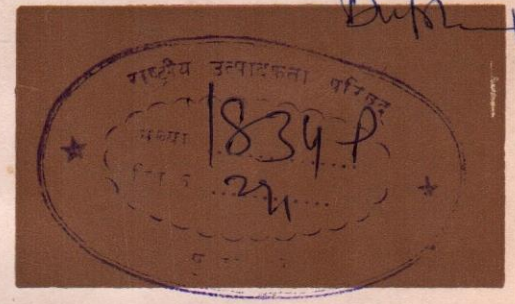

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V.S. Chopra
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PRODUCTIVITY, the principal organ of the National Productivity Council of India, is a professional, research-based Journal, providing techno-managerial expertise for a productive expansion of the Indian economy. It disseminates knowledge of the latest productivity techniques for pushing forward the growth of Indian industry, and features from time to time the best available papers dealing with different techniques and facets of productivity, and on all aspects of the national economy.

The views expressed in the Journal are those of the individual contributors and not necessarily the views of NPC.

Guidelines to Authors : Contributions from authors should be original and unpublished. Articles should, in general, cover areas like :

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- Management Information System
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- Materials Management
- Maintenance Management
- Financial Management
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All tables should be typed on separate sheets. If the manuscript contains charts and graphs, they should be drawn in Indian ink on thick drawing paper, clearly, legibly and in large size. Footnotes should be complete and numbered serially and appear on the same page on which the reference appears. References/Bibliography should appear in double space on a separate sheet. Authors whose contributions are accepted are paid a nominal honorarium and 25 copies of reprints.

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PRODUCTIVITY

INDEX TO VOL. XIX, 1978-79

ARTICLES

Author	*Title*	*No. (Page)*
	AGRICULTURAL PRODUCTIVITY	
Chattopadhyay, P	Cost of Cultivation of Jute : A Case Study	3 (385)
Das, Ghanshyam	Conservation of Soil and Water Resources of Hills : Problems and Possible Solutions	2 (203)
Jha, T P	Solving Food Problems Through Post-Harvest Technology	2 (193)
Singh AJ Sain Inder & Joshi, AS	Growth Performance of Punjab Agriculture (1950-51 to 1974-75) : An Analytical Study	3 (401)
	CONSULTANCY AND TRAINING	
Lavakare, SP (Mrs.)	Developing Special Training Programme	1 (97)
Takanaka Akira	Problems of Management Consultancy Development in Developing Countries : An Overview	3 (281)
	INDUSTRIAL ENGINEERING	
Jain, DK	A Practical Approach for Job-shop Scheduling for Increased productivity	1 (111)
Mohanty, RP Patnik, N. & Sahu KC	A Work Study Programme for job-shop Machining Operation : Drilling as Example	1 (75)
Raman, MVV	Startegy for Improving Quailty of Incian Products	1 (23)
Ram Prakash	Unused Inventories in Petroleum Enterprises of Central Government	3 (311)
Srivastava, SS	Product Improvement	1 (105)
Stanislao, Joseph	Dynamic Behaviour in Grinding	1 (7)
Stanislao, Joseph	Electric Discharge Machining : Alternative to Precision and Quality	3 (295)
	MAINTENANCE MANAGEMENT	
Chaudhuri, Dipak & Das, SC	Importance of Maintenance Considerations in Selection of Machine Tools	1 (33)
Gupta, AD & Tanwar, SP	Design of Preventive Maintenance Schedule	3 (377)
Kaushik, VP	Machinery Malfunction Diagnosis by Vibration Spectrum Analysis	1 (61)
Prem Vrat & Mudaliar, MS	Optimal Replacement of Weaving Machines : A Case	2 (243)
Sethi, Narendra K & Matarese, Philip	Assessment Centres	3 (331)
	PRODUCTIVITY STUDIES	
Chandra, Durgesh	Productivity Dynamics	1 (45)
Kotia, DK	Measurement of Capital Productivity	2 (211)
Nesa, L'abbe' Wu	Thirty years of Linear Programming Applications : An Enquiry	2 (179)

Author	Title	No. (Page)
Acharya, S & Nair, NK	Empirical Issues in Total Productivity Measurement : An Experiment with Cement Industry in India	3 (365)
Onitri, HMA	Productivity and Economic Development	1 (1)
Pickett, James	Measuring Environmental and Economic Impact of Alternative Technologies	2 (145)
	OTHERS	
Menon, KSV	Market Intelligence as a Tool for Effective Marketing	2 (159)
Monga, ML	Industrial Relations Machinery : A Case	2 (217)
Padhye, AG	Corporate Planning : Perspective and Problems	2 (175)
Sahu, Sadananda & Sahu, Kailash C	Plant Layout Decision Models : A Review	2 (223)
Shaligram, KR	Coking Coal Import : The Decision Problem	3 (359)
	RURAL DEVELOPMENT	
Acharya, S & Jha, Satish	Rural Development Efforts in India : An Assessment	4 (497)
Azad, RN	Planning Process for Integrated Rural Development : A Simplistic Approach	4 (555)
Brahm Prakash	Planning for Rural Development : Evaluation of the 1978-83 Plan	4 (565)
Gandhi, Pravinchandra V	Industry and Rural Development	4 (551)
Menon, KSV	Rural Development and Financial Institutions	4(579)
Mohan, Manendra	Marketing of Non-Farm Products	4 (619
Muthayya, BC	Rural Development : People-Centered Approach	4 (509)
Radhakrishna, R & Sastry, SAR	Rural Poverty : A Historical Perspective	4 (531)
Rajagopalan, S & Vyasulu, Vinod	Appropriate Technology for Rural Development	4 (633)
Rondineli, Dennis A	Small Industries in Rural Development : Assessment and Perspective	4 (457)
Rodinelli, Dennis A & Ruddle, Kenneth	Nonformal Education and Training for Rural Development	4 (637)
Ruttan, Vernon W	Integrated Rural Development Programme : A Skeptical Perspective	4 (481)
Schneider, Nartmut	Towards Self-sustaining Rural Institutions : The Congo experience	4 (687)
Sen, Lalit K	Rural Energy Scene in India	4 (655)
Singh, RL & Singh Rana PB	Transformation Model for Rural Development : A Geographical Appraisal of Spatial Inequality	4 (605)
Sivaraman, B	Role of Rural and Small Industries	4 (441)
Tandon, Rajesh	Rural Development : Problems and Prospects	4 (521)
Vepa, Ram K	District Industries Centres : A Leap Forward	4 (545)

BOOK REVIEWS

Title	Author/Editor	Reviewer	No. (Page)
Amidst Heat and Noise : Durgapur Recalled, *All India Management Association*, New Delhi, 1977, pp. 133	Bagaram Tulpule	Warrier, SK	1 (121)
Backward Area Development : Strategies and Policies, *Management Development Institute*, New Delhi, Nov. 1977, pp. 303, Rs. 30.00		Vepa, Ram K	1 (124)
Consultancy Services in the USA, Canada, India : *Administrative Staff College of India*, Hyderabad, 1977, pp. 151, Rs. 75.00	Moses, I	Khader, SA	3 (415)
Esesntials of Storekeeping and Purchasing, *Sultan Chand & Sons*, New Delhi, Revised Edition, 1971, pp. 190 (Students' Edition Rs. 10.00), Library Edition, Rs. 20.00	Verma, MM	Menon, PG	2 (271)
Financial Accounting An : Introduction, *Harcourt Brace Jovanovich*, New York 1977, pp. 564.	Walgenbach, Paul H. Diettrich, Norman E & Henson Earnest I	Dhameja, NL	2 (265)
Getting Along Better with People : 128 Proven Ways, *India Book House Pvt, Ltd.*, Bombay,pp. 134	Rustomji, MK	Seth, BR	2 (269)
Idle Labour In India *Manohar Publications*, New Delhi, 1978, pp. 160, Rs. 50.80	Ahuja Kanta	Verma, JD	4 (737)
Industrial Jurisprudence *N.M-Tripathi (P) Ltd.*, pp.XI+176 Rs. 28.00	Chandra, Mahesh	Naik, MJ	1 (130)
Integrated Approach to Rural Development with Social Justice, *NSS Unit, Delhi* School of Social Work, Delhi, pp. (ii+78).	K.D. Gangrade (Ed.)	Menon, KSV	4 (735)
Management By Motivation, *Taraporevala Publishing Industries Pvt. Ltd.*, Bombay, In arrangement with *American Management Association Inc.*, 1977. Price Rs 38.00	Gellerman, Saul W	Chattopadhyay, P	3 (419)
Management : Concepts and Analysis, *Vivek Publishing Company* Delhi, pp. 254, Rs. 48.00	Joshi, Navin Chandra	Soeny, Kewal	2 (267)
Management Trainee Scheme Sutlan Chand & Sons, New Delhi, 1978, pp. 60, Rs. 20.00	Virmani, BR	Kalra, SK	2 (272)

Title	Author/Editor	Reviewer	No. (Page)
Manual on the Planning of Labour-Intensive Road Construction, *ILO*, Switzerland, 1977, pp. 254, +ii, 40 Swiss Francs	Edmonds, Allal & GA (In collaboration with A.S. Bhalla)	Verma, JD	3 (496)
Operations Research *Sultan Chand & Sons*, New Delhi pp, 728+16 (Supp.) Rs. 22.50 (Student Edition)	Swarup, Kanti Gupta, PK & Mohan, Man	Saksena, JP	2 (270)
Personnel Management, *Sultan Chand & Sons* New Delhi, 1978, pp. 270, Rs. 35.00	Tripathi, PC	Chopra, B (Mrs.)	3 (424)
Principles of Accounting, *Harcourt Brace Javanovich*, New York, 1976, pp. 934.	Walgenbach, Paul H, Diettrich Norman E. and Hanson Ernest I	Dhameja, NL	2 (265)
Profile of Indion Managers, *Vidya Vahini*, New Delhi, pp. 54, Rs. 15.00.	Saiyadain, Mirza S & Monappa, Arun	Soeny, Kewal	1 (128)
Project Formulation in Developing Countries, *Macmillan Company of Indian Ltd.*, New Delhi, pp. 268, Rs. 30.00	Matto, PK	Prakash, Ram	3 (416)
Public Finance in Ancient India, *Abhinav Publishers*, 1978, pp. Xiii+271, Rs. 60.00	Sarkar, KR	Mahajan, VS	3 (429)
Report on a Study of the Debt-Equity Ratio Norms, *Management Development Institute*, New Delhi, 1978, Rs. 40.00	Madan, BK	Chattopadhyay, P	1 (134)
Rural Development in Action, *Somaiya Publications Pvt. Ltd.*, Bombay, 1977, pp. 205, Rs. 45.00	Srivastava, Uma Kant & George, PS	Thapar, SD	4 (733)
The Rural Elite in an Indian State--A Case Study of Rajasthan, *Manohar Book Service*, New Delhi, 1976, pp. 236, Rs. 50.00	Iqbal Narain, Pande, KC & Sharma, ML	Rao, CV	4 (740)
Towards Modernisation-A Study of Peasantry in Rural Delhi, *National Publishing House*, Delhi 1973, pp. xii+159, Rs. 35.00	Mulay, Sumati (Mrs.) & Ray, GC	Singh, Harkirat	4 (743)

Contents

April-June 1978
Volume XIX
Number 1

	Conspectus	(ii)-(vi)
H.M.A. Onitri	Productivity and Economic Development	1
Joseph Stanislao	Dynamic Behaviour in Grinding	7
M.V.V. Raman	Strategy for improving Quality of Indian Products	23
Dipak Chaudhuri S.C. Das	Importance of Maintenance Considerations in Selection of Machine Tools	33
Durgesh Chandra	Productivity Dynamics	45
V.P. Kaushik	Machinery Malfunction Diagnosis by Vibration Spectrum Analysis	61
R.P. Mohanty N. Patnaik K.C. Sahu	A Work Study Programme for Job-shop Machining Operation : Drilling as Example	75
S.P. Lavakare (Mrs.)	Developing Special Training Programme	97
S.S. Srivastava	Product Improvement	105
D.K. Jain	A Practical Approach for Job-shop Scheduling for Increased Productivity	111
	Book Reviews	121
	New Books : Annotated List	129
	Index to Advertisers	142

Conspectus

Productivity and Economic Development

The level of productivity can be regarded as a central determinant of the standard of living. If the total productivity is low, then the abundant resources are drained away by way of high cost of exploiting them, large scale importation of goods and services, high prices of products in domestic and international markets, etc. Drawing heavily from the Nigerian experience, this paper shows that efforts should be made to raise the level of productivity so as to compensate for the shortfall in financial resources. This would not only lead to cutting down costs of exploitation, but also to stable prices which are competitive in international market..... H M.A. Onitri (Page 1)

Dynamic Behaviour in Grinding

This investigation deals with the effects of wheel "hardness" on the external characteristics of a workpiece during a standard surface grinding process. Currently, there is limited information available concerning the precise methods by which the "hardness" of the grinding wheel is classified with respect to the total grinding system. The investigation is an attempt to study the relationship between wheel-workpiece (SAE 4340) interaction as a function of various grinding parameters. By independently manipulating various process variables, different surface roughness was produced..... Joseph Stanislao (Page 7)

Strategy for Improving Quality of Indian Products

The paper highlights the imperative need for improving quality of Indian products and suggests a quality strategy involving micro and macro approaches for achieving results within the next 5 to 10 years. The micro-strategy emphasises product quality and consumer satisfaction by suitable quality control programme, cost reduction in addition to quality improvement, vender relations, raising the status of quality control programmes, etc. At the marco-level, the paper suggests that institutions like, NPC, DGTD, and ISI should collaborate with research bodies, universities, professional associations and chambers of commerce to promote quality movement in the country.....M.V.V. Raman (Page 23)

Importance of Maintenance Considerations in Selection of Machine Tools

This paper emphasises the important role of the designer in improving the reliability as well as the maintainability of machine tools. Generally, a buyer should consult the supplier of machine tools regarding final selection and after-sales service which would be provided to the user in carrying out maintenance of the machine tools. Some guidelines for quick and proper maintenance of machine tools are listed for the benefit of maintenance personnel..... Dipak Chaudhuri & S.C. Das (Page 33)

Productivity Dynamics

Higher productivity means prosperity or, in other words, to produce more and more outputs from less and less inputs. In order to realise this objective, one must have a deep insight of the dynamics of productivity. On the one hand, inputs like materials, energy and labour should be effectively utilised and on the other, outputs like finised goods, should be maximised. Other outputs like wastes of energy and materials should be reduced to minimum. This calls for proper application of techniques like waste reduction, cost reduction, job-enrichment, etc. The latter can play a vital role in motivating labour to carry out tasks more efficiently..... .. ...Durgesh Chandra (Page 45)

Machinery Malfunction Diagnosis by Vibration Spectrum Analysis

The increasing sizes of single stream process plants have posed to the maintenance engineers the problem of costly downtime. This, together with the high capital cost of the equipments, has dictated the plant engineers to seek a reliable system of monitoring and diagnosis of machinery health. The vibration spectrum analysis technique has been developed to meet this end. The technique consists of sensing the overall vibrations, analysing or unscrambling the complex singnal into its component frequencies, identifying the frequencies with the defects causing them and comparing the severity of each defect with the past trend or pre-established values. The technique has helped the plant engineers to optimise their maintenance activities and has given a new concept to the maintenance of rotating machines—predictive maintenance or on-condition maintenance. This paper attempts to give an insight into this new technique which, though of recent origin, is gaining popularity with the users of rotating machines .. .. V.P. Kaushik (Page 61)

A Work Study Programme for Job-Shop Machining Operation: Drilling as Example

The paper describes an approach methodology to determine the operational time for a machining operation, namely, drilling in a job-shop environment, where variabilities with respect to men, machines, materials, etc., are the regular occurrences. The approach suggested inter-relates facts by way of experimentation, observation and logical arguments so as to make an objective analysis. It is argued that in a complex process, when the causal variables and the response mechanism are unknown empirical modelling may not be valid; rather the approach should be directed to continuously evaluate the decisions and procedures with the examination of their plausible consequences. ..... R.P. Mohanty, N. Patnaik & K.C. Sahu (Page 75)

Developing Special Training Programmes

This article attempts to give an approach for developing special training programmes, the need for which is not fulfilled by on-going programmes on management. The approach for developing a special training programme consists of determining specific needs, establishing training objectives, selecting the trainees, designing the training programme and evaluating the same. For the special training programme to be effective, it should be job-related so as to stimulate trainees' active interest and involvement and thus enable them to apply learned techniques and concepts in their respective job situations. The special training programme, considering the cost incurred in developing and administering it, must justify itself by contributing substantially to the overall effectiveness of the organisation.....S.P. Lavakare (Mrs.) (Page 97)

Product Improvement

The need of the day is to have a check on quality of products which would further enhance their demand in international and domestic markets. In addition to Government regulations to enforce adherence to specific standards of quality, efforts should be directed towards improvement of the existing products and also towards designing newer and better products. In doing so, parameters like performance, availability, reliability and survivability of a product should be given top priority .....S.S. Srivastava (Page 105)

A Practical Approach to Job-Shop Scheduling

This paper presents a new approach to job-shop scheduling with the help of PERT/CPM technique. The shops which can be considered for this type of scheduling are cutting, pressing, drilling, machining, fabrication, assembly, testing, etc. By drawing PERT schedule for various jobs, right decisions can be taken in respect of the critical resources. By appropriately coding the activities and job numbers, it becomes easier to identify at random the respective activity or job. Similarly, trade code and delivery schedules can be coded and shown on PERT charts. This scheduling process helps in completing various jobs on time.....D.K. Jain (Page 111)

Contents

July-September 1978
Volume XIX
Number 2

	Conspectus	ii-vi
James Pickett	Measuring Environmental and Economic Impact of Alternative Technologies	145
K.S.V. Menon	Market Intelligence as a Tool for Effective Marketing	159
A.G. Padhye	Corporate Planning : Perspective and Problems	175
Nesa L' abbe' Wu	Thirty Years of Linear Programming Applications : An Enquiry	179
T.P. Ojha	Solving Food Problem Through Post-Harvest Technology	193
Ghanshyam Das	Conservation of Soil and Water Resources of Hills : Problems and Possible Solutions	203
D.K. Kotia	Measurement of Capital Productivity	211
M.L. Monga	Industrial Relations Machinery : A Case	217
Sadananda Sahu and Kailash C. Sahu	Plant Layout Decision Models : A Review	223
Prem Vrat and M.S. Mudaliar	Optimal Replacement of Weaving Machines : A Case	243
	Book Reviews	265
	New Books : Annotated list	275

Conspectu

Measuring Environmental and Economic Impact of Alternative Technologies

The paper i) discusses the problems of the environment in the context of developing countries, ii) considers the conceptual and practical limitation of economic analysis in the appraisal of alternative technologies, and in the light of the same, iii) searches further for guidelines which might illuminate project appraisal in the developing countries when alternative technologies are considered and when environmental and economic considerations are taken into account .....James Pickett (Page 145).

Market Intelligence As a Tool for Effective Marketing

This paper attempts to draw a conceptual frame to assess the importance of market intelligence for effective marketing and also highlights its relevance and significance to the Small Scale Units (SSUs). Against the backdrop of the date-gap, limited resource endowment and other constraints facing them, some suggestions have been offered to organise a market intelligence system in the State Small Industries Corporations (SSICs) designed to cater to the needs of the former... .....K.S.V. Menon (Page 159)

Corporate Planning : Perspective and Problems

Corporate Planning can do much, if our managers have the necessary conviction and commitment to make it work, and make conscious effort to overcome their misgivings and clear their doubts. Although most of the objections raised against Corporate Planning are only of apparent and not of real value, some do warrant a logical resolution. While the term Corporate Planning is used to connote slightly variant concepts, each has its distinct utility. This paper seeks to clear some wide-spread ambiguities and misconceptions regarding Corporate Planning and throws up in relief the immense potential in this technique, illustrating the points adequately wherever it is necessary to do so.. .....A.G. Padhye (Page 175).

Thirty Years of Linear Programming Aplications : An Enquiry

With the advent of the simplex method in 1947, linear programming has been put to extensive use in business and industry to solve manufacturing and non-manufacturing problems. The paper reflects the historical development of linear programming over a thirty-year period of its applications in industry and highlights the main events that led to the present state of the art of linear programming. The paper also discusses the wide variety of linear programming applications in the manufacturing and service industry. A non-comprehensive list of the applications of linear programming as published in various journals is also given.....Nesa L'abbe' Wu (Page 179).

Solving Food Problem Through Post-Harvest Technology

In view of the limitations of pre-harvest technology, it has become all the more relevant to prevent losses of foodgrains during post-harvest operations. To do so, improved methods of harvesting, threshing, drying of crops, processing and milling of grains and their storage and transportation should be practised more vigorously than ever before. The paper attempts to identify the types of losses, analyses their causes, and suggests possible remedial actions..... T.P. Ojha (Page 193)

Conservation of Soil and Water Resources of Hills : Problems and Possible Solutions

In the hills of Uttar Pradesh, the problem of conservation is not only economical and institutional but technical as well. Heavy soil erosion is taking place due to the misuse of natural resource. The main carrier of the silt flow is water. In addition to the economical and institutional measures which are very important, new thinking is required to put the technical know-how in operation. The farmer needs to be provided with skill to earn more through judicious use of water resources in the form of irrigation-cum-soil conservation measures and new farm equipments to free him of the drudgery of manual labour by using bullock power. Some possible solutions and some new tested techniques have been discussed in this paper.....Ghanshyam Das (Page 203).

Measurement of Capital Productivity

The ratio 'Profit : Capital Employed' is the ultimate measure of managerial effectiveness. Its principal value lies in its ability to focus attention on the total operation, thus allowing management to evaluate the effects of existing policies on the firm's objectives. The ratio 'Profit : Capital Employed' can further be divided and sub-divided into a number of ratios, each expressing a stated resource input in terms of output (added value). By an examination of trends over time, those inputs which are resulting in a greater or less output can be readily identified..... ..... D.K. Kotia (Page 211).

Industrial Relations Machinery : A Case

The author attempts to highlight the working of industrial relations machinery in Haryana, created for maintenance and promotion of industrial peace. The conciliation, arbitration and adjudication machinery's performance has been analysed. The analysis leads to raise certain questions which deserve immediate focussing of the attention of labour administrators in the State and pinpoints that even after 30 years of its life-span, the machinery still needs to be invigorated. There is a growing tendency in favour of adjudication reflecting certain definite misgivings about arbitration process which needs probing..... M.L. Monga (Page 217).

Plant Layout Decision Models : A Review

This paper presents a comprehensive review and appraisal of approaches and models for developing plant layouts. It lays emphasis on the more recent developments including introduction of computerised heuristic algorithms in better layout planning and has proved to be of immense use to planners, architects and builders..... Sadananda Sahu & Kailash C. Sahu (Page 223).

Optimal Replacement of Weaving Machines : A Case

The weaving machines are subject to deterioration in course of time and hence entail increase in the rate of maintenance costs; besides, such machines become less efficient and outdated after some time. A case-study was conducted in a textile mill, to suggest an optimal replacement strategy to be adopted in case of weaving machines. A suitable modified mathematical model was used and all the factors such as the acquisition cost of a new machine, the salvage value of the old machine, the maintenance costs to keep the machine in reasonable working condition, the rate of inflation and the discounted cash flow were taken into account. All the calculations were done with the help of computer. In the end sensitivity analysis was performed with different combinations of parameters like various rates of inflation and various rates of interest..... .....Prem Vrat & M.S. Mudaliar (Page 243).

Contents

Productivity Council LIBRARY Delhi.

October-December 1978
Volume XIX
Number 3

	Conspectus	(ii) - (vi)
Akira Takanaka	Problems of Management Consultancy Development in Developing Countries : An Overview	281
Joseph Stanislao	Electric Discharge Machining : Alternative to Precision and Quality	295
Ram Prakash	Unused Inventories in Petroleum Enterprises of Central Government	311
Narendra K. Sethi Philip Matarese	Assessment Centres	331
K. R. Shaligram	Coking Coal Import : The Decision Problem	359
S. Acharya N. K. Nair	Empirical Issues in Total Productivity Measurement : An Experiment with Cement Industry in India	365
A. D. Gupta S. P. Tanwar	Design of Preventive Maintenance Schedule	377
P. Chattopadhyay	Cost of Cultivation of Jute : A Case Study	385
A. J. Singh Inder Sain A. S. Joshi	Growth Performance of Punjab Agriculture (1950-51 to 1974-75) : An Analytical Study	401
	Book Reviews	415
	New Books : Annotated List	433
	Index to Advertisers	440

Conspectu

Problems of Management Consultancy Development in Developing Countries : An Overview

It is well known that the problems of managemen consultancy work and those of managing a consul tancy organisation are varied and diversified, an therefore it is difficult to generalise such problem irrespective of different backgrounds and conditions This paper is based on the survey report conducted in APO member countries and discusses at length the type of problems faced by all concerned. It also presents possible solutions to bring about considerable improvements in management consultancy and stresses the pivotal role of National Productivity Organisations in member countries of APO..... Akira Takanaka (Page 281)

Electric Discharge Machining : Alternative to Precision and Quality

Electric Discharge Machining (EDM) is no longer a laboratory curiosity, it has been proven to be a successful manufacturing process for industrial use. As of now, the main barrier to the wide acceptance of EDM in mass production is its low rate of metal removal. However, judging from the exceptional progress of the past few years, it may be concluded that the process has an excellent future. As more and more refinements are incorporated into the various elements of EDM, there is no doubt that the process will gain increasing acceptance as a production technique by the metal working industry..... Joseph Stainslao (Page 295)

Unused Inventories in Petroleum Enterprises o Central Government

This paper examines the behaviour patterns of inventories in 11 Central Government Petroleum Enterprises over 1966-67 to 1976-77. In all, six tests were conducted : inventory turnover ratio; trends in investment of inventories; comparison of levels of holding with similar undertakings under different management styles; regression analysis according to three pre-conceived models; analysis of growth rates and corroborative evidence of indepth at micro-level. One of the findings of the study is that though the undertakings have taken advantage of economies of scale in holding inventories there is still scope for reduction of inventories. Also, the evidences in the report indicate that the generally held hypothesis that the level of inventories is higher is valid and what is required is a constant vigil on the levels of inventories so as to maintain them at an optimum level..... Ram Prakash (Page 311)

Assessment Centres

Assessment Centre, as suggested in this paper is not a technique that is panacea or the ultimate selection device but rather, it is a methodology which when used with the traditional means of evaluation and with significant amount of common sense can benefit employers and employees alike.....N. K. Sethi and Philip Matarese (Page 331)

Coking Coal Import : The Decision Problem

With the improved economic conditions and a liberalised policy of importing essential industrial inputs, the dormant issue of import of coking coal would boost the metal output of the existing blast furnaces and help attain the steel output target. This paper develops the various dimensions of the decision problem, to form an analytical basis for policy measures.....K. R. Shaligram (Page 359)

Empirical Issues In Total Productivity Measurement: An Experiment with Cement Industry in India

In this paper, an attempt has been made to cover certain gaps in total productivity measurement, which often leads to erroneous conclusions. Attempt has been made to highlight discrepancies that may arise due to the *ex-ante* nature of a production function and its estimating using *ex-post* data. Certain measures that would minimise these discrepanices have also been suggested. Later a detailed empirical exercise has been carried out using data from the Cement Industry in India. Most studies in India on production function estimation and total productivity estimation are far from perfect on some count or the other because of lack of empirical considerations. There is need to estimate these production relations accurately for all the major industries to obtain a techno-economic profile of the Indian industrial sector.....
S. Acharya & N. K. Nair (Page 365)

Design of Preventive Maintenance Schedule

Effectiveness of a preventive maintenance programme depends upon appropriate selection of its time schedule. An attempt has been made in this paper to apply a systematic procedure for determining preventive maintenance schedule for stochastically failing equipment. It has been assumed that preventive maintenance is carried out after a fixed period of time and that equipment failures are statistically independent of the type of previous maintenance. JJ McCall and James A. Person's models have been used to determine preventive maintenance schedule for the machinery of a thermal power plant. The models are applicable when the failure characteristics of an equipment are known and also when only mean life estimate is known..... A. D. Gupta & S. P. Tanwar (Page 377)

Cost of Cultivation of Jute : A Case Study

This paper attempts to present a case study on the cost of cultivation of jute and mesta and pinpoints the inadequacy in the methods officially adopted therefor and the manner in which such costs should be collected, collated and presented for different purposes. It shows that there exists a direct relationship between the productivity levels attained and the cost of cultivation incurred and/or imputed..... P. Chattopadhyay (Page 385)

Growth Performance of Punjab Agriculture (1950–51 to 1974–75) : An Analytical Study

This study compares the growth rates of area, production and yield at the district and state levels for Punjab over the pre-green revolution period from 1950-51 to 1965-66 and post-green revolution period from 1965-66 to 1974-75. An attempt is also made to examine the contribution of different components to agricultural production and productivity. The study concludes that there have been significant changes in the compound growth rates of area, production and yield from the pre-green revolution period. Due to the technological breakthrough, paddy-wheat rotation has become a dominant crop rotation. The decomposition of agricultural production and productivity revealed a sharp shift in the relative roles of yield and area, in particular with the yield assuming the role of a dominant contributor to the increase in production and productivity in the post-green revolution period, as compared to area which played a prominent role during the pre-green revolution period. Further, the more detailed decomposition of production and productivjty revealed that price structure has been making a negative contribution which points to the urgency for re-orienting agricultural production and price policies.....A. J. Singh, Inder Sain, & A. S. Joshi (Page 401)

Contents

SPECIAL NUMBER ON RURAL DEVELOPMENT

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	Conspectus	(iii) - (xi)
B. Sivaraman	Role of Rural and Small Industries	441
Dennis A. Rondinelli	Small Industries in Rural Development : Assessment and Perspective	457
Vernon W. Ruttan	Integrated Rural Development Programmes : A Skeptical Perspective	481
Sarathi Acharya Satish Jha	Rural Development Efforts in India : An Assessment	497
B.C. Muthayya	Rural Development : People-Centered Approach	509
Rajesh Tandon	Rural Development : Problems and Prospects	521
R. Radhakrishna S.A.R. Sastry	Rural Poverty : A Historical Perspective	531
Ram K. Vepa	District Industries Centres : A Leap Forward	545
Pravinchandra V. Gandhi	Industry and Rural Development	551
R.N. Azad	Planning Process for Integrated Rural Development : A Simplistic Approach	555
Brahm Prakash	Planning for Rural Development : Evaluation of the 1978-83 Plan	565

K.S.V. Menon	Rural Development and Financial Institutions	579
R.L. Singh Rana P.B. Singh	Transformation Model for Rural Development : A Geographical Appraisal of Spatial Inequality	605
Manendra Mohan	Marketing in Rural India.	619
S. Rajagopalan Vinod Vyasulu	Appropriate Technology for Rural Development	633
Dennis A. Rondinelli Kenneth Ruddle	Nonformal Education and Training for Rural Development	637
Lalit K. Sen	Rural Energy Scene in India	655
Hartmut Schneider	Towards Self-Sustaining Rural Institutions : The Congo Experience	687
	Select Bibliography on Rural Development	705
	Book Reviews	733
	Index to Advertisers	746

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—Editor

Conspectus

Role of Rural and Small Industries

The developing nations with a large, low and medium income groups in the rural areas can and should closely investigate the potential of the village and cottage industries sector. What is more important is a proper distribution of the produce from these industries, which would mean organising an effective marketing system. The author feels that, as long as an organised marketing system for small sector is absent, the large producers will have a definite edge over them. Since there exists sophisticated markets for the produce from the cottage and village industries, there is a need for making an organised marketing effort, where necessary, through the state organisations.....B. Sivaraman (Page 441)

Small Industries in Rural Development: Assessment and Perspective

This paper reviews the problems of stimulating rural investment and the major obstacles facing government agencies in assisting rural industrialists. The author suggests that project management is the most effective means of formulating and implementing small-scale industrialisation policies, and that it can serve as a coherent conceptual framework for problem identification and diagnosis, and for organising government incentives, technical assistance, research, consultancy and training activities.....Dennis A. Rondinelli (Page 457)

Integrated Rural Development Programmes : A Skeptical Perspective

The Community Development Programmes of the 50s were least successful in efforts to expand the economic base needed to support rural development. Though it is possible to identify number of relatively successful pilot projects, it is difficult to find example of successful rural development programmes. The author examines this problem in the light of (a) the urban-industrial impact hypothesis; (b) the theory of induced technical change; and (c) the new models of institutional change; and on the basis of recent development experience, puts forth some guidelines with respect to programme ideology and design of any large scale rural development effort..... Vernon W. Ruttan (Page 481)

Rural Development Efforts in India : An Assessment

This paper presents a scenario of rural development efforts made in India during the last three decades. Starting with various interpretations of the concept 'Development' and scanning in brief, the various programmes like CDP, Panchayati Raj institution, SFDA, MFAL, DAP, TAD, HAD, etc., the paper critically assesses the success of such programmes. The authors suggest that when there are conflicting interests between groups of population, hard decisions are necessary.....Sarathi Acharya & Satish Jha *(Page 497)*

Rural Development: People-Centered Approach

In any rural development programme, an attempt should be made to understand the motivational level, potentiality of the people to participate, the status of their selves, the type of leadership available and the nature of developmental personnel. The knowledge of these variables are important because they not only further the objectives of development but also bring about the development of the people..... B.C. Muthayya (Page 509)

Rural Development: Problems and Prospects

Rural populace, by and large, lack economic resources and their social status is quite low. In addition, they lack political leverage. Studies conducted so far, do not emphasise the development of the capacity of weaker sections of the rural population. The author presents two examples, one each from Maharashtra and Rajasthan, to indicate the process through which the capacity for utilising developmental resources can be enhanced among the rural poor.....Rajesh Tandon (Page 521)

Rural Poverty : A Historical Prespective

This paper attempts to view the present mass poverty and economic disparities in the backdrop of the evolution of institutions and economic classes beginning with the pre-colonial era to the post-independence period. The present poverty has deep roots in the historical past as can be seen from the institutions created then for colonial exploitation. Land revenue, legislative institutions, various attempts to disintegrate the village-based handicrafts industries, etc., led the village artisans to become landless labour. The authors feel that the post-independence development efforts too, have failed to release millions of people from poverty, lethargy and inhibitions created over the colonial era spanned over centuries .....R. Radhakrishna & S.A.R. Sastry (Page 531)

District Industries Centres : A Leap Forward

The idea behind setting up of District Industries Centres (DICs) is basically to bring administration to the people at the grass-roots level. It is a logical culmination of the programmes that have been undertaken in the past, but the success of such programmes will depend upon the support it receives from state governments as well as the enthusiasm it can generate among potential entrepreneurs. Given a sound institutional framework, there is a great potential both in human and material terms, which can be mobilised to establish a network of industries in rural areas.....Ram K. Vepa (Page 545)

Industry and Rural Development

This paper emphasises the role of industry and industrial houses in augmenting the pace of rural development efforts in India. Industrial units that are engaged in R&D or manufacturing activities which could be useful in the development of small areas, should take up these activities in a few selected areas. Business houses should take up rural development work as an integral part of their normal functioning. Rural Development work should be regarded not as a charitable activity, rather as an expansion of the function of business.....Pravinchandra V. Gandhi (Page 551)

Planning Process for Integrated Rural Development : A Simplistic Approach

A simplistic methodology for a field operator which can be the starting point of the process of planning and implementation of integrated rural development, is presented in decentralised micro-level planning at the grass-roots level. It will require a massive effort and collaborative endeavour of all those concerned with rural development in various capacities to make a meaningful headway.....R. N. Azad(Page 555)

Planning for Rural Development: Evaluation of the 1978-83 Plan

This paper presents some of the substantive issues related to rural development, in their form/shape as provided in the Draft Five-Year Plan 1978-83. According the author, if unemployment, poverty and inequalities are the main concerns of the planner, then there is hardly anything in the Plan which ensures their elimination. The strategy of the Plan is to sustain higher agricultural productivity and to that effect provisions for necessary infrastructure are proposed. This may lead to appreciable improvements in the growth rates, but will not necessarily eliminate poverty or inequalities. It may not be possible to generate enough employment opportunities as claimed in the Plan; organisation, management and market linkage would be major impediments to development of rural-based small and cottage industries..... Brahm Prakash (Page 565)

Rural Development and Financial Institutions

This paper discusses the rationale behind the renewed emphasis on rural development within the broad theoretical framework of regional economic analysis and the role played by financial institutions so far. It also delineates specific areas which can be thought of for expanding the activities of financial institutions with a definite focus on rural development in general and 'target group' in particular. .....K.S.V. Menon (Page 579)

Transformation Model for Rural Development: A Geographical Appraisal of Spatial Inequality

The basic consideration of any planning postulate should be oriented as much to spatial arrangement of resources as to the emerging settlement system in any space. The concept of 'agropolitan centres' and 'village clusters' are considered feasible in the context of rural development in India. At regional level, growth centres/service centres need to be developed in corroboration with agropolitan centres while, at micro level, establishment of community centres will operationalise the process of rural transformation, involving the use of appropriate technology.....R.L. Singh & Rana P.B. Singh(Page 605)

Marketing in Rural India

Development of rural marketing should not be equated with the extension of the distribution system which is surely one important aspect of the process of marketing. The role of marketing at present stage of rural growth is more fundamental, almost vital. The process of distribution would make the goods and services available to the far-flung areas. Marketing, however, has to be viewed as the initiation of the process of motivation for the bulk of rural population, especially in those states which have not yet tasted the new agricultural prosperity..... Manendra Mohan (Page 619)

Appropriate Technology for Rural Development

Poverty is the result of the fact that the people who add value by their labour are different from those who realise this value. The distinction between value realisers and those who control means of production is thus quite important. Because of the disparity between value adders and value realisers, the former are not motivated to use their entire potential in production process. In an appropriate technology scheme, however, they would be motivated to produce more using entire skills, as value adders and value realisers would be one and the same. Besides, appropriate technology would improve their skill through a process of voluntary participation.....S. Rajagopalan and Vinod Vyasulu (Page 633)

Nonformal Education and Training for Rural Development

Education can play a crucial role in promoting social change, much needed to acclerate the pace of rural development. But such formal education has had little impact on stimulating rural development. This paper reviews some of the fundamental limitations of formal education for promoting rural development, explains the nature and characteristics of nonformal and informal approaches and outlines the features of an educational and training programme needed to stimulate rural productivity and economic growth in developing countries.....Dennis A. Rondinelli & Kenneth Ruddle (Page 637)

Rural Energy Scene in India

Low energy input and heavy dependence on traditional and non-commercial sources of energy in rural areas is clearly a function of the backwardness of Indian economy. This paper examines, on the basis of sector-by-sector analysis, the appropriateness of the various alternative sources of energy for cooking, agriculture, rural industries, lighting and transportation in rural areas.....Lalit K. Sen (Page 655)

Towards Self-sustaining Rural Institutions : The Congo Experience

The experience of rural development project in Congo with regard to its objective of "creating the institutional structure necessary for rural development", is presented. The project experience is then used to discuss ten general hypotheses about rural institutions. They refer to the creation, operation, support activities and poverty orientation of the rural institutions. From this discussion emerges the need for a further hypothesis with regard to the social integration of the rural institutions and the people who work with them. Conclusions are drawn with regard to the concept of integrated rural development as well as with regard to size, time and assistance requirements of rural development projects..... Hartmut Schneider (Page 687)

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Productivity and Economic Development

H.M.A. Onitri*

In spite of the great scientific advances made by man, the standard of living of the vast majority of the world's population still depends more on man himself than on the technological aids that are now available to him. It is his will to work, his ability to find solutions to his problems, the efficiency with which he can use technological aids, his foresight in planning for the future, and the wisdom he can exercise in choosing a course of action among the various alternatives that are available to him, that provide the central explanation for the level of living at which he subsists.

Central Importance of Productivity

In short, except in the few cases where resources are so profusely abundant in relation to population, the level of productivity is a central determinant of the standard of living. Undoubtedly, abundant natural resources, accumulated productive capital in the form of roads, ports, health and educational facilities etc., are necessary ingredients for the attainment and maintenance of a high living standard. However, without a high level of productivity, the standard of living may still be abysmally low even when these other favourable factors are present. If productivity is low, abundant resources will be frittered away in the high cost of exploiting these resources, products will be imported which, with better productivity, should have been produced at home, and a substantial proportion of available foreign exchange will be expended to pay for the services of foreign technicians whose technical qualifications may be even inferior to those of their domestic counterparts, except that they have been brought up to be better disciplined and, therefore, far more productive in the application of technical knowledge. People often wonder what the foreign technicians are really doing. There may be only one foreign technician on a construction site manned by five

* Director, Nigerian Institute of Social and Economic Research, Federal Ministry of Labour. This paper was presented by the author at the National Conference on Productivity, organised by the Productivity, Prices and Incomes Board, at Abadan, Nigeria between 22nd and 25th January 1978.

hundred local people. The foreign technician may not even be very visible, yet most people would agree that his presence there may determine the quality of the finished product.

The central importance of productivity in explaining differences in living standards is often ignored in comparing situations in developed and developing countries but not so in comparing differences among developed countries themselves. Because developed countries are often engaged in fierce competition in the world market for industrial products, they are very conscious of the relationship between their level of productivity and their ability to compete with other developed countries. Low productivity in a particular country shows itself not only in the high prices of industrial products in the domestic market but also in the lack of competitiveness in the international market. The resulting balance of payments difficulties are often sufficient to drive home the lesson that the nation must be more productive if it is to earn enough foreign exchange to pay for its imports. Hence there is almost continuous comparison in the levels of productivity among the world's great industrial nations.

Those developing countries like Hong Kong, South Korea, Singapore, the Philippines, India, Mexico and Brazil, that have made some inroads into the world industrial market, have also become somewhat conscious about the level of productivity, particularly, about the relationship between changes in wages and salaries and the trends of productivity. The situation is different in those developing countries which still rely very largely on the export of raw materials in exchange for industrial goods. In these countries, the critical importance of productivity is often overlooked, while attention is focussed more on the prices received for exported raw materials in relation to the prices paid for imports. There is usually little awareness of the role that a high level of productivity can play in raising the standard of living in the developing countries, and in promoting greater self-reliance.

Japanese Experience

We are currently witnessing on the international scene one of the great ironies of history. Two countries—West Germany and Japan—defeated in World War II, with most of their industries destroyed, are now

successfully challenging their victors in the world market for industrial products. Their share of world industrial production and trade goes up higher and higher every year, their currencies continue to rise in value, sometimes to their own embarrassment, and their problem is how to reduce their huge trade surpluses. The Japanese situation is even more startling. Ninetyfour million people crowded on a land area of 372 sq. kms. of which only 46,000 sq. kms. is arable with no significant mineral resources, have surprised the world with an unusually-high level of productivity. The country now accounts for more than 60 percent of the world's ship building capacity, and a high proportion of total world industrial production. Millions of people all over the world are served everyday by Japanese technology. One of America's present worries is how to protect her own domestic industries from the onslaught of Japanese imports. The European Economic Community has also taken similar steps in recent months. Many reasons have been given for the success of the Japanese experience, but no one is in doubt that the central explanation is a high level of productivity. At the centre of the success is the Japanese worker. His standard of living is high largely because he is very productive.

The importance of manpower productivity is shown in a recent article on comparative productivity in the developed countries. The writer notes as follows :

> "All that a worker has to sell is his productivity. His productivity is determined partly by his skill which itself depends both on his natural aptitudes and on his training and education—it depends also on the equipment he has to use, and it depends on the efficiency with which his work is organised. Anything which reduces the worker's productivity is a direct attack on the worker's interest. To rob a worker of his productivity is like robbing a farmer of his crop; it is, by its nature, a crime".[1]

Conditions for High Productivity

To some extent, low productivity is an aspect of the vicious circle of poverty in which many developing nations are trapped. Poor standard

1. The Machinery for Wasting Manpower, by William Rees-Mogg, *London Times*, Oct. 5, 1977.

of living—bad health, lack of education, bad housing, poor transportation to and from work, bad conditions in the work place, etc.—reduces the worker's productivity, and low productivity in turn reduces the capacity of the society to improve living standards. The effect of poor living standards on the mind may be even more serious. Motivation is low, particularly if the worker feels cheated and exploited, and the will to work is correspondingly reduced.

Getting out of this vicious circle is not an easy task. However, there are five courses of action which together could form part of an effective policy package. In the first place, a new social orientation in the society, involving greater fairness and justice in the distribution of income, could persuade the worker that he is working for his own benefit and the good of the nation rather than for the benefit of a few privileged members of the society. In the second place, a sustained attempt to improve working conditions, especially housing, transportation, feeding and health facilities, could substantially improve the worker's productivity. Thirdly, clear arrangements for associating increased rewards with increased productivity could serve as sufficient incentive to higher productivity. The other side of the coin is, of course, that appropriate penalties should be associated with low productivity. Where this is lacking, the incentive for high productivity will be seriously diminished. Fourthly, there should be a more systematic approach to formal and non-formal training in all spheres of economic activity. This fourth element in the package may warrant some explanation. The importance of training for a job would be readily admitted, but it often happens that, at lower levels of skill, training is taken for granted and sometimes it is not even considered necessary. An unskilled worker, a messenger or a cleaner, is supposed to go straight on the job, without any training, whereas even a few days training in the specific tasks on which they are employed could make them much more efficient. The same is true of the vast army of semi-skilled and skilled workers—drivers, motor mechanics, welders, carpenters, etc.,—who pick up their training, informally, in motor garages, roadside workshops and building sites. Without doubt, these informal arrangements have produced some good workmen. However, a little formal effort to supplement the informal arrangement could raise productivity substantially.

The role of education and training in productivity improvement is, however, much wider than this. Many observers believe that productivity

objectives should be built into the whole educational system, such that at any level in the educational pyramid, the student would have acquired a minimum level of discipline and motivation in his approach to tasks and problems. A fifth element in the policy package is an appropriate institutional arrangement to ensure that increases in wages and salaries in particular sectors bear some relationships to increase in productivity in those sectors.

It would be an interesting exercise to consider how various elements have combined to bring about high levels of productivity in the developed countries and in those developing countries that have had some success in this sphere. However, this would be an impossible task in this short paper, particularly as it may involve an analysis of complex cultural and historical factors on which there is no universal agreement. What is clear from the experience of several of these countries is that every country can choose its own path for the attainment of a high level of productivity. High level of productivity can be achieved under various economic systems, provided that economic and social policies are consistent with the requirements of increased productivity : fairness and justice in the ordering of the society, improved working conditions, appropriate rewards for increased productivity, an educational system geared to improved productivity, and an orderly incomes policy.

Productivity and Nigerian Development

It is against this background that the improvement of productivity in the Nigerian setting should be considered. The question should be seen as part of the general problem of designing a new development strategy for the next decade. Since there is general acknowledgement that the level of productivity is low in almost all sectors, a sustained attempt to improve productivity should be an essential component of the new strategy.

Given the dim financial prospects that have now been painted for the Nigerian economy, it should be the aim of the Productivity, Prices and Incomes Board to ensure that the level of productivity in the economy is raised to compensate, to some extent, for the shortfall in financial resources. The Board can do this in many ways. Firstly, it can ensure that those projects and programmes that are likely to promote higher

productivity, should be given high priority. Secondly, it should ensure in its norms and guidelines that increases in remunerations are geared towards increases in productivity. Thirdly, it should ensure that, where appropriate, increases in productivity are reflected, to some extent, in lower prices for the final product. And finally, it should draw attention to elements of unfairness and injustice in economic and social organisation that will tend to reduce the workers' motivation or increased productivity. □

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Dynamic Behaviour in Grinding

Joseph Stanislao*

Introduction

Great changes in technology have occurred since the start of the Industrial Revolution. Improvements in grinding processing, equipment, and abrasives have helped in producing parts to more rigid specifications. However, with increased demand for specific properties in the finished product, it is imperative that the capabilities as well as the limitations of finishing techniques be examined and evaluated more closely. Grinding is an effective means of stock removal for certain classifications of materials. The abrasive system, as illustrated in figure 1, when contrasted with other stock removal methods, offers greater production flexibility. In order to achieve this flexibility, the selection of the proper abrasive with the correct system setting is important.

The grinding wheel is a complex cutting tool which is difficult to study because of intrinsic variations in "hardness," shape, size, density, bonding, etc. Because it is also difficult to control many of these factors in one or several experimental studies. it is essential to single out the most important parameters and concentrate on those which have the greatest influence on the grinding process. The "hardness" of a grinding wheel is one important factor. The grinding wheel is heterogeneous in nature, and hence its "hardness" cannot be measured by any one of the standard tests used for measuring the hardness of homogeneous materials. The hardness of a wheel may vary from one manufacturer to another. This is because abrasive grains used for a wheel have various physical characteristics, sizes, and shapes, even when made from the same lot. The distribution of grains in a wheel is not uniform; thus, bond bridges have different magnitudes and strengths even when the same grain size and bond concentration are used.

"Hardness" of a wheel, however, can be expressed in terms of the forces which develop during grinding as a function of the surface generated on the workpiece. This research deals with wheel forces or cutting forces for specific machine settings. These are forces which should indicate an optimal grinding for specific surface characteristics.

* Dean and Professor of Engineering, North Dakota State University, Fargo, Noth Dakota

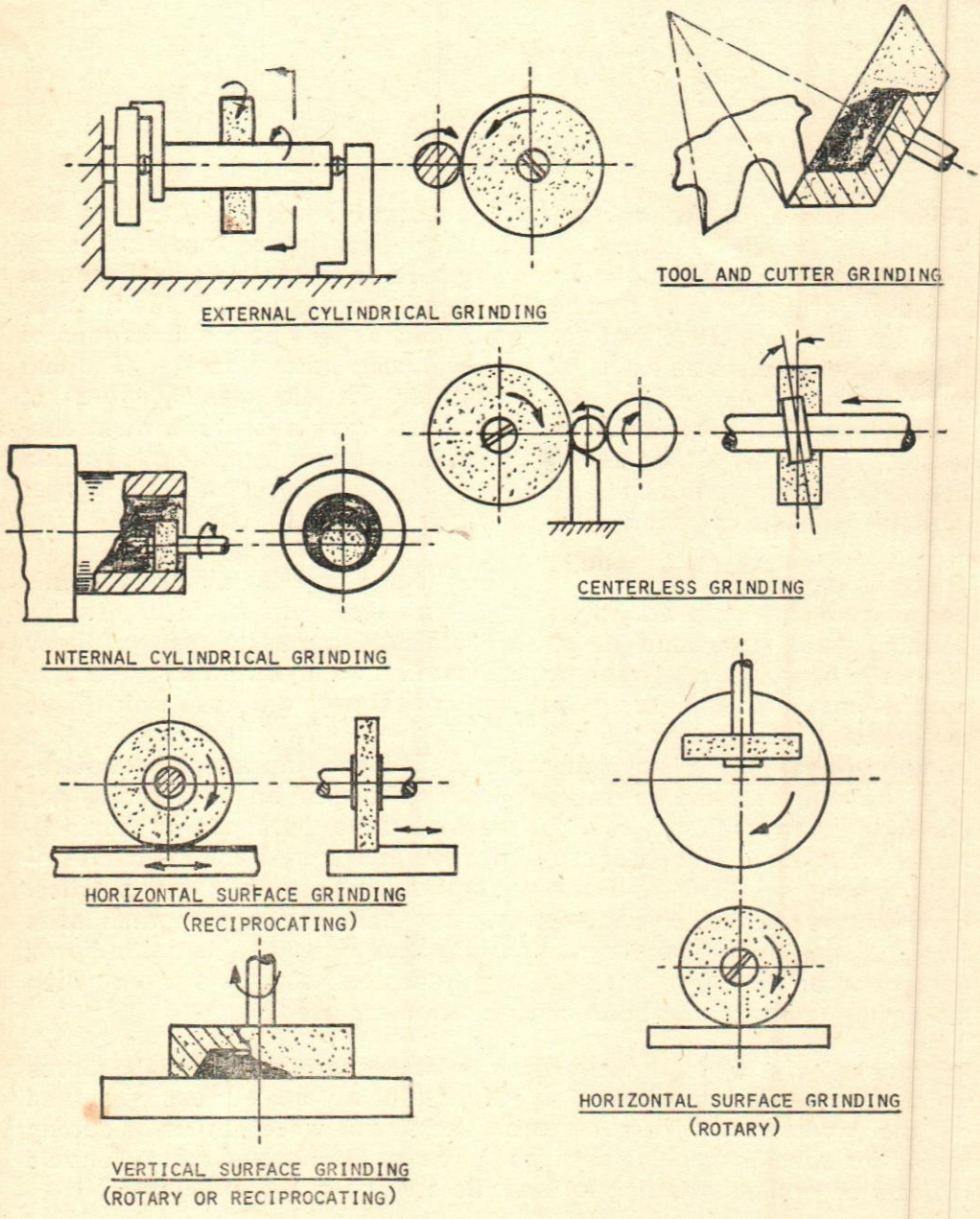


Figure 1 - Various Grinding Systems and Their Application

There has been considerable research work done on grinding wheel abrasives and bonding materials. However, the total amount of work done, which takes a system approach to analysing a grinding process, is still relatively small compared to other areas of machinability research. The literature survey has been done mainly on "hardness" of grinding wheels. It was divided into four main topics : (1) internal stresses in the workpiece, (2) relationship of "hardness" of grinding wheels, (3) methods of determination of "hardness" of grinding wheels, and (4) surface characterisation.

The work of Marshall and Shaw[1] in 1952 is the first known work in which actual grinding forces were subjected to any degree of detailed analysis. One of the most significant works conducted by Reichenbach, *et. al.*[2] developed some of the basic kinematics of grinding and amplified some of the earlier work of Marshall and Shaw. In particular, Marshall and Shaw emphasised the importance of chip thickness in the mechanics of grinding. Backer, *et. al.*[3] found that grinding forces were independent of the "hardness" of the metal ground, but if the grinding conditions had been such as to produce a chip thickness of 30 micro inches or greater, the forces would have been influenced by the specimen "hardness".

Nowikowski, *et al.*[4] conducted some experiments on 4340 steel, 52 Rc, and found that distortion in the workpiece increased with wheel "hardness." They also found that distortion increased with increase in wheel speed and with higher downfeed or depth of cut. When appreciable tensile stresses were generated during grinding, there was a concurrent temperature rise. According to Tarasov[5] the stress is the result of a thermal upset caused by the hot metal at the wheel-work interface attempting to expand and being offset by the restricting adjacent cold material.

It is important to emphasise at this point that wheel "hardness" is not

1. Marshall, E.R. and Shaw, M C., "Forces in Dry Surface Grinding," *Transaction, American Society of Mechanical Engineers*, 74 (1952), pp. 61-72.
2. Mayer, G.S., Kalpkaciolu, J E., and Shaw, M.C , "The Role of Chip Thickness in Grinding," *Transaction, American Society of Mechanical Engineers*, 78 (1956), pp. 847-859
3. Backer, W.R. and Merchant, M.E., "On The Basic Mechanics of the Grinding Process," *Transaction, American Society of Mechanical Engineers*, 17 (1956), pp 865-875
4. Nowikowski, L.J., Maranchik, J Jr..and Field, M., "Dsitortion and Residual Surface Stress in Grinding and Milling of the High Strength Steels," *Transaction, American Society of Mechanical Engineers*, 68 (1945), p. 175
5. Tarasov, L.P., "Relation of Surface Roughness Reading to Actual Surface Profile," *Tansaction, American Society of Mechanical Engineers*, 67 (1945), p. 189

to be understood as structural hardness, such as ultimate strength, yield point, etc., but rather as a functional hardness. Wheel "hardness" is most commonly influenced by the composition of the filler or matrix, curing cycles, and the adjustment of the abrasive to matrix bond strength. The abrasive concentration or the ratio of abrasive volume to bonding volume is also important.

Over the last few years, a considerable amount of information on the characterisation of the workpiece as related to grinding action has become available. Most attempts have been directed at finding a physical expression for the properties of the workpiece. One such attempt by Rubenstein[6] has been made recently through a "ductility" or "machinability" index as :

YP = Machinability Index Ratio

where Y = surface free energy

P = the yield stress or hardness of material

Ratterman[7] found that the modulus of resilience (MOR) of the workpiece is related to the grinding performance. MOR is defined as :

$t^2/2E$ = MOR

where t = tensile yield strength of the workpiece

E = the elastic modulus of a specific material

MOR = units of inch-hounds/cubic in. This is the ability to resist impact before failure.

The higher the value of the modulus of elasticity the lower the value of MOR and the more easily the material can be ground.

Recent literature outlines the determination of "hardness" of grinding wheels by methods which can be classified into two broad categories :

(1) Static tests, which supply data on the "hardness" of bond under static loads.

6. Rubenstein, C., "The Role of Surface Energy in Metal Cutting," *Proceedings of Conference on Machinability*, Iron and Steel Institute, (1965)
7. Ratterman, E., "How Tungsten Carbide Properties Affect Diamond Wheel Life,' *Cutting Tool Engineering* (June, 1966, p. 45.)

(2) Dynamic tests, the results of which are obtained by simulating actual processing conditions.

The latter category shows the combined effects of "hardness" grain size, materials, and machining conditions. This dynamic test approach was used in this research, because it simulated actual process conditions more closely.

Surface Characterisation of Workpiece

Smoothness of a surface is usually indicated by micro inches AA (arithmetic averages) and micro inches RMS (root mean square). However, there are a number of additional techniques for surface analysis. Surface analysis may be quantitative or qualitative. The quantitative method may be subdivided into two-dimensional and three-dimensional methods.

Two-dimensional methods are usually concerned with the surface profile rather than the surface as a whole. Stylus type equipment is most commonly used, although optical, electrical, or pneumatic methods may also be used.

Quantitative three-dimensional methods are used to obtain data on the surface as a whole rather than on a two-dimensional profile. Measurements using three-dimensional methods of analysis may include such criteria as coefficient of friction, gas absorption, and total reflectivity.

Qualitative data methods are usually obtained by means of the microscope, the interferometer, the electron microscope, and the stereo microscope. The data may be in a two or three-dimensional form.

Ultimately, the only way a surface can be characterised is by using a combination of different parameters.

Experimental Procedure

The equipment necessary for the experimental phase of this research was available at the North Dakota State University. Surface Grinder was modified to meet experimental design requirements. The wheel spindle of the grinder was adapted so that an infinitely variable rpm

range of 50 to 3,500 was available. The grinding machine was also equipped with an infinitety variable speed motor reduction unit resulting in a table speed range of 10 to 40 ft./min. The necessary accessory to regulate and maintain speed control was also adapted to the system.

A standard dynamometer was constructed to meet specific experimental requirements. Although the concept was not original, the unit was capable of measuring normal (Fn) and tangential (Ft) forces during the grinding operations. The dynamometer had to be sufficiently sensitive to detect the grinding forces for the total experimental range and yet be sufficiently rigid to prevent any system vibration of the workpiece from affecting it. The body was constructed of aluminium and was equipped with Baldwin-Lima Hamilton (SR-4 Type A-8) strain gauges mounted to each of the octagonal ring surfaces. This is shown in figure 2.

The specimen was arranged on the dynamometer, so it alone would interact with the grinding wheel. The workpiece surface was dressed at high wheel speed to remove all surface unevenness and to assure that the surface was parallel to spindle rotation. The grinding wheel was dressed after each test run and the speed was adjusted to compensate for any wheel diameter reduction. A red pencil mark was made along the periphery of the wheel, and the revolving wheel was passed slowly over the diamond point until the pencil mark was no longer visible on the periphery. This insured that the wheel was perfectly concentric with the spindle and a new cutting surface was provided.

The wheel speed was set with a stroboscope. The wheel speed was checked under load to determine if there was any loss of speed during grinding. This preliminary speed test proved that the machine system was capable of grinding with a maximum depth of cut of .005″ without any wheel slippage. This check procedure was also conducted on the table feed to determine if the variable speed motor was capable of driving the table at all grinding conditions whithin the experimental design. After some minor adjustments, all systems were calibrated and the experimental procedure was ready to start.

The experiment was conducted on SAE 4340 Alloy specimens. The steel from the manufacturer had a hardness of 20 Rc. The workpieces were hardened in the laboratory to 52 Rc and rechecked for hardnees before the start of the experiment. A load of 150 kg. and a spheroco-

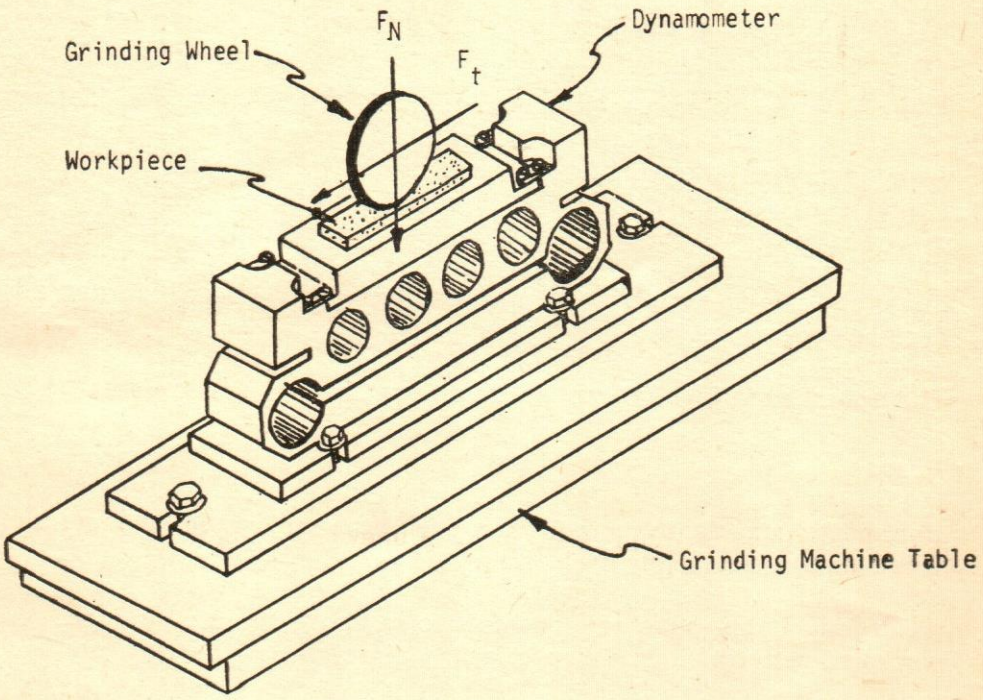


Figure 2 : Two-Dimensional Grinding Dynamometer

nical diamond BRALE penetrator in the required load and penetration setting for the carbon scale readant was used. Six readings were taken on each workpiece surface to verify an average hardness of 52 Rc.

Composition SAE 4340

C	0.38-0.43%	Si	0.20-0.35%
Mn	0.60-0.80	Ni	1.65-2.00
P	0.04 max.	Cr	0.70-0.90
S	0.04 max.	Mo	0.20-0.30

Before the start of the experiment, care was taken that the amplifier recorders were properly balanced. A calibration curve was developed

for three attenuator settings. One used in this experiment (ATT5) is shown in figure 1 b.

A surface analyser, the Brush Model GL 110, was used to determine the characteristics of the surface after grinding. Before any readings were recorded, the workpiece was cleaned with a solvent, and a stylus transducer was positioned on the ground surface. The stroke length of the stylus was .025, having a unit of measure cutoff value of .03. The surface readings were repeated three times in three different locations, and the average of the three readings (RMS) was recorded as the surface roughness.

The actual experimental procedure consisted of the following :

Phase I

Set speeds and depth of cut for a specific wheel grade having a similar wheel matrix except for grain size.

Make only one pass of the wheel to measure the cutting force on the workpiece specimen in an up-grinding direction.

Repeat this one pass experiment for :

—three wheel grades,

(32A 46-H8-VBE) Soft

(32A 46-K8-VBE) Medium

(32A 46-N8-VBE) Hard

—three depths of cut, (.001 inch; .002 inch;.003 inch)

—three wheel speeds (2,000; 2,500; 3,000 rpm)

—three table speeds (10; 15; 20 ft./min.)

The wheel speed of 2,000; 2,500; and 3,000 rpm was based on a 7-inch diameter wheel. If the wheel diameter (7-inch) changed due to wear, the spindle rpm was changed to maintain a constant peripheral wheel speed of 3,663; 4,579; of 5,495 ft./min.

Phase II

Remove dynamometer and repeat the experiment as in Phase I. The readout results in Phase II of the experiment were to gather data on surface analysis and chip analysis. The reason for removing the dynamometer and placing the specimen on a solid surface was to avoid vibration from the dynamometer which would have affected the surface characteristics.

Results

Since cutting forces were initially chosen as criteria for measuring grinding process effectiveness, they were plotted in different ways in order to detect any process trends. The cutting forces, normal force (F_n) and tangential force (F_t), were measured by a strain gauge dynamometer, which was calibrated with various attenuator settings. The grinding force read out was recorded on a Sanborn Model 321, dual channel amplifier and recorder.

To prevent wheel wear and/or possible accumulation of chips within the grinding wheel, only one pass was made at full wheel width with conventional up-grinding conditions and a minimum grinding cycle. In order to provide a fresh cutting surface on the wheel periphery, the wheel was dressed with a single-point diamond before each successive test run. The rpm was adjusted to maintain a constant peripheral grinding wheel speed as the diameter changed due to wheel wear and dressing.

Within the limits of the capacity of the machine and instruments, the results showed that the normal forces (F_n) were always greater than the tangential forces (F_t) for all wheel grades and machine settings used. This is illustrated in figure 3.

If one observes the grinding forces for any three grades of wheels (soft, medium, and hard) and for any given wheel and table speed, the grinding forces increased with increased depth of cut for both normal and tangential forces. This would appear normal since an increase

in depth of cut would result in a greater volume of material to be

The grinding forces were a minimum with soft wheel grades

wheel speeds. If one observes the extreme conditions,

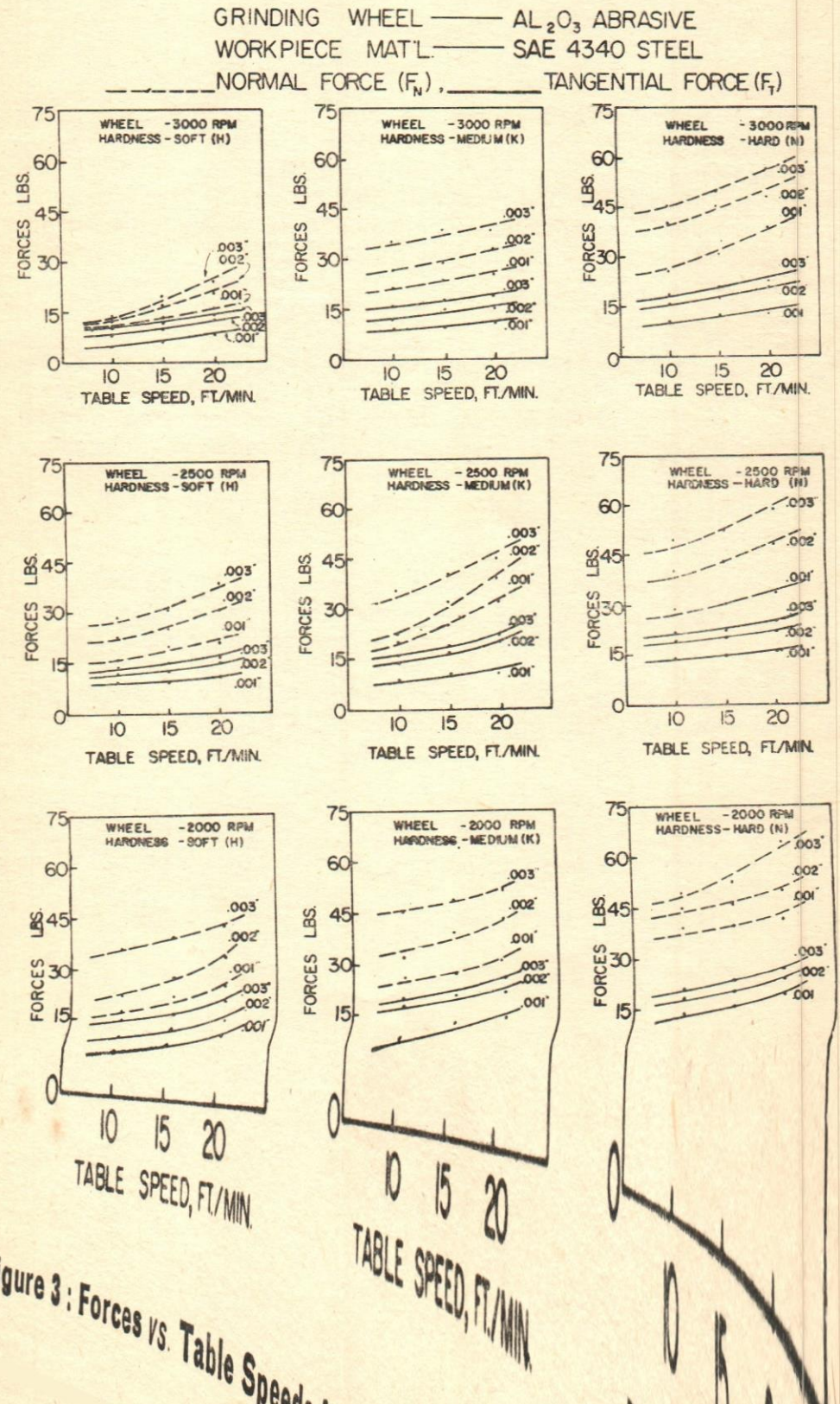


Figure 3 : Forces vs. Table Speeds fo

one can detect that with a hard wheel (N) and the lowest wheel speed, the forces were greater in all ranges. The normal grinding force was significantly more sensitive to wheel hardness than the tangential force. Again, one would suspect that this would occur since the wheel velocity is far greater than the table velocity. This becomes more obvious when one scans horizantally all three depths of cut (.003; .002; and .001 inch). When scanning vertically with wheel hardness constant and depth of cut varied, one can detect a change in grinding forces, but this is not so significant as when wheel hardness is varied.

For various table speeds, there appears to be an increase in grinding forces with an increase in table speed. The increase in forces for all table speeds appears to be generally uniform for all machine settings. However, again the effects seem relatively low, compared to the wheel hardness parameters.

Another of the most striking results can be detected when comparing grinding forces as a function of depth of cut for each wheel grade, table speed, and wheel speed, shown in figure 4, with surface roughness as a function of wheel hardness.

In comparing figure 3 with figure 4 one can now begin to detect specific process trends in surface roughness. In figure 4, surface roughness (RMS) increased with wheel hardness, table speed, and depth of cut. However, if one scans figure 4 horizontally while keeping table speed constant, one can see that depth of cut and wheel hardness play a major role in surface roughness, followed by wheel speed.

Furthermore, one can see that table speed had a minimal effect on surface roughness within the range of this experiment. In other words, it would appear that all these parameters, which normally control process behaviour, affect surface roughness with varying degrees. Therefore, wheel hardness and depth of cut appear to play a major role in determining surface roughness, while wheel and table speeds play relatively smaller roles. This was evident within the range of this study, and if greater ranges could be obtained, these variables might begin to show different behaviour trends.

Grinding (Macro *vs.* Micro)

One of the main objectives was to measure the grinding force in a

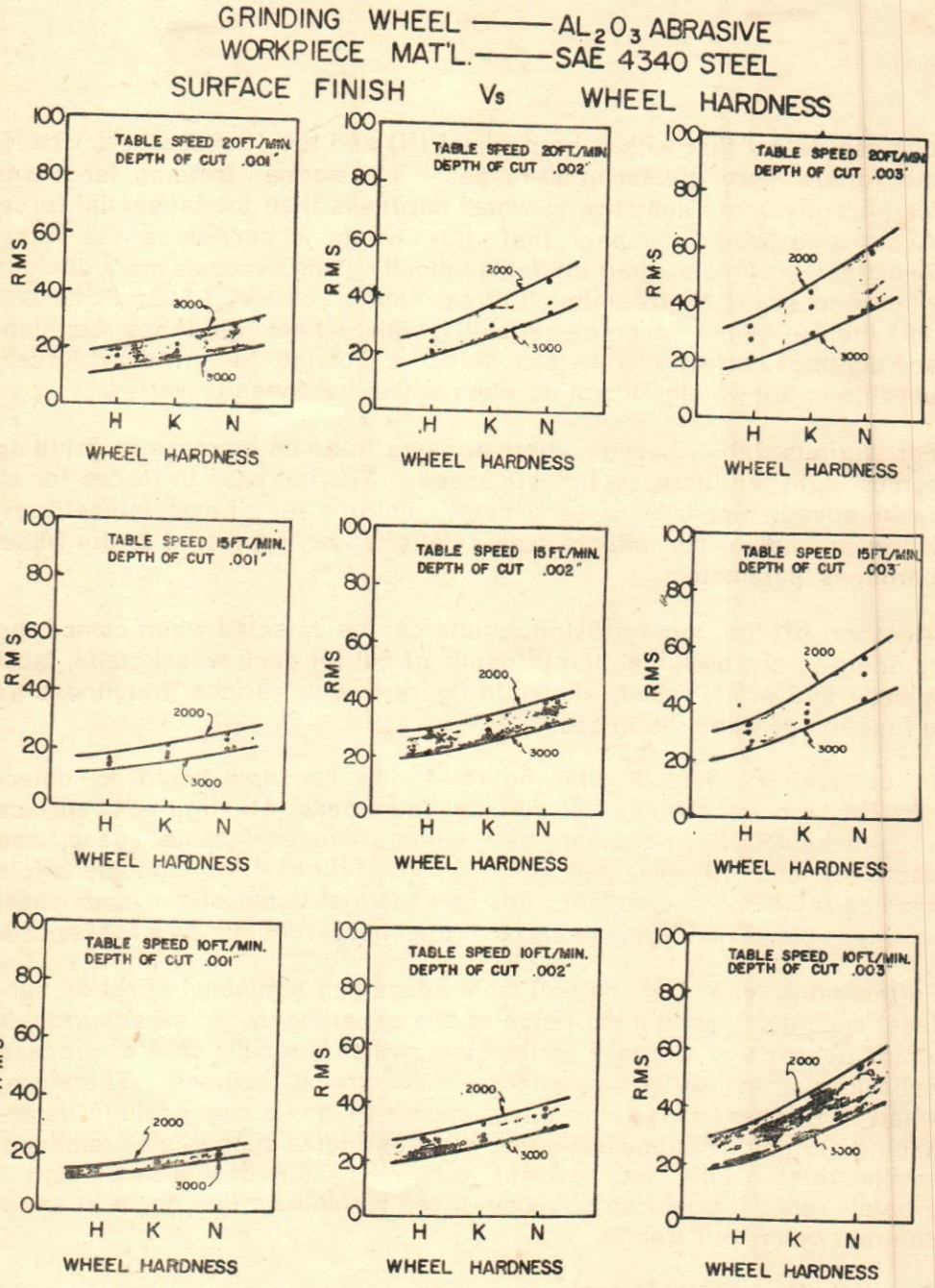


Figure 4 : Surface Roughness *vs.* Wheel Hardness

dynamic condition. To achieve this it was necessary to analyse some of the parameters which are the components of the grinding process. In this investigation, a 7-inch wheel (AL_3O_2) having a thickness of one-half inch was used when grinding SAE 4340 steel workpiece (51 Rc). By replicating the wheel periphery impression on carbon paper, the average number of grains per square inch could be estimated.

In figure 5, the area of contact could be calculated and the number of grits per area of contact could be estimated. Since the dynamometer could only sense the total force exerted by the number of grits at any unit of time, it is possible to calculate what the force would be on a single grit assuming that the number of grits calculated were evenly distributed over the area of contact at any given time interval.

From this, a velocity vector system on a single grit could be developed. This is illustrated in figure 5 where the grit and shear velocity can be estimated.

In addition to developing the velocity vector model of a single grit, a force system model can now be formulated in order to estimate magnitude of order of the process parameters. In figure 6 a typical force system is developed, patterned after a single point turning operation. The force system assumes that one can measure experimentally the grinding forces and utilise these forces ($F_N F_T$) to determine the forces on an individual grit. In this article, no experimental data will be shown showing the micro analysis; however, the emphasis was placed on the macro level of the grinding process.

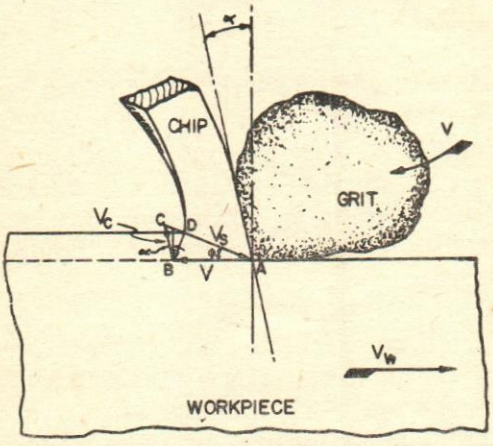
Conclusion

Within the limits of this study the data seemed to show :

1) That grinding forces in general behave logically with wheel workpiece interaction.

2) Whenever there was an increase in grinding forces, there was an accompanying increase in surface roughess.

3) The normal grinding force (F_n) displayed the higher force level

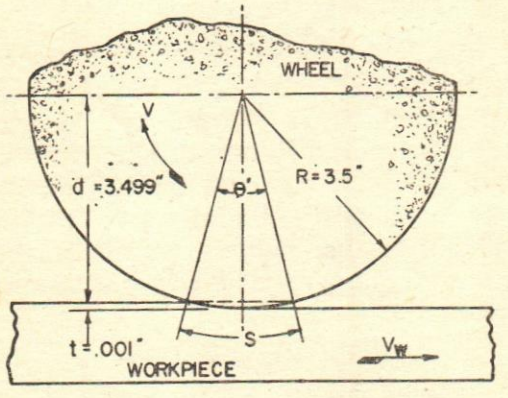


TYPICAL VELOCITY VECTOR SYSTEM

AB = GRIT VELOCITY
AD = SHEAR VELOCITY
BD = NORMAL SHEAR VELOCITY

AB = V
AD = $V \cos \phi$
BD = $V \sin \phi$

WORKPIECE & WHEEL INTERACTION



$\theta/2 = \cos^{-1}(d/R)$, $S = R\theta = D \cdot \theta/2$

$S = D \cdot \cos^{-1}(d/R)$
$= (7.0) \cos^{-1}(3.499/3.5)$
$= (7.0)(.0244 \text{ radians})$
$= .171$ inches

$S/2 = .171/2 = .086$ inches

AREA OF CONTACT
$A = (\text{WIDTH OF WHEEL}) \cdot (S/2)$
$= (.5)(.86)(10^{-1})$
$= .043 \text{ in}^2$

NO. OF GRITS ON A
$N = (330 \text{ grits/in}^2)(.043 \text{ in}^2)$
$= 14$ grits

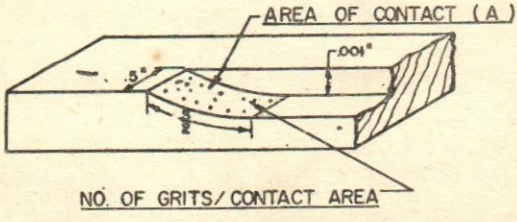
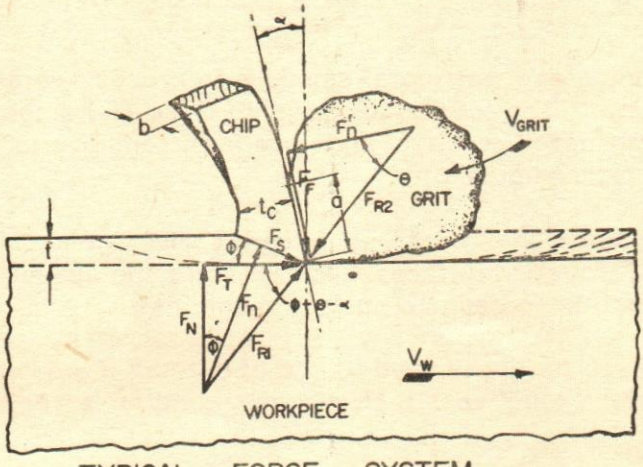


Figure 5 : Workpiece-Wheel Interaction



TYPICAL FORCE SYSTEM

V_{GRIT} = GRIT VELOCITY (fpm)
V_w = WORKPIECE VELOCITY (fpm)
F_{R1}, F_{R2} = RESULTANT FORCES (lbs.)
t = DEPTH OF CUT (inches)
t_c = CHIP THICKNESS (inches)
t_3 = CHIP WIDTH (inches)
Φ = SHEAR ANGLE (degrees)
α = GRIT RAKE ANGLE (degrees)
θ = FRICTIONAL ANGLE (degrees)
F_N = NORMAL COMPRESSIVE FORCE (lbs.)
F_T = TRANSVERSE FORCE (lbs.)
F_F = FRICTIONAL FORCE (lbs.)
r = CHIP RATIO
γ = SHEARS STRAIN (inch/inch)
L = DIMENSIONLESS CONSTANT
a = INTERFACE LENGTH (inches)
b = INTERFACE WIDTH (inches)
A = CONTACT AREA (in^2)
R_1 = % OF SHEAR ENERGY GOING TO CHIP
R_2 = % OF FRICTIONAL ENERGY GOING TO CHIP
q_1 = ENERGY DUE TO SHEAR (Btu/in^2-sec.)
q_2 = ENERGY DUE TO FRICTION (Btu/in^2-sec.)
k = THERMAL CONDUCTIVITY (Btu-in./sec-in^2 °F)
c = SPECIFIC HEAT (Btu/lb.-°F)
ρ = SPECIFIC WEIGHT (lb./$inch^3$)
K = DIFFUSIVITY (in^2/sec.)
θ_S = SHEAR TEMPERATURE (°F)
θ_T = CHIP-GRIT INTERFACE TEMPERATURE (°F)
θ_0 = AMBIENT GRIT TEMPERATURE (°F)
J = WORK EQUIVALENCE (778 ft-lb/Btu)
u_s = SHEAR SPECIFIC ENERGY (in-lb/in^3)
u_F = FRICTIONAL SPECIFIC ENERGY (in-lb/in^3)

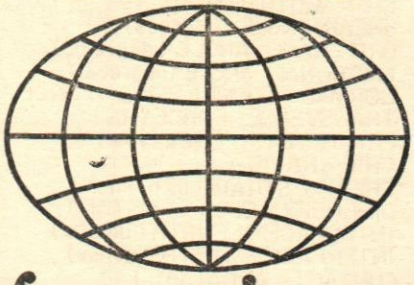
Figure 6: Single Grit Force System

reading and was more sensitive to process parameter manipulation. The tangential grinding force (F_t) displayed the lower force level reading and was less sensitive to process parameter manipulation.

4) Higher wheel hardness generally gives greater force readings and rougher surfaces. Wheel and table speeds had a smaller effect on forces and surface roughness.

5) Wheel hardness and depth of cut had a greater influence on surface roughness than did wheel and table speed. □

There's a



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Strategy for Improving Quality of Indian Products‡

M. V. V. Raman*

Introduction

The basic objective of India's economic development is to provide improved standards of living for its people to lead a good life. It has now been generally recognised that higher productivity in all sectors of the economy leads to higher standards of living. This implies effective utilisation of available resources for production of goods and services people require, at prices they can afford. In this achievement of higher standards of living, product quality assumes a great significance, whether it is purchased by an individual or an industrial concern or for defence purposes. Product quality, its appearance, life, reliability, safety, etc., enters into every activity of an individual, including his protection for internal and external threats. Product quality also enters in a big way in the realm of economic development, because of the need to export products, services and technologies of Indian origin.

The Indian economy during 1975 has shown great improvement and a sense of direction and purpose seems to have been understood. It is now the time to strive for excellence in product quality by deliberate effort, to contribute to the economic development. In the long run quality products are always cheap in price. The chain reaction set by the improved product quality for a variety of items stabilises and consolidates the existing technology making way for developments of new products. It is, therefore, an opportune time to discuss strategies for improving the quality of Indian products to be achieved within a specified period of next 5 or 10 years. Such a strategy should be developed after examining, analysing and evaluating the existing situation from various points of view—Government policy, entrepreneurship, consumer awareness, education level, technological advance and maturity, industrial experience, economic development, political aspirations, cultural background and the need to export and the like. This strategy should also

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lead to increased productivity with an opportunity of providing full employment in the economy.

The present paper, after discussing economic and industrial background, attempts to outline a strategy at both macro and micro levels. The micro-level strategy is the quality control strategy to be incorporated in a quality control system at the unit level. The marco-level strategy represents all other actions that support or assist the unit level quality activity, to be undertaken by Government and other organisations. The two strategies are discussed in the paper and together lead to activities that hasten the improvement of the quality of the products on a permanent basis, leading to product diversification, new product development, and indigenisation, contributing substantially to economic development.

Economic and Industrial Background

When India attained freedom in 1947, the economy was characterised by weak infra-structure and elemental handicaps, without any base for progress in any sector of the economy. The problem of economic development was colossal in magnitude. 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 in economic development and progress.

In order to help strengthen the foundations of economic and social life and stimulate industrial growth and scientific and technological advances, a series of Five-Year Plans have been put into operation since1951. The heavy investments planned in the public sector were intended to create a substantial infra-structure of basic facilities and availabilities power, steel, etc.—for the support and promotion of the mixed economy, the development of which formed, and continues to form, the hard core of the governmental policy. The substantial expansion of the private sector, particularly in the sphere of small industry, that has taken place during the last twenty-five years since Independence, is largely due to expansion of supplies and facilities made available through public sector investments, and the associated increase in purchasing power due to income generated through enhanced public expenditure in the process of development.

Having briefly touched upon the economic background, a discussion on industrial development in this framework, particularly, the quantum, variety and quality of its products, will provide a basis for the development of a quality strategy leading to a full-employment economy. Considering the present problems facing the Indian economy, to talk about full employment may look far-fetched; however, what we are attempting is the development of a quality strategy, taking into consideration not only the magnitude of the population but also other relevant characteristics of the population and the economy. In fact, this is a significant consideration which distinguishes the strategy from those of the more industrially-advanced countries, with their own cultural characteristics and other economic features.

Industrial development, the forerunner of a decent standard of living, cannot take place in vacuum. It requires technological maturity, investment, entrepreneurship and a governmental policy conducive for such development. Starting with almost no technological base, shy capital and poor entrepreneurship, the present-day level of industrial activity is no mean an achievement. However, considering the requirement as postulated in the government policy, much still remains to be done; and considering the process of achievement, a lot more could have been done.

Admittedly, there are many impediments for a smooth progress—lack of consolidation of technology (resulting from poor management and entrepreneurship), need for advanced technology (resulting from lack of research) foreign exchange shortage, etc. However, these are not insurmountable; shrewd businessmanship and appropriate governmental policies could certainly pave the way for progress. In this connection, it should be pointed out that the present industrial development has taken place mostly on the basis of borrowed technology, and not based on our own research, which brings a host of problems along with it. In addition, there are no research divisions attached to industrial units. These aspects have implications with reference to quality, in as much as many problems pertaining to research crop up, which in other advanced countries, would have been solved prior to coming to manufacturing floor.

For a developing country like India, the increasing need for foreign exchange must necessarily be met through increased export earnings for

which quality, price, delivery and after-sales service assume great importance. Further, political and national conditions, as past experience has shown, force the economy to move towards self-sufficiency as far as possible.

As a governmental policy, Indian products enjoy protection from competition from abroad. When any particular product is being produced with reasonable quality, the import of that product is restricted or eliminated to conserve the much-needed foreign exchange. Experience of the use of some of the products has shown that the entrepreneurship in India has more often than not taken this opportunity 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 in those cases. It is a sad commentary to recall that the government had to intervene and appoint committees to investigate complaints against poor quality or abnormally-high prices or impose price restrictions in some 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. Lack of entrepreneurship and the tendency to look to government for providing jobs, have been the causes for not setting up small scale or other type of industries to tap this potential. It is only at the initiative of the government and with their assistance that the small scale industries are being established on regional basis.

The demand for many of the consumer products has outstripped the supply and it is not uncommon to wait for them, in spite of their doubtful quality (at least in some cases) and poor after-sales service. Though the consumer is indignant at the situation, there is nothing he can do about it. In this type of a situation, particularly where there are shortages, neither competition nor quality nor price has anything to do to sell a product. Attention has now been focussed on the problem, but the solution calls for a new strategy, particularly with reference to quality. Obviously, this situation cannot continue.

Huge investments have been made in industry and other services. However, the performance of this sector in terms of quality, costs and profits could be substantially improved. In addition, this sector is also a supplier of raw materials and products which are to be used by other industries and services, whose quality and reliability counts a lot.

Quality Control Status

The quality control movement started quite some time back (around 1959) and there are evidences of its applicability for the betterment of product quality, but it cannot be said with confidence that quality control policies with well-defined objectives and emphasis on the use of all available methods and techniques, have found place in Indian industries for betterment of the quality of products. In the agency of developmental process, quality including its reliability and safety aspects has been a premium. What is more appalling is the lack of forceful propaganda move to show the benefits of quality control programmes in a convincing way to the enterpreneurs.

Quality control in various organisations has not found adequate place, though inspection aspects have somewhat been appreciated. Evidently, a new strategy need be developed which has the force of penetrating top layers of management. Some advocates, in a quality control conference, suggested that government should legalise the quality of products as is done in the case of pharmaceuticals. Of course, this would be an impossible task, and probably would never work; however, the concern behind such a suggestion is to be noted.

Though the consumer is frustrated with the products, he is increasingly expressing his dissatisfaction with regard to quality and price. It may not be possible for the manufacturer to continue to do things which were somehow being tolerated. In addition, the stability and success of the economy depends to a great extent upon exports.

The present concept of quality control that is being propagated in India is Quality-Reliability. Inspection aspects and statistical quality control (SQC) aspects have been well popularised during the last twenty years. The ideas of 'Total Quality Control' have also been well appreciated. The present emphasis on reliability is born out of experience with the

use of products. The consumer's right to have trouble-free products of proven reliability at reasonable prices is the basis for the new thinking. This is forcing the producer to think in terms of product audits, performance in the field and consumer satisfaction, and adjusting his quality control programme to meet this new emphasis. It does not mean that it has gained the popularity with the producers to the extent of introducing reliability programmes in the majority of industries, but it may be expected to be so in the near future. This, of course, is a move in the right direction and obviously should form part of any quality strategy.

From this new emphasis on the product itself and the consumer, the producer has to have adequate quality control programme, as otherwise he may have to face a new crisis in terms of product failure and customer dissatisfaction.

It is generally agreed that the implementation of quality control programme in its fullest sense has not found place in the Indian industries, in spite of the fact that many successful applications have been documented. Obviously, it appears that the projection of quality control as something merely to do with improvements in quality has not caught the imagination of top management and technical personnel. It appears that effective penetration could be made by projecting quality control as 'Cost Reduction' programme, in addition to quality improvement. Limited experience suggests that the inspection and rejection costs could be in the region of 20-25 per cent of the total turnover, and this emphasis should prove effective in introducing quality control programmes in a systematic way. This also then should form a part of quality strategy. Further implications of this *vis-a-vis* full employment are discussed in the subsequent section.

It has been observed that the product development and manufacture has been based on technical collaboration from outside sources. The emphasis has been to introduce products and make profits as quickly as possible (may be nothing wrong from short-term point of view) rather than consolidate technology and use it effectively for quality improvement, cost reduction, and new product development. It is, therefore, appropriate to use quality control programme as consolidators of technology through building of information on products, processes, materials, and field performance using all known methods and techniques. In fact, this strategy would be most suited to the present Indian

conditions. Besides, it lays a foundation for effective modification and diversification which may become relevant with 'consumerism'.

Suppliers' quality has been a major problem in the Indian industry. In fact, much of the product dissatisfaction has been attributed to this cause. Without going into details of this problem, it should be mentioned that the manufacturer has a responsibility towards his product and, therefore, he should play a positive role in finding solution to this problem. Thus vendor relations and their development based on specific steps should be evolved and practised to mutual advantage. These steps should include among others development of clear and realistic specifications, proper quality evaluation, effective communication, and mutual assistance. It is only then a supplier, acceptable (in terms of quality, cost and delivery) to the manufacturer can emerge under the Indian environment. This approach should form part of the quality strategy.

Though a lot of noises are made with regard to quality at all levels, the seriousness with which it is practised in terms of deliberate effort is far from satisfactory at the top levels of the general management. The overall objective of the enterprise should be related to product quality, consumer satisfaction, and continuous development, and the whole organisation should be structured around this objective. The status of the quality control programmes should be elevated, as they have immense potentialities in Indian industries, particularly from the point of view of 'consolidation of technology'.

Though the internal markets have not yet been fully exploited, yet export orientation to Indian manufactures appears to provide the necessary challenge and fosters the quality level achieved at competitive prices. This should remove the idea, which seems to be embedded in the minds of some management and technical personnel, that there are two qualities (or quality standards), one for export and the other for 'internal markets, with differential' 'efforts' and 'treatments'.

Micro-Strategy (Quality Control Strategy)

Based on the above discussions, in summary, the quality control strategy from Indian experience should be based on the following lines :

i) Emphasis on product quality and consumer satisfaction, and adjusting the quality control programme internally to meet this aim;

ii) Emphasis on cost reduction in addition to the quality improvement;

iii) Emphasis on vendor relations and development based on specific steps : development of realistic specifications, proper quality evaluation, effective communication and mutual assistance;

iv) Emphasis on quality by the general management of the company;

v) Raising the status of the quality control programme to operate at a higher level and gearing the functions of other departments to suit this objective; also, to achieve coordination with external agencies—government and other agencies like standards body, research organisations, etc.

vi) Emphasis on the quality control programme 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 and techniques and experience. Obviously, this should be achieved by the introduction of a programme, keeping in view the promises and purposes; the information system to be documented comes from the application of the programme in the area of Incoming Materials Control, Process Control and Product Control, through the coordination of information on various aspects like quality of design, quality conformance and quality of 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.

vii) In fact, this amounts to building a Quality Information System (QIS) capable of providing information at the point of use for decisions on all quality issues, both internal and external, including quality improvement and product and process development, import substitution and the like. The QIS may include all items of strategy mentioned (and include others as well) but for

the purpose of pinpointing a logical and feasible strategy they are itemised independently.

Macro-Strategy

The macro-strategy, namely the Quality Control System, that should find place at the unit level, integrating engineering technology, statistical and managerial principles, leading to improvement in product quality and at the same time achieving cost reduction through QIS has been discussed. The development of such a system would be the responsibility of individual units. However, it should be emphasised that development of such a system is greatly assisted and hastened by an appropriate macro-strategy, as development of such a system in individual units has interface with many external factors. These are beyond the scope of individual units and it is suggested that organisations like National Productivity Council, Directorate General of Technical Development, Indian Standards Institution and Indian Statistical Institute should take the lead in collaboration with research bodies, universities, professional associations and chambers of commerce, to create a quality movement in the country. This movement, together with the productivity movement, already in full swing, will enable the economy to be strengthened and grow faster. The macro-strategy may be interpreted to mean all external factors that have an influence in the successful development of an effective quality control system as implied. These could be external pressures (e. g. consumerism), economic need (e. g. exports), or external support (e. g. research and development). A broad indication may be given as under :

(i) Mass education programmes in quality control methods for industrial personnel —workers, supervisors, engineers, middle and top management to provide the needed understanding and implications of quality of products.

(ii) Education programmes for consumers through the media of radio and television to make them appreciate the fact that quality products are cheaper in price and safe in the long run; to educate them in the 'use' of the products.

(iii) Development and publication of abundant quality control literature—applications, case studies, manuals both general and specific, on

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ways in which you could have improved your original specification. Machine tool designer, like architects, must appreciate that whereas machine tool or a house is to them a transient problem, it is to the user or occupier a permanent feature of his everyday life and ask the machine tool industry to help him to be wise before the event rather than after the event."[2]

Before buying a new machine tool, either for a new enterprise or for replacement, it would not be a wise practice to take a decision based only on the catalogue.

It is now widely accepted that machine tool industry is perhaps the most diverse industry in the world. More often, the users criticise the machine tools manufacturers for not producing the right type of machine tools which may meet their specified requirements. But unless the users are prepared to accept the exhorbitant prices and the long delivery schedules for the machine tool, designed and manufactured to suit their individual requirements, a compromise has to be made (1).

Performance of the machine tool means the yardstick by which we can measure the ability to produce economically the desired change of components. Economies of production/machining are determined by two factors:

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industry, that appeal to various levels of management.

(iv) Undertaking empirical studies, particularly in the area of quality losses and quality costs in each individual unit or on industry-basis to appreciate the quality problems from cost considerations.

(v) Research studies which would contribute towards understanding quality-motivation.

(vi) Establishment of research cells in individual units to assist in product development, indigenisation as well as in solving quality problems that may arise in day-to-day operations.

(vii) Uplifting the level of technology in the country by research efforts in national institutions and universities towards the improvement of quality of products on a continuing basis.

(viii) Government policies, as the largest purchaser to influence the

1. Time unit cost or machine hour rate,
2. Process time, generally known as floor to floor time.

The first factor depends primarily on utilisation, labour cost, general running cost, maintenance cost and depreciation cost. The latter depends on metal removal ability to produce desired quality, ease of operation, tooling techniques and suitability.

These two depend on many considerations. We would generally like that the machine tool must be ideally suited to the manufacture of our product, must have inherent qualities in the design to promote high metal removal rate during the roughing stage of the machining process together with more refined qualities and characteristics compatible with financial consideration. Besides, if we add the other requirements, the machine tool must cover the maximum range of product size and variety. The end result is the machine tool of a very high cost. It must also be recognised that many among the modern machine tools are produced with plants considerably older and less accurate than the plant of the new machine itself. It is really a super-craftsmanship to produce an accurate product from an inaccurate machine.

With due consideration to the various factors, both in respect of the new machines for replacement and for new enterprises, better collaboration between producers of machine tools and better appreciation of each other's problems will ensure more rapid progress of the industry and the country at large.

Selection Criteria

The reasons for the purchase of a new machine tool can be grouped as follows :

1) Where there is an imperative need which may be due to any of the three factors, namely, (i) the necessity to replace the old machine which is wearing out, (ii) the need to increase production, and (iii) introduction of new projects.

2) Where machines are bought to increase financial return on capital employed and to contribute towards profitability of the user.

Selection of machine tools depends on both technical and economical considerations (5). Technical considerations imply that the various factors including the reliability and maintainability should be taken into account. The machine tool itself should be considered along with the ancillary tools and other controlling equipments as a package system because if any one unit of the system cannot be used then the maximum efficiency expected of the machine tool will not be obtained.

As regards profitability, according to reports published by the Machine Tool Industry Research Association, the total cost of machine could probably be cut by 20% if machine tools were properly matched to the work that they have to do. In this connection, reference is being made to an interesting study in a firm in Bombay, with more than 100 lathes. The study revealed that lengths of most of the jobs which were machined on those lathes were of one-third the capacity the lathes could accommodate. It clearly shows that unless the manufacturers are in close contact with the users to study their problems, proper selection of machine tools cannot be made.

The factors influencing purchase of a machine tool may include the following : (6).

1. Available funds for investment by the firm;
2. Expected future orders;
3. Policies of the Government;
4. Availability of machine tool, delivery date, price, etc.
5. Policy of the Company;
6. Cost of labour and its availability;
7. Attitudes of shopfloor people;
8. Utilisation level of shopfloor people;
9. Accuracy and intricacies of the components;
10. Set-up time and floor time;
11. Batch sizes;
12. Multi-shift working and the existing machine tools.

The area of selection lies actually on quantifying the acceptable alternatives and arriving at a logical choice by the process of elimination. There are various economic models available, which could be applied

with advantage for selection of the right kind of machine tool.

In a developing country like India, there are limitations of capital investment both in terms of indigenous money and foreign exchange. The high interest rate would also limit the borrowing of capital for any investment. While investing for more sophisticated machine tools, the wages of labourers in Indian conditions must be brone in mind, because an Indian labourer gets paid much less as compared to his counterpart in developed countries. A choice has, therefore, to be made between a less costly, simpler machine tool with cheap labour and a sophisticated machine tool with high investment, costlier labour, and in some cases, involving import. We should also consider the maintenace aspect of the machine tools which we are going to purchase. A machine tool has generally a life of 20 years, during which period it requires 3 to 4 major overhauling due to which its reliability during the remaining period goes down. Overhauling time also depends on the maintainability of the machine tools. There is need to study the maintainability and reliability of machine tools and the information available through such studies may be compiled through a data bank for being utillised by the machine tool designers to effect suitable improvment in their designs.

The old concept of "operating the machine till failure" has been proved to be irrational in the light of the objective of keeping more machines available for use at a point of time. The designer, the manufacturer, the user and the repairer all share the responsibility of keeping a machine operative at the time of need. The modern approach, in this context, gives due emphasis to maintenance considerations from design to disposal ("womb to tomb" approach) stage (4).

The following paragraphs discuss the salient features of maintenance of machine tools which should be pursued by the users in collaboration with the manufacturers.

Maintenance of Machine Tools

Generally maintenance costs are important elements in general production; but it is found that the maintenance is not given the consideration it deserves in the design stage of the machine tool. We often hear: "this

machine tool is so well-designed that it will not need any maintenance." In real situations, however, one does not find a machine tool which does not need some kind of maintenance (8). And yet, the designer should make endeavour to design a machine tool which requires as less maintenance as possible and can be carried out with minimum of downtime. Those components which are critical as far as maintenance is concerned should receive particular attention of the designer at the design stage itself. If the designer could identify the components and the sub-system requiring frequent attention to keep the machine operational, overall maintenance time of the machine tool could be reduced by adopting "design for maintenance" approach. One pioneer machine tool manufacturer in the country has eliminated the use of grease gun by making lubrication system entirely automatic in one of the models of lathe. The design has facilitated easy dissipation of heat. Further, using new hydraulic version for automatic adjustment of clutch and brake, preloaded Gamut bearings placed in honed bores for avoiding any adjustment and generating a vibration-free running, the same machine tool manufacturer had improved the performance of the machine tool, while at the same time reducing the chances of its frequent repair. The design is also featured by separate mounting of brake, pump, electrical motor and electrical systems which help simplify maintenance tasks.

Fault correction in machine tools can be carried out at several levels. Of course, choice of level would depend on the type of component and type of organisation. The levels are: (a) routine maintenance, (b) minor repair, (c) medium repair, (d) emergency repair, and (e) major overhaul. While designing the machine tool, the objective before the designer should be to minimise the frequency of such actions by increasing reliability of the machine tool.

Concepts of Reliability in Design

A designer can simplify the problem of maintenance by increasing the reliability of the machine. The effectiveness of a design can be assessed by measuring the reliability of the item designed. The term reliability is defined as "the probability of a device to perform its purposes adequately for the period of time intended under the operating conditions encountered". Mathematically it is expressed (3) as

$$R(t) = \exp\left[-\int_0^t \lambda \, dt\right]$$

where λ = failure rate

t = mission time

Some idea of reliablity of the device can be obtained from its MTBF (Mean Time Between Failure) where MTBF $= \int_0^\infty R(t)\,dt$.

More the MTBF, more reliable is the device.

If a machine is composed of several components having their individual failure pattern and failure of any component causes the failure of the machine, then the reliability of the machine is given by

$$R_s = \prod_{i=1}^{n} R_i$$

where R_i = reliability of the component,

n = total number of components

It can be shown mathematically that MTBF of the machine is less than the MTBF of any component. A designer can reduce the problem of maintenance by reducing the frequency of failures which, in other words, would mean increasing the reliability of the machine. The above task can be carried out with the following methods :

1. Reducing number of components to a minimum.
2. Wherever possible, trying to provide redundant components so that the load coming to a component is shared, thereby its failure rate is reduced.
3. If possible, using better components with lower failure rates.
4. Using safety factors for mechanical components and derating principle for electrical and electronic parts, in order to reduce stress generated on the component.
5. Trying to reduce environmental stress on the machine to a minimum.

Maintainability Considerations in Design

A machine may appear to be sound as far as the reliability considerations are concerned. But since no machine is perfect for infinite operation, one can expect the occurrences of failures which can be estimated from its MTBF. Whenever the machine fails, repairs are to be done and in order to make the machine available for operation, such repairs must be done promptly. The time required to complete repairs depends largely on the design of the system and organisation of the repair activity. As such repair time can be divided into two components —active repair time and the organizational time (10). The active repair time will be composed of inspection and fault detection time, and time to carry out the actual repair. If the location of the failed component causing the failure of the machine tool is such that more time is spent to identify and reach the component, the active repair time would automatically be more. The quality of the machine which enables one to complete repair/maintenance actions quickly is known as maintainability. It is defined as the probability to complete repair action within a given time. It is indicated by maintainability function or by the MTTR (Mean Time To Repair). The designer must have before him both the maintainability and the reliability considerations so that overall downtime can be reduced. The following example would explain this:

If m/c A has MTTR=3 hrs with a reliability=0.9 for 10 hrs of operation time during its useful life period then one would, expect one failure in every 100 hrs of operation time. There is m/c B for which failure rate =·05/hr with reliability=0.6 for 10 hrs of operation time and MTTR=2 hrs. One would expect a total downtime of 300 hrs/year for m/c A. From availability considerations m/c B is superior to m/c A since the saving of downtime for B is 33% over A in a year consisting of 2000 operating hrs.

After a certain stage, any increase in reliability can be achieved only by substantially increasing the costs. At this stage, increase in maintainability would be a better proposition than increase in reliabilty. The designer of machine tools may, therefore, bring in the concept of increasing the availability of the machine tool by choosing a suitable combination of MTBF and MTTR of components (9). The Availability Index of any machine can be defined as

$$\text{Availability Index} = \frac{T_o}{T_o + T_R} = \frac{\text{Operating time}}{\text{Operating time} + \text{Repair time}} = \frac{1}{1 + \sum_{i=1}^{n} \frac{l_i}{T_i}}$$

where,

l_i = repair time for the ith component,

T_i = time to failure of the ith component.

The designer's aim should be to increase this Availability Index. This Index should be calculated on the basis of machine's entire period of operation, or at least of a period equivalent to the length of its maintenance cycle. One can follow the following principles in order to increase the availability (combination of reliability and maintainability).

1. The machine tool must have high resistance to external influence. The units and mechanisms which make it up must be sturdy. The number of components should be less but strong enough to withstand loads and vibrations. Friction surfaces should be protected from dirt. Anti-friction materials should be used for friction couples.

2. Precision mechanisms must be protected from shock and other harmful influences.

3. Materials with low coefficient of linear expansion should be used where temperature deformations are possible.

4. To prevent corrosion, special coatings, paints or additives in oils and coolants should be used wherever needed.

5. Latest-developed materials for wear resistances etc., should be used.

6. The machine tool should be located in a temperature-and-moisture-controlled room. The room may also be insulated against vibration. In certain situations, the room should also have dust control facilities.

7. The machine tool should have the feedback system which would

provide automatic regulation of parameters of machine. There should be some circuit breakers to prevent overloading. There should be some built-in indicators, whenever corrective action is needed.

8. The location of the components in the machine should be such that the one which fails frequently has greater accessibility than the one having less frequency of failure.

9. Wherever possible, the modular design should be used for the machine. This would facilitate the replacement of the failed module with a new one.

10. Standardisation and interchangeability principles must be introduced which would enable quicker replacement. It is expected that a machine tool designer should use, as far as possible, all standard items for fastening, clutches, etc., so that during the maintenance operation, the maintenance man requires less number of gadgets to handle and can use standard parts as are readily available in the market, for replacement.

11. Use of colour codes for the purpose of identification should be made for easier replacement work.

12. The design and configuration of the machine tool should be such that it does not pose any safety hazard for the maintenance personnel. Suitable handles can be provided while handling heavy items.

13. The manufacturer must provide necessary test gears and tools so that while disassembling the unit, less time will be spent in searching for tools.

14. A comprehensive and well-written workshop repair manual which clearly brings out all steps for assembly and disassembly, the checks necessary to ensure the serviceability of components, etc. Various clearances and tolerances should be provided and tools required should be supplied by the manufacturer to the user. A fully-exploded view of the machine and its subassemblies should also be supplied. This would help in carrying out quick and correct maintenance.

15. Since for greater mechanisation in the machine tool more of the electrical and electronic components are to be used in large numbers and reliabilities of these components would influence the durability of the machine tool, it is desirable to go in for selection of better materials and technologically-sound components.

16. There should be an organised system to feed back the information on failures of machines to the manufacturers, so that 'design-use-design' becomes a continuous process.

17. For ease of design and manufacture of machine tools, a data bank of failure rates and maintenance requirements of components of various sizes, types, materials can be developed. For electronic items such data in the form of MIL Handbook are already available, but for mechanical components the same are not available and efforts can be made towards its development.

18. The service engineers of the machine tools manufacturers will not be able to cater to needs of the users of their product. The manufacturers should consider offering training programmes on maintenance of machine tools where the users could send their maintenance people to be trained to gain knowledge on locating faults and effecting quick maintenance.

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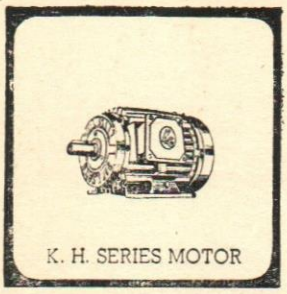

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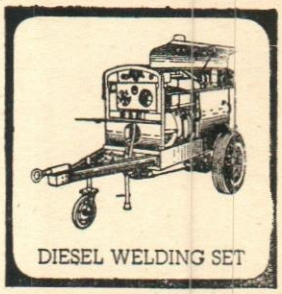

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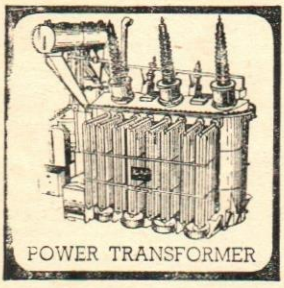

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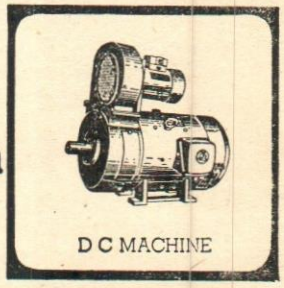

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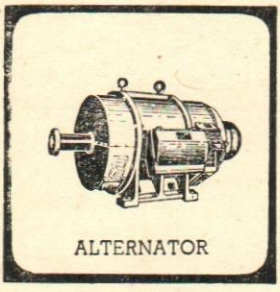

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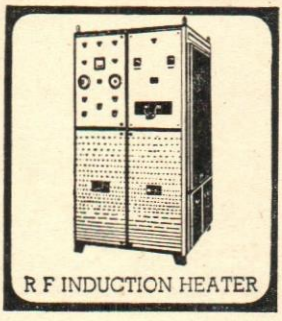

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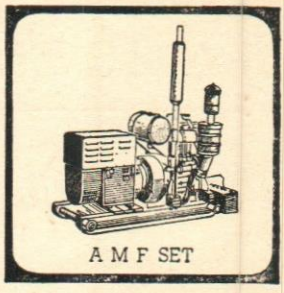

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Productivity Dynamics

Durgesh Chandra*

Production and Productivity

All working people, be he a farmer, carpenter, blacksmith, technician, engineer, nurse, doctor or surgeon, trade union leader or government official, shop-keeper, businesman or an industrialist, are interested in productivity. When any person strives to make a better life for himself and his dependants, he must rely on higher productivity more than harder labour. Higher productivity would benefit each and every individual irrespective of whether he is self-employed or is employed by a small or large organised industry in public or private sector and in turn bring national prosperity. In simple language, higher productivity means prosperity; it means to produce more and more outputs from less and less inputs; it can be measured as the ratio of output to input.

In any industrial undertaking, inputs consist of materials, machines, money, motive-power, and man-power. Output can be evaluated in terms of value of goods and services produced. What comes 'out' of the factory as a saleable, useful product is commonly termed as 'Output' and what goes into the production as 'Input'. Productivity refers to a comparison between the quantity of goods and services produced and the quantity of inputs made in turning out these goods and services. It is convenient to compute inputs and outputs in terms of money to measure productivity and if productivity is to be increased for the benefit of all—those employed in the industry, the consumer and the national exchequer—the activities in any industry must be done well and efficiently. What do we do in any industry ? Raw materials are purchased from the market outside and brought to the factory; people come to work from outside; electrical energy is either purchased from the power supply company or fuels are purchased from outside and converted to electric power in the captive power plant; machines are purchased from outside and the goods produced are sold to outside market. Thus everything seems to be coming in or going out of the factory and in the factory a conversion process takes place when raw

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materials are converted into goods of higher value and better utility and sold as finished goods. Productivity aims at performing this conversion efficiently and it generates economic gains many times more than the cost of effort put in to raise productivity. It can be done by increasing the value of output or reducing the cost of inputs.

How to Increase Productivity ?

Productivity in an industry can be increased by improving human skills, constructive efforts, and methodology by employing improved technology, the need for which is great in developing economy of underdeveloped nations. In any industry, productivity can be enhanced by adopting any one or more of the following three courses, either singly or in combination with the others :

1. Reduce the value of inputs by eliminating wastes.
2. Increase quantity or quality or both of the output.
3. Modify the system so that by a small increase in input larger benefit in output values are obtained.

National Productivity

For industrial usage, it is convenient to use money values of output and input, but for national consideration, one is interested to know as to how the people of a country as a whole are faring in the productivity field. The agricultural product quantity of wheat may Increase from 23 million tons to 25 million tons in a year, but if the population in the same period is also increased from 580 million to 650 million, the availability of wheat per person would be poorer. As such, at national level, it is customary to measure productivity with the entire population as input and value of all goods and services produced as output, commonly known as Gross National Product.

$$\text{National Productivity} = \frac{\text{Gross National Product}}{\text{Population}}$$

$$= \text{Per Capita Income.}$$

Per Capita GNP in India is Rs. 670 (at 1970-71 prices). When compared to some of the European countries and Japan, it does not present a happy picture.

PER CAPITA GNP IN SELECTED WEST EUROPEAN COUNTRIES AND JAPAN

Countries	*Per Capita GNP (US $)*
Belgium	2,960
France	3,360
Italy	1,860
Japan	2,130
Netherlands	2,620
United Kingdom	2,430
West Germany	3,210
Average per Capita GNP	2,546 = Rs 19,097
As compared to India	= Rs 670
U.S.A	4,424 = Rs 33,181

(1 US $ = 7.5 Rupees)

The standard of living of the people is dependant upon the national productivity and it can be observed from the above figures and as verified by actual existing conditions that the spectre of poverty looms large in our society and even today two-thirds of our population live below the poverty line. This proclaims the urgent need to raise national productivity which can be achieved by—

1. Firmly checking the population growth, the importance of which cannot be over-emphasised,
2. Increase of national productivity,
   (a) by improving the skills and productivity of today's working population,
   (b) by increased industrialisation to provide employment to today's unemployed, the available workforce.

'India is well endowed in natural resources. Compared to a country like Japan, which has to depend for most of the raw materials on imports from foreign lands, India's natural resources are vast and varied. The country has got extensive deposits of coal and iron-ore and a large potential of oil and natural gas. There are plentiful supplies of other

minerals and vast stretches of thorium sands. The country has also got considerable forest resources. The Indian farmer is a sturdy worker and has taken well to innovative methods and use of improved seeds, fertilizers and pesticides. If the vast water resources of the country are properly contained and utilised, he can well meet all the expectations and demands of a growing population. Since independence a number of new industries, large scale, small-scale and ancillary, basic and consumers, have come up both in the public and private sectors. The public sector industries are mostly large, basic and key industries. Indigenous and imported technology has reached a level where huge plants can be manufactured and run by Indian engineering and technical personnel. The country has ample funds of managerial expertise and business enterprise. Vast capital resources can be generated within the country and additionally imported.'

'The woking population today, if given proper vocational training, can provide a large army of mechanics, fitters, welders, electricians and other skilled workers, to serve as a backbone to an expanding economy. Gainfully employed, this workforce, with rising incomes, can provide a vast assured market for the country's consumer industries. What is needed is the earnest drive towards higher productivity. Even if by the year 2001 we aim to achieve what other developed nations have already achieved, we would have to strive for 14% annual economic growth rate with contained population.

Table 1 below gives per capita consumption target for some of the selected items to give an insight into the quantum of industrial development that should be feasible and achievable.

Table 1

PER CAPITA CONSUMPTION OF SELECTED ITEMS

	1971	*2001*
A INDUSTRY		
1 Crude Steel (Kgs)	14.0	370.3
2 Cement (Kgs)	26.9	457.4
3 Aluminium (Kgs)	0 4	8.5
4 Newsprint (Kgs)	0 4	16.4
5 Paper & Paper Board (Kgs)	1.8	50.8
6 Population per Automobile	44.4	4.7

		1971	*2001*
B	**ENERGY**		
	1 Coal (Kgs)	130.0	2760
	2 Crude Petroleum (Kgs)	36.2	828
	3 Electricty (Kilowatt hrs)	109.0	2883
C	MASS COMMUNICATION		
	1 Population per Radio receiver	46	3.4
	2 Population per Television receiver	12500	17.7
	3 Population per Telephone	424	4.4
D	HEALTH		
	1 Total Calories per day	1990	3500
	2 Population per hospital bed	1655	97.3
	3 Population per physician	3689	600
	4 Population per nurse/midwife	3408	300
E	EDUCATION (Nos. in millions)		
	1 Pupils in Classes I to V	59.35	58.83
	2 Pupils in Classes VI to VIII	13.44	33.86
	3 Pupils in Classes IX to XII	7.28	68.07
	4 Pupils at the University stage	2.51	31.98

It is obvious that the annual growth rate of GNP of 3 to 5 per cent, as hitherto achieved, will have no tangible impact on the life and living standard of the people. A much larger leap is vital in the industrial growth to meet the aspiration of the people for a better living. In a developing country where there is a large number of people unemployed, it is all the more essential that expansion of production is given high priority in the national activity. But here too, productivity required to generate the requisite surplus of the output over the inputs sufficient to attract and motivate people is of prime consideration and would help improve the national economy at accelarated speed. The productivity movement always generates productivity consciousness in all sectors of national life and it is only possible by training and development of people, utilisation of science and technology and improved methodology in organised industrial activity.

Sources of Higher Productivity

If we look at an industrial plant as a system, the inputs would consist of materials, energy, and labour and outputs consist of finished goods, waste energy, and waste materials.

To increase productivity, the objective of the industrial manager is to keep the costs of the sum of energy and materials and labour as low as possible. In many electrolytic processes, the energy cost is a considerably large part of the total cost and not much choice may be available in the kind of energy to be used, while in other cases outgoing waste energy in the form of heat is often neglected. It is more common to collect waste materials and feed it back to the industrial process but the energy once wasted is difficult to recover. With increasing cost of energy, it is advisable to prepare energy flow diagrams to show quantity, form, source and quality of energy required or produced in the process and this data can be analysed to identify areas where substitution or alternative process will promise increased efficiency or where energy can be transformed or reused. It is sometimes possible to use heat energy from one process to another or transform it to electricity.

I—HUMAN CAPITAL

Human Capital is the basic element of any development plan of a country and the quality of labour in terms of productivity explains the difference among countries in levels and rates of growth. When one kind of labour is more productive than another, it is more valuable and earns more. In fact, we can measure the quality of labour by its price or earnings which tend to equal its value in productive capacity. In some parts of India we can employ a person for Rs. 5/- per day even today, whereas in United States minimum wages for manual labour would be Rs. 15/- per hour. When we talk of the quality of labour, we mean a number of complex characteristics. The output of a worker depends upon the strength, energy, and his willingness with which he applies his knowledge, skill and adaptability to the given task. A willing and conscious worker can get along well with less supervision. In many cases, the cost of the supervision is a major part that is avoidable.

'He that hath a trade hath an estate', Ben Franklin advised young men in stressing the need for training. Education and training help improve labour productivity. "Output per manhour" or "Labour productivity" can be increased by the development of skill of the workmen by well-tailored and job-oriented training. Total human resources include not only manpower, measured simply by number of manhours, but it also takes into account the intangible capital employed in education and

training of the workmen. In normal course of economic development, output per manhour rises as a result of skill development and proper training. It will not be true to say that more number of years spent at school or colleges is essential for higher productivity. Education is a costly merchandise and can only serve to add impressive epitaphs against the name of a person if it is not need-based. An educated civil engineer would not be able to lay bricks in a construction job as nicely as a skilled mason; a qualified automobile engineer will not be able to service his own car as good as a trained station attendant. Formal education is often replaced by informal training on the job. You would come across many a good welder who has not gone to a training school but has learnt the trade while working with other welders.

II—TANGIBLE CAPITAL FOR HIGHER HUMAN PRODUCTIVITY

The yield per manhour can be increased by employing tangible capital invested in equipment, tools and tackles, material handling systems and machinery. Indian workman is unduly criticised for poor productivity. He cannot do much with his two bare hands. When he is required to do drilling and making holes in a mining operation by chisel and hammer, with all his energy, devotion and hard work, he can make small holes and use gunpowder for blasting, the output in open-cast limestone mines is 2-3 tons per day. For the same operation if pneumatic drills are employed, several holes 100 feet deep can be made in a few hours and, with the use of high power explosives, 2-3 thousand tonnes of materials can be collected in the same period of time. Such plant and equipment, tools and tackles, and mechanical means employed with the human labour can be termed as 'Tangible Capital' and it would be more meaningful to evaluate "Output per unit of labour and Capital" or briefly "Total Productivity" and not mere output per manhour. The manhours required for unit production is shortened with the use of tangible capital. The statement below gives productivity figures for India as compared to some other countries :

STEEL		*CEMENT*	
Country	*Tonnes/Man-year*	*Country*	*Tonnes/Man-year*
Japan	200	USA	1400
West Germany	150	Japan	1200
France	150	U.K.	1100
India	60	India	190

ALUMINIUM	
USA	200
Canada	125
Japan	95
India	25

SUGAR	
USA	450
Puerto-Rico	400
Philippines	120
India	24

AIRCRAFT

	No. of Man-year/Jet plane produced
USA	115
France	150
U.K.	180
India	1400

These statistics are likely to indicate that our productivity per person is very poor and our workmen are likely to be blamed for not putting proper effort. This is not so when we check with "Total Productivity" in view. If, along with the number of man-years put in, we examine the tangible capital employed and intangible capital invested in their training, tangible capital per man is a very poor figure. The U.S.A. leads all nations in the field of productivity since the tangible capital employed there is large. In the U.S.A., one does not see anybody lifting or carrying heavy weights any more. Fork-lifts, elevators, conveyors, hay-loaders, bulldozers and motor trucks—tangible capital—share the load. Such substitutes for human labour are used by us also, but not to the extent and not in such large volumes, as in other countries. The amount of tangible capital per man-hour is only 2 per cent of the United States level. Low level of productivity is thus explained and is associated with scarcity of the tangible as well as intangible capital. To increase the productivity, we need to cover this "technological gap".

Manpower is the basic resource as all other resources like materials, money and machinery are products of human labour. Poorly-utilised or unutilised manpower resources of a country seriously hamper its economic development. Lack of skill, social inhibitions, indolence, unemployment, lack of education and traning constantly retard national progress. If a man consumed more than what he produced, some section is bound to fall below subsistance level. Besides, a large number of anti-social problems tend to develop and mar the national character. The answer to the problem lies in making people more and more productive. Unless continuous and determined efforts are made in this direction, with the rapid growth of population, the GNP may even register a fall.

It is not the material resources that increase productivity. Japan has very meagre material resources, yet by paying continuous and sustained attention towards improving the efficiency of manpower, has attained an unprecedented rate of economic growth. This is what we have to do for our survival, for our economic growth, for improving the standard of living of our people, and for taking the rightful place in the comity of developed nations by the year 2001, if not earlier. Any scheme for manpower development is never too early to begin. The scheme has to conform to the physical needs of a particular nation, and must necessarily bring about higher productivity in all fields of national activity and should be dovetailed into the existing cultural pattern of the society. In our case, agriculture deserves specific emphasis.

III—AGRICULTURE AND MANPOWER DEVELOPMENT

Some people erroneously believe that agriculture does not offer as much scope for raising the level of productivity as the industries do. They surmise that agriculture is typically characterised by a low rate of productivity growth and diminishing returns as new marginal lands are brought under cultivation or as the soil of the land is exhausted. They consider agriculture as a less-intelligent avocation and with all the toil and hard labour put in, it would comparatively contribute less to national economy than the productive industrial units. The experience in several countries, including USA have shown that by proper training and education of the farmer and improving technological and material inputs for agriculture, spectacular rise in the level of national productivity is possible. When 80 per cent of our population is rural-based and depends on agriculture in some form or the other, increase in agricultural income would bring about well-diffused benefits serving the cause of socialistic pattern of society and better results would be achieved when industries and servicing organisation develop closer links with agriculture. The Indian farmer would have to make use of extensive modern agricultural inputs like mechanised farming, ploughing, plating and cropping, proper seeds, seed farming, use of fertilizers, pesticides, proper irrigation facilities and upkeep of plant and machinery. In this context, service organisations will need to be geared to offer timely service. Also, agricultural manpower will need to be trained in the use of these inputs.

Agriculture offers direct employment to more than 150 million people and if any impact on national income is to be felt, their incomes have to be improved. Out of 160 million hectares of land under cultivation and sown, only 30 million hectares is irrigated and remaning part has to depend entirely upon unpredictable rain. During the years rainfall is good and satisfactory, the farmer is happy, but when the monsoon fails, he is hard hit. About 130 million hectares yield only one crop a year. The land per person in the countryside is decreasing from 1.18 hectares in 1951 to 1.08 hectares in 1971. The agriculture does not provide a wholetime job. Most of those who work in villages, do so only for a few months in a year. The seasonal nature of agriculture, only one crop in a year, and paucity of subsidiary occupations are the casues of widespread rural under-empioyment.

If the objective to improve the in-built employment potential of the rural sector is to be fulfilled, the farm productivity has to be increased. This is possible by the adoption of new cropping patterns required for the use of high-yielding varieties of defferent food and cash crops and extension of areas under multiple cropping, and by providing irrigation from more major, medium, and minor irrigation works.

The consumption of fertilizer is indicative of a country's agricultural productivity. This level of fertilizer consumption per hectare of agricultural land in our case, as compared to some of the Asian countries, is as under:

Table 2

FERTILIZER CONSUMPTION

(Figures in Kgs/Hectare)

Country	*N*	P_2O_5	K_2O	*Total*
China (Taiwan)	189.58	44.12	68.63	302.33
Japan	136.76	105.10	104.95	346.81
Korea	122.34	51.95	30.46	204.75
India	6.87	1.66	0.92	9.45

By proper education and understanding, the farmer can be made to accept the programme of cooperative farming, pooling of land, and joint cultivation. The productivity can be increased manifold by mechanised farming, provided small and uneconomic cultivators are prepared to join their land and their labour.

IV—TECHNOLOGICAL IMPROVEMENTS

With rapid progress of science and technology in the service of mankind and its application in developing new processes of production, the developed countries are going ahead at an increasingly faster rate and the developing contries are lagging behind, thus widening the 'Technological Gap'. For economic survival, it is essential to ensure that this gap is reduced in as short a time as possible. Sometimes we continue to operate old plant and obsolete technology even when they have ceased to be economical proposition by themselves, because of resistance to change advanced from many sections. This is primarily due to lack of innovativeness more than anything else. The plea advanced is that the primitive technology is more labour-intensive and helps solve unemployment problem.

Employment is to be provided by more industrialisation, new factories, new openings and not by employing two people where work can be done by one. It is necessary to appreciate the difference between rise in production and rise in productivity. Rise in production is often accomplished by increasing productive unit whereas rise in productivity aims at producing more from the given assets at the expense of lesser input resources. The former envisages more work while the latter examines more intelligent way of working. For productivity rise, output-input ratio must be improved by techno-managerial innovativeness. Whereas increasing production is helpful in giving more employment today, productivity movement is a **must** for sustained economic growth and future industrial development.

At times, resistance to technological change is presented as a solid dead wall by trade unions who view such improvements as labour-reducing gimmicks. The rationale of productivity benefits in terms of better utilisation of material and human resources and acceleration of tempo of economic activity in general leading to a further growth and more employment opportunities, can be brought home to them. The productivity rise stands for creation of a higher level of surplus in the output over the input than before. This surplus is distributed and results in prosperity to the employees of the productive unit and the consumer and the national economic prosperity. The rationale of Labour Unionism should ensure that fair portion of Productivity Surplus is passed on to workmen.

V—ENERGY CONSERVATION

Energy is the capacity to do work and is the basic resource and input for economic development. It means something to all of us. To the housewife it is the commodity she buys as kerosene, gas, and electricity for lighting the house. To the engineers, it is the heat for industrial furnaces or the motive power that drives the machinery. To the economist, it is a key ingredient for national prosperity. The standard of living of the people of any country, the growth of its economy, and its power to improve the national prosperity can best be measured by how much and how best it consumes energy and its energy resources. Today the United States which is the highest in per capita productivity consumes one-third of world's energy with 6 per cent population of the word. The sole characteristic is its huge appetite for energy for industrial consumption. The commercial energy consumption in USA is 11.130 tonnes of coal equivalent, while consumption in India is 0.189 tonnes only. It can be inferred that when we have such a low demand on energy and still we have power shortage and non-availability of fuel oil due to its high import price and improper supply of indigenously available coal due to transportation difficulties, we face a great problem in improving GNP of the nation. The consumption of energy influences the national production and income and to reach the contemplated targets, we must have abundant energy as cheaply as possible.

The industrialisation of a country has always resulted in changes of traditional energy sources. What fuels we use and how best we use them is indicator of a country's economic and industrial progress. Advanced countries do not any more use any "non-commercial" fuels such as firewood, vegetable waste, and dung. They use 'commercial energy sources' like coal, oil and natural gas. We still use these non-commercial fuels to the extent of 35% of our total energy requirement. Wood was the source of energy of the eighteenth century. It was slowly reduced by coal, followed by natural gas and oil which are more convenient fuels to burn. It appears from the historical facts that in every 50 years span of time a new and more-convenient fuel has been found and after a decade or two we would be able to exploit a new fuel—nuclear energy or solar energy. Even today the entire economy of Middle-East countries is dependant on their oil reserves. It is important in this context that our research is directed towards the search for new fuel. The solar energy is abundantly available from an inexhausti-

ble source and when this is commercialised, it would be the cleanest fuel with no fear of pollution in its use, which would be a necessity of the future if this planet is still to remain inhabitable.

An abundance of energy is synonymous with high standard of living and a healthy national economy. In the crisis of shortage and inadequate availability, the efficiency with which energy is produced and also the efficiency with which it is used would both help redress the problem. By increasing the efficiency of energy production we can increase the supply and by more-efficient use of energy we can reduce the amount that is needed.

On an average, 70-75 per cent of the energy is wasted in its production and use and the first step in any productivity movement is to reduce this waste. The largest energy savings and the easiest to accomplish can come from its use in domestic and commercial sector, transporation, and industrial utilisation. In India, we consume about 60% of total energy in domestic sector, 17% in transporation, and 23% in industrial and agricultural use. With the increased industrialisation, these figures would tend to even out and would need equal attention in our drive towards energy conservation and efficient utilisation.

In production of energy, another breakthrough can come from the conversion of municipal waste and refuse garbage, agricultural waste, and all other solid waste to energy. It is not difficult to generate steam for industrial use from such waste. At Sangus, Massachusetts, USA, a steam-generating plant using 1500 tons per day of waste is set up. Techniques seem to be feasible to convert this waste into synthetic fuels and the most promising processes are : Hydrogenation Process developed by Herbert R Appell and Irving Wender of Bu Mines Pittsburgh Research Centre; Pyrolysis process developed by Garrett Research and Development Company, California, USA; and production of methane by bioconversion through digestion by anaerobic bacteria. This certainly would be better use of such waste than landfills and other conventional methods of disposal. Bombay and its suburbs alone produce 2000 tonnes/day of such organic and inorganic waste.

Gains of Productivity

Productivity rise does not take place automatically. One has to work for it, making the most purposeful and [illegible]

'feel' of the machine with their fingers and listening its heart-beats through a piece of metal rod. However, it is more of an art than a science. Human faculties face serious limitations in certain cases, particularly for sensing the vibrations. At low frequencies the fingertip sensations are prone to feel normal vibrations as excessive, whereas at high frequencies the reverse is true. The inference drawn is that although human tactile senses are indeed very sensitive, yet they are deceiving indicators of machinery vibration. Moreover, when the stakes are too high, i.e., the machines involved cost millions of rupees (leaving aside the losses due to downtime) it is worthwhile to have a reliable system which can sense and analyse the parameters more accurately and rapidly.

Vibration Analysers

It has been realised since long that rotating machinery ailments manifest themselves in terms of vibrations and human faculty of touch for sensing the vibrations has serious limitations. The early attempts to measure vibrations in quantitative terms were by using vibrographs based on mechanical amplification of the vibrations. Later on, with advancements in the science of electronics, vibrographs were developed utilising electronic methods. The vibrographs give reliable readings of overall vibrations, but are incapable of pinpointing the cause of vibration.

The latest on the scene are vibration analysers which can not only measure the level of vibration but can also lead us to pinpointing the cause of vibration, besides being capable of doing other functions such as speed tracking or dynamic balancing, etc. These analysers work on the basic concept that each defect in a rotating machine produces vibration at a frequency characteristic to this defect. The vibrations produced by a rotating machine are quite complex and the job of the analyser is to analyse and break up the overall vibration into its component frequencies. An interpretation of this data can lead to the cause of vibrations. To make an analogy, the analyser can be compared to a radio set. A rotating machine is like a big State having several radio stations. The radio stations can be labelled as coupling, blading, gear box, vanes, unbalance, misalignment, etc. All these radio stations are sending out their own signals at their own frequency. The analyser is simply a radio which when tuned to the gear mesh frequency would

give the amplitude of vibrations emitted by the gears, whereas when tuned to the unbalance frequency, it would give the amplitude of vibrations produced by unbalance.

Vibration Analysis Technique

The technique of vibration spectrum analysis comprises of several activities such as selecting a suitable transducer and analyser, acquisition and interpretation of data and maintaining a data-bank. Some practical information for these activities is briefly given as follows :

Transducers : A transducer or 'pick-up' is a device used for sensing the vibrations. It converts mechanical energy of vibrations into electrical signals which can be sensed, amplified and measured by suitable electronic circuitry. All the transducers available today fall into one of the following three types :

i. Displacement Transducers

ii. Velocity Pick-ups

iii. Accelerometers.

Their characteristics and usefulness differ and hence selection of the proper transducer requires a basic knowledge of their principle of working and limitations.

Displacement Transducers : These are known by various names such as displacement transducers (or probes), eddy probes, non-contacting probes or proximity probes. As these names suggest, this transducer senses the changes in gap between two surfaces or the displacement of one with respect to the other. These probes are most popular on the continuous monitoring devices fitted on turbines and compressors. This type of probe consists of essentially three components as shown in Fig. 1.

—Probe

—Signal Conditioning Driver

—D.C. Power Supply

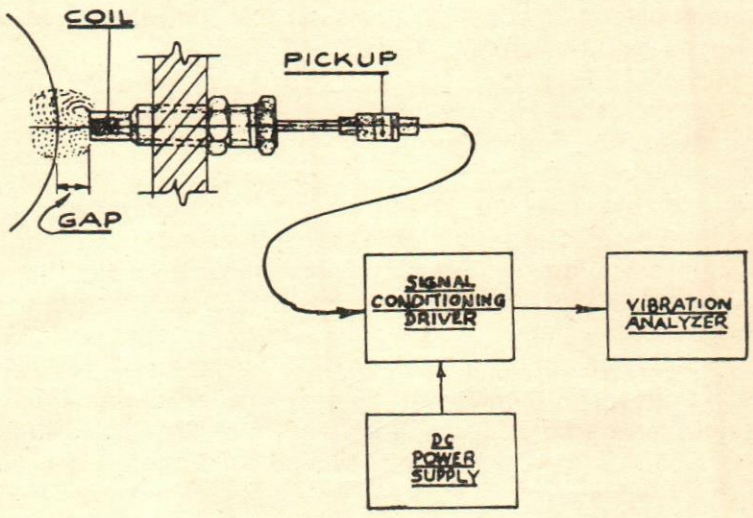

Fig. 1 : Noncontacting pick-up

The probe is mounted rigidly on the casing and the gap between the shaft and the probe is set. The signal driver generates a very high frequency (radio frequency) AC signal called the carrier signal. This RF signal is applied to the pick-up which contains a small coil in its tip. This signal produces a magnetic field around the tip of the pick-up. When any metallic object (in this case the shaft) comes within the range of this field, small eddy currents are set on its surface. These eddy currents create a power loss in the carrier signal which is measurable. Thus when the gap between the two surfaces (probe and shaft) changes, it produces a corresponding change in the amplitude of carrier signal also. The changes in the gap on account of vibration are detected as an AC signal which can then be fed to the analyser for analysis. Since the probe is always used along with a monitor or analyser, the DC power supply unit is generally incorporated as a part of the monitor system. Their sensitivity is around 200 mV per milli inch of displacement (peak-to-peak) and the response is linear over a good range of gap (around± 30 mils).

Velocity Pick-up : This is known as seismic pick-up also and senses the velocity of the vibrating object. It is very popular with portable vibration meters and analysers because it does not require any driver or a D.C. source of power. The pick-up is held in contact with the vibrating object and the output from it can directly be fed to an analyser.

Fig. 2 shows the diagrammatic construction of a velocity pick-up. As shown, it consists of a coil of fine wire, supported by springs with low stiffness. The coil is suspended within a strong permanent magnet which is attached rigidly to the case. When the pick-up is brought in contact with a vibrating object, the magnet follows the vibrations of the object (being in contact with it) whereas the coil remains stationery in the space. The relative motion between the coil and the magnet produces a voltage in the coil which is directly proportional to the rate of relative motion, i.e., vibration velocity.

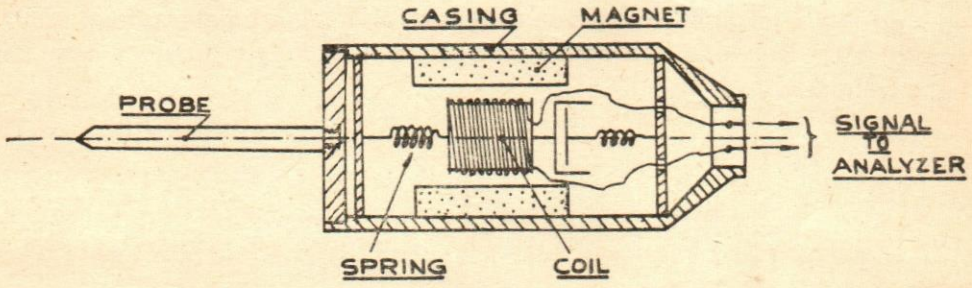

Fig. 2 : Velocity Pickup

The sensitivity of this pick up is constant only over a specified frequency range. At low frequencies the pick-up output drops exponentially. Secondly, the pick up may require re-calibration once a year or so because the strength of the permanent magnet may change with passage of time.

Accelerometers : The accelerometers can be termed as newcomers to the field of vibration transducers. They consist of a 'piezoelectric' material (natural or synthetic crystal or ceramic material) which produces an electrical charge when a force is applied on it. Since force is proportional to the acceleration (force = mass × acceleration), the transducer measures the acceleration of the vibrating object, hence the name. Construction principle of a typical accelerometer is shown in Fig. 3.

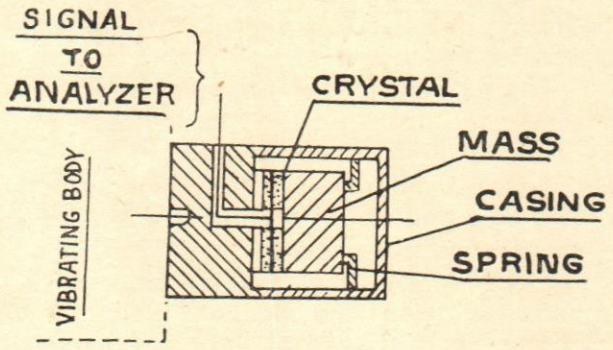

Fig. 3: Accelerometer Pick-up

The output of an accelerometer is very small. It requires an amplifier and a DC power source in order to make the signal strong enough to be sensed by the analyser. Some types of accelerometers have built-in amplifiers. Because of their construction, the accelerometers are very light weight and compact.

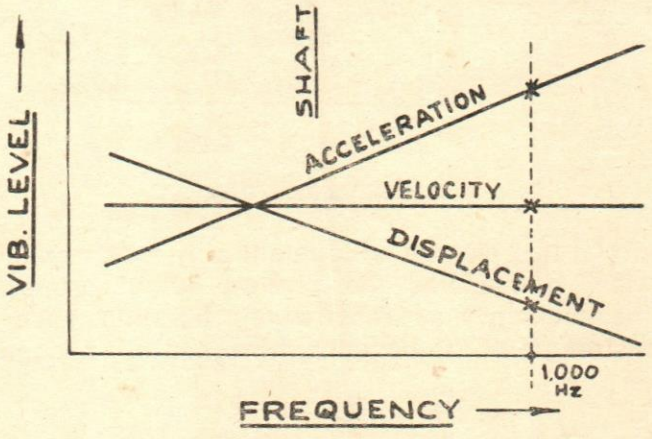

Fig. 4: Response Relation Between Acceleration Velocity and Displacement

Choosing the Correct Transducer

The relative response characteristics of the three types of transducers are shown in Fig. 4. It can be seen that for low frequencies the output

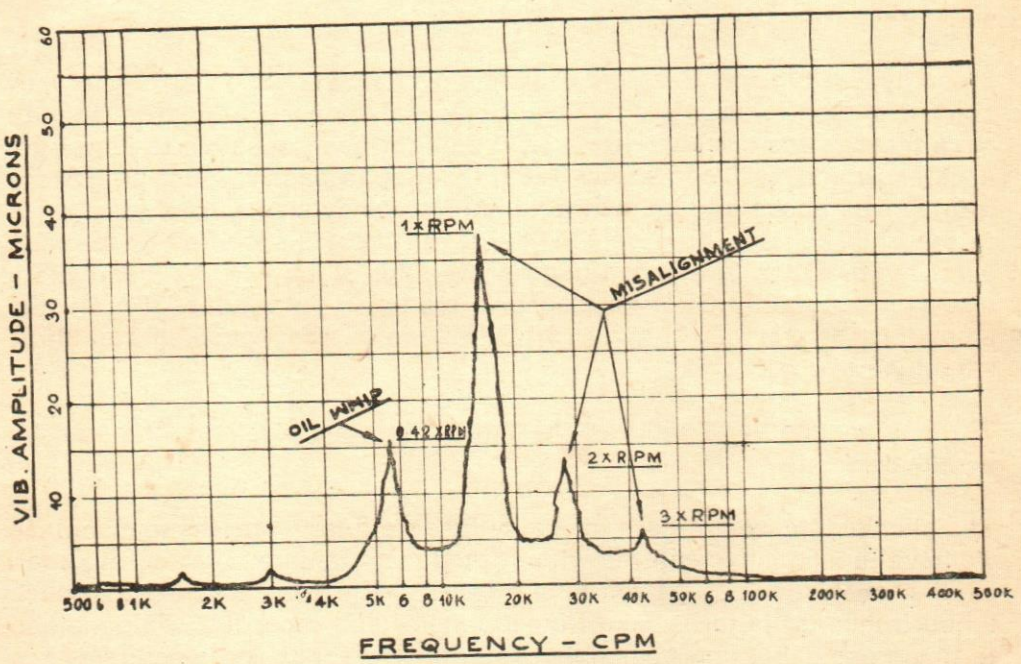

Fig. 5 : Typical Centrifugal Compressor Vibration Signatures

of proximity probes is higher, whereas at higher frequencies the output drops. In a reverse way, the output of accelerometers is low at low frequencies but increases with the increase in frequency. Because of this, the accelerometers are particularly suitable for measuring the vibration of gears, anti-friction bearings and high-speed turbines, etc. The advantage with a proximity probe is that it measures the shaft vibration relative to the housing. It is particularly useful in the case of relatively-light-weight rotors (such as of centrifugal compressors) mounted in heavy massive casings. In such cases, because of mass impedence there may be little outward evidence of rotor vibration even though the rotor may be vibrating excessively.

The seismic type pick-up has the advantage of being both rugged and portable. Thus depending upon the frequencies to be expected and the nature of the machine involved, a suitable choice can be made.

Choosing the Right Type of Analyser

Many types of analysers are available in the market. In principle, they consist of electronic filters which allow only a particular frequency to pass through the circut. However, it has not been possible to construct a filter which will allow only one frequency to pass through it. Some frequencies above and below the tuned frequency also will always pass through. The rejection sensitivity of a filter is specified by its band width. For example, a broad-band width filter of say $\pm$ 5% band width when tuned to 1000 CPM (cycles per minute) would allow 70% of the amplitude at 950 CPM and 1050 CPM also besides passing the 100% amplitude at 1000 CPM.

The sharper the band width of the filters, the more reliable the results would be.

The simplest analysers have manually tunable filters. In these machines we have to manually scan the whole frequency range by turning the knob of the analyser just as we tune a radio. The peak amplitude at each tuned frequency is to be read from the meter and recorded. This method is time-consuming and human errors in tuning for peak amplitude and recording can creep in.

The next better models available also have manually tunable filters but allow a semi-automatic analysis by jacking their output to a X-Y recorder which gives us a amplitude versus frequency plot. Thus the time spent in fine tuning at each frequency and human errors in reading and recording the data are elminated. An example of a typical plot obtained on a compressor is shown in Fig 5.

The next better models incorporate electronically-swept filters which automatically tune the filter and record the data on a X-Y recorder. Some models of this type have a facility of RPM "tracking" also which "locks" the analysers filter to the shaft speed, thereby eliminating errors due to transient speed changes.

The above models incorporating tunable filters suffer from the limitation that each filter requires a response time and hence at one particular instant we get the picture of one particular frequency only and remain ignorant about the amplitude at other frequencies at that particular ins-

This fact limits the tunable analyser to analysing the steady state conditions only. Transient phenomenon cannot be analysed by these. This limitation has been solved by developing real-time-analysers. These analysers incorporate specially developed circuitry to time compress the signal spectrum and the amplitude versus frequency data for the entire spectrum is displayed instantaneously, on an oscilloscope. Since the events are sensed, analysed and displayed as they are occuring without a time lag, these analysers are known as REAL TIME ANALYSERS. The analysis is automatically and continuously updated to show what is happening to the vibration spectrum of the machine. Permanent record of the spectrum can be had by a high-speed camera or an oscillograph.

In certain cases, the analyser is also handicapped in pinpointing the cause of vibration because it cannot differentiate between an exact subharmonic and a vibration frequency that is slightly different. The problem has, however, been solved by the researchers by developing instrumentation for harmonic analysis.

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The choice of a particular type of analyser is dictated by one fundamental question. Can the package reduce the maintenance costs and downtime enough to pay for its cost and yield profits? The principal factor is, therefore, of economics. It would not be advisable to acquire a RTA (real time analyser) package costing around say Rs. 5 lakhs for the predictive maintenance of a pump costing Rs. 50,000. However, the author's experience has been that for the present Indian conditions, a portable, tunable anlayser with semi-automatic/automatic analysis accessories is a sound investment for the predictive maintenance of process plant rotating machines. This package may cost around Rs. 60,000—70,000 but, for the reasons enumerated above, it is worth its cost.

Interpretation of Data

When the necessary data have been acquired with the help of analysers, the next step is interpretation of data which is a difficult part of the vibration analysis technique. This consists of finding answers to the following two questions :

1. What are the factors causing vibration ?

Table I—Vibration Trouble Shooting Chart

S. No.	Prominent vibration frequency in terms of RPM	Most likely cause	Other Possible Causes	
			Causes	Distinguishing Features
1	2	3	4	5
1	1 x RPM	Unbalance (normally radial but overhung rotors cause axial vibration as well)	i) Misalignment or bent shaft	Distinguished by the presence of high axial vibrations also. Whether the vibration is due to misalignment or a bent shaft can further be differentiated by phase analysis.
			ii) Eccentricity of pulley, antifriction bearing, gear, motor armature etc.	Look for these causes if the vibrations do not disappear after balancing the rotor.
			iii) Bad Drive Belts	The amplitude is quite often pulsating. The belt appears "frozen" under a strobe light.
			iv) Electrical problems	Note the vibration pattern when the power is switched off. If the amplitude disappears the instant power is switched off, the cause is electrical.
			v) Reciprocating forces	Are inherent in reciprocating machines. Can only be reduced by a better design or isolation.
			vi) Resonance	If the severity of above defects is low or negligible but the vibration amplitude is excessive, look for resonance.

1	2	3	4	5
2	2 x RPM	Mechanical loosenees	Misalignment	Confirmed by presence of high axial vibration also
			Bad Belts	The bad belt appears "frozen" under a strobe light
			Reciprocating forces Resonance	
3	3 x RPM	Misalignment	Bad drive belts	
4	Sub-harmonics of shaft RPM exactly 1/2 or 1/3 x RPM etc.	Journal bearings loose in housing	i) Bad drive belts ii) Sub-harmonic resonance iii) "Beat" vibration	The belts would appear "frozen" under a strobe light
5	Slightly less than 1/2 x RPM around 42% to 48%.	Oil Whip	i) Bad drive belts	" " "
6	Electrical mains frequency (50 c/s or 3000 CPM)	Electrical problems such as broken rotor bars, eccentric rotor, unbalanced phase in poly-phase system, unequal air gap etc.		The amplitude of vibration dropes the moment power is switched off
7	Very high frequencies, quite often at impact rates of antifriction bearing components.	Damaged antifriction bearings		
8	Very high frequencies at tooth-meshing rate (No. of teeth x RPM)	Damaged or worn gears		
9	Blade or vane passing frequencies (No. of fan blade or No. of impeller vanes x RPM)	Aerodynamic		
10	Shaft critical Speed	Hysteresis whirl		
11	High frequency unrelated to running speed	External sources	Cavitation Recirculation Rubbing	

2. What is the severity of the defect ? Is it safe to run machine in this condition ?

Identifying the Frequencies : The defects causing vibration can be located by critically examining the vibration spectrum plot. This requires a thorough understanding of the construction features of the machine being investigated. To start with, the first two or three most significant readings of amplitude are selected and their correlation with the running frequency is established. Table I gives a list of some of the common defects and the vibration frequencies produced by them. Taking guidance from the table, one can pinpoint the probable cause of the vibration.

Identifying the Severity : Once the causes of the vibration along with the amplitudes produced by them have been established, the next step is to decide whether the vibrations are normal, high or alarming ? Does the fault need immediate correction or it can wait till the next planned shutdown ? For helping the engineer in this regard, several standards are available. Prominent among them are :

1. VDI 2056 : 1964 — Criterion for Evaluation of Mechanical Vibrations of Machines. (VDI—German Engineers' Association).
2. BS 4675 : 1971 — A Basis for Comparative Evaluation of Vibration in Machinary.
3. ISO-2372 — Mechanical Vibration of Machines with Operating Speeds from 10-200 rps. Basis for Specifying Evaluation Standards.
4. ISO-2373 — Mechanical Vibrations of Certain Rotating Electrical Machinary with Shaft Heights Between 80 and 400 mm.
5. ASME Paper 67-PEM-14 — Vibration Tolerances in Industry.
6. AP1-617 — Clause on Centrifugal Compressor Vibrations.
7. DIN 45665.

However, it must be borne in mind that the limits prescribed in these standards should be taken only as a guideline. No vibration standard can specify a limit to which the vibrations may reach before a failure occurs. The object of these standards is not to tell how much vibration a machine will take before failing but to give a fair warning of incipient problem so that corrective measures can be taken before the failure occurs. Care must also be exercised to see whether the vibrations are of the shaft in relation to the housing or of the housing itself in relation to space. The bearing housing vibrations have no fixed relationship with the shaft vibrations. The relationship may vary from machine to machine and also on the same machine from one frequency to the other. It is difficult to place too much confidence on the limits of vibrations of bearing housing or the machine casing because in these cases the vibration amplitude is a function of mechanical impedence which may vary widely from machine to machine. The dynamic response of the machine should, therefore, be kept in view while assessing bearing housing or casing vibration amplitudes.

A better approach is to lay more emphasis on the trend of vibrations than the absolute values of the amplitude. For knowing the trend, the best bet is to keep a record of the machine signatures taken at regular intervals and to compare these with the original signatures of the machine taken when it was known to be in good condition. By experience gained from the behaviour of a particular machine, or similar machines elsewhere and by taking guidelines from the standards, permissible limits for each machine can be established. The general experience is that a machine fault requires rectification when the vibration level increases to 2 to 3 times (6 to 10 dB) the normal level.

Conclusion

Vibration analysis techniques can serve as a valuable tool for the predictive maintenance of rotating machinery. Initially the utility of the programme may be found to be a bit limited but as the personnel gain experience and the data banks are built up, the techniques would be found more and more useful. It may not be out of context here to mention that the vibration analyser is not a magic box. It is only a tool developed to aid the engineers in carrying out the diagnosis work. Its usefulness depends on the skill and knowledge of the person using it. If used skilfully, the

vibration spectrum analysis techniques serve as an invaluable aid to the maintenance engineers in optimising maintenance activities and reducing downtime. □

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A Work Study Programme for Job-Shop Machining Operation: Drilling as Example

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Introduction

It is no exaggeration to assert that problems of maintaining sound standards far overshadow those of developing sound standards in the first place. Therefore, developing and maintaining sound standards is probably the most difficult and continuous problem with which the industrial engineer has to cope with. In fact, such a problem does rate high among the most frustrating problems of industry. Intrinsically, correct time standards development is fairly a complex process if precision is accepted as the judgement criterion. However, all time standards are peculiarly the result of arbitrary decisions, not necessarily random or irrational, but arbitrary nevertheless. In developing time standards, it is essential to select a base. Once this base is selected, the test of validity and reliability of this standard is the degree of consistency with which it relates to all other standards embodying the same basic concept. The intent of the paper is not to explore the implications and ramifications of this, but to present the detailed analysis of a test programme for determining operational time for a machining operation, namely, drilling.

The manufacturing system which has been undertaken in the project, disussed in this paper, is a job-shop type production system where there are wide variabilities in relation to customer's design, product specifications, materials uses, etc. For example, a shop which manufactures products like pressure vessels, heat exchangers, etc., require several tube plates, flanges, and baffles. These components essentially require drilling as the most vital and primary operation. Furthermore, various materials like stainless steel, mild steel, cladding material, etc., are required for functional purposes and the thickness of such plates vary in wide ranges. Also, various sizes of holes and in large numbers, to meet specified design criteria, are required. The study of the drilling operation to develop suitable rational standards is considered important with a view to making effective pre-production planning and scheduling.

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Further, it is observed that for different types of materials the selection of the machine tool, the fixturing, and the machining conditions which include speeds, feeds and cutting tools, etc., constitute a complex process. There usually exists a wide latitude of speed, feed, cutting tool and fluid combinations, all of which will satisfy the minimum surface quality conditions required by the blueprint. The objective of the manufacturing engineer then is to arrive at a combination of machining conditions which make it possible to machine the part at the lowest cost and the highest production rate.

Validity of Time Formula

The operational time required to drill a hole can be functionally related by the equation :

$$T = F(D, t, M, S, f, \alpha, \beta, \gamma) \qquad \ldots\ldots(1)$$

where

T = Time required to drill a hole
F = Functional form
D = Drill diameter (size of the hole)
t = Thickness of the material
M = Hardness of the material
S = Speed of drill
f = Feed of drill
α = Angle of drill trip
β = Relief angle of drill
γ = Heat transfer of lubricant used.

When we possess information on these concomittant variables it is natural to seek a way of expressing the form of the functional relationship and testing the desirable strength of the relationship. In other words, we not only seek a mathematical function which tells us how the variables are interrelated, but also seek to know how precisely the value of one variable can be predicted, if we know the values of the associated variables. In such an analysis, it is necessary to postulate some alter-

nate functional models and then to find out which alternative gives an optimal fit. This type of analysis can be approached in two different ways : the deductive and inductive or inferential. By deductive approach we build up a model as a logical consequence of a set of initial facts. The procedure requires that we deduce the consequences of our premises or preliminary equations. The inductive approach, on the other hand, refers initially to a set of observations about how a process behaves or what it looks like, and attempts to reconstruct or infer the nature of the underlying mechanisms that cause the process to behave as it does.

Although these approaches, are very much scientific and often proved beyond doubt in physical and allied problems, and yet science often fails when the basic variables and basic mechanisms of a process are not known with certainty. Therefore, we can develop the hypothesis that just because a definite model has been constructed and a specific mathematical procedure followed, it is fallacious to assume that the causal relationship exists among the variables. Therefore, what is needed is intelligence, as well as perception, keen judgement and a sense of values in identifying the absolute requisites of the situational factors.

Equation 1 involves several variables. Within the limits of possibility, the possible outcomes of the interactions and conflicts of the variables may be either quite complex or often computationally interactable. For generalising the model, therefore, we cannot resort to mathematical expediency at the cost of process realities. Whether it is worthwhile to spend the extra effort over analytic procedure may only be an academic research exercise.

When wide variabilities are involved in the job-shop for drilling, the mathematical analysis has got certain limitations. For example, the hardness characteristics of materials will decide the selection of machine variables like drill angles, speeds and feeds, and sharpness of the drill. An arbitrary selection cannot be made for generalised modelling. An attempt may be made to have a constrained analysis so as to arrive at a near optimum condition. The constraints may be identified on the following lines. An increase in drill speed beyond the range for the work material results in the production of fewer holes before regrinding becomes necessary; conversely, a lower speed permits the

cutting of more holes. The most efficient speed produces highest hole production at the lowest drill costs including the cost of sharpening the drill and associated downtime. The ideal speed depends on a number of variables like (i) composition of work materials, (ii) depth of hole, (iii) cutting-fluid efficiency, (iv) type and condition of drilling machine (maintainability), (v) hole quality specifications, and (vi) difficulties of set-up. Similarly, the selection of proper feed is also important because of the fact that higher feeds will permit producing more holes and the basic limitations that prohibit the arbitrary selection of feeds are associated with (i) characteristics of chip formation, (ii) life of tool and hence the associated costs, (iii) hole quality characteristics, (iv) heat generation and transfer characteristics while cutting, and (v) cutting fluid efficiency.

Since, as mentioned earlier, causal mechanisms of a process are not known with certainty the constrained situations that we have perceived and identified are very much uncertain in nature and they are sometimes interacting and often conflicting. Therefore, our developed hypothesis in earlier paragraph is having ample amount of inductive evidence of validation.

Holistic Approach

Since in this project we pursue the objective of achieving a systematic interrelation of facts involved in developing sound standards, it is telt, therefore, to devise an approach by way of experimentation, observation, and logical arguments from the behaviour of the actual production system. This approach we designate as holistic because we formulate a sequentially interrelated programme in such a manner that the complete sequence of steps taken ahead of test ensures that the appropriate data would be obtained in a way which would permit an objective analysis leading to valid and rational inferences with respect to the total production system. The analysis by holistic experimental approach answers the following basic underlying questions.

(i) How is the effect to be measured, i.e., what are the characteristics in determining operational time to be analysed?

(ii) What factors (human, machine, environment) influence the characteristics to be analysed?

(iii) How many times should the basic experiment be performed?

(iv) How can the random variabilities involved in situations be recognised and how can they be resolved?

(v) What should be the form and nature of analysis so as to derive meaningful conclusion?

(vi) How large an effect may be considered important?

When we recognise that the above-mentioned questions are only a small sample of those that might be asked and resolved, it is evident that much careful thought should be given to the planning stage in any experimental investigation. Therefore, in this investigation a very simple and elegant programme is planned which can be implemented in any work study investigation so as to provide maximum amount of information at minimum cost.

Test Programme

Since the planning of a test programme is an important part of any investigation, it is essential to make every effort to obtain all the relevant information. It has been experienced that the amount of time consumed in the planning phase can be materially reduced if the formidable communication barrier is overcome by way of mutual discussions of all parties concerned. Here we propose the following programme (Programme 1) for consideration and we feel that such a programme has worked well in a mutually-supporting atmosphere in a production system.

PROGRAMME-1

A. Formulate the Objectives of the Investigation

1. Identify the important problem area.
2. Outline the specific problem with current limitations.
3. Define the precise scope of the programme.

4. Determine relationship of the particular problem to the whole system.

B. Systematise the Background Information

1. Perceive and identify available sources of information.
2. State the propositions, to be verified, to the concerned parties in greater details.
3. Collect opinions and agree on magnitude of differences considered worthwhile.
4. Choose the factors to be studied and determine the practical range of these factors and the specific levels at which tests will be made.
5. Consider the effect of variability of the situation and plausible interactions as well as conflicts among the factors.
6. Consider human relations angles of the system.

C. Implement the Test Programme

1. Develop methods, materials and equipments.
2. Prepare a systematic schedule of activities in a stepwise and sequential order of perfomances.
3. Incorporate the effect of variables under study by controlling, balancing, or randomising them.
4. Arrange for ordelry accumulation of observations and data.
5. Adjust the programme in line with comments from concerned parties and record modifications.

D. Analyse the Data and Intreptet the Results

1. Consider all the observed data.
2. Reduce recorded data to interpretable form.
3. Confine conclusions to strict deductions from the evidence at hand.
4. Derive conclusions as to the technical meaning of results as well as their operational significance.

The programme presented here is in no way exhaustive but provides guidance only for a general work study problem investigation. The investigator in a particular problem can tackle the steps in the manner suitable to him. The step given in C-5 will really trigger new lines of thoughts, facilitate finer programmes and will finally lead to a very stable system.

Implementation

In accordance with the steps outlined above, we present here the factual information pertaining to the study as follows :

(i) The study is limited to three types of materials which are basically used for manufacture of tube plates, flanges and baffles, such as stainless steel clad material (having stainless lining on both surfaces and core materials being carbon steel), and mild steel.

(ii) Two sets of drilling machines having speed and feed ranges of (150, 220, 300, & 0.2, 0.3), and (180, 250, 355 & 0.22, 0.35) are selected.

(iii) The thickness of plates of different materials which came to the shop during the study period are 52, 60, 67, 95, 100 mm for stainless steel, 60, 80, 110, 120 mm for clad material and 45, 80, 86, 95 mm for mild steel.

(iv) For complete drilling in tube plates, the drilling process consists of operations like centre drilling, pre-drilling, core-drilling, reaming, chamfering and grooving; whereas for baffles and flanges the drilling process consists of only generating a hole to the specified size. The centre drilling is up to 6 mm depth in a drill of 9.5 mm diameter. But for pre-drilling, centre drilling and reaming 18.00 mm diameter drill is selected. Grooving speed is taken to be 56 rpm and by hand feed.

(v) Sufficient number of observations are recorded and incorporated considering all variabilities like change of operators, change of machines, change of timings during a shift (such as early hours of shifts, middle of shift, before tea-break, after tea-break, before

lunch-break, after lunch-break, before the close of the shift), after introducing a new tool, just before change of a tool, etc , change of pitches, etc. Such variegated conditions are necessary to randomise the work process and to balance out any plausible bias in measurement.

Analysis

An attempt is made here to study the effect of variables on the operational time so as to derive some meaningful inferences and to construct a generalised pragmatic data system. With these objectives in view, we parameterise some of the variables like speeds and feeds, drill size, etc., under identical conditions of material type, etc., and try to study the effect of material thickness over the operational time. Such an approach is justified from practical standpoint. For example, a standard thickness of jobs may not be available all the time as it is a job-shop; therefore, the thickness becomes the most predominant dependant variable for which interpolation or extrapolation may be a suitable guide for production scheduling and cost planning. The other variables are to be constrained by observations of actual conditions. Several graphs are plotted and they are displayed in Figs. 1 to 11 for various conditions. The following conclusions are considered relevant from technological as well as work measurement point of view:

(i) For stainless steel and clad material, during the movement of the drill, a constant and continuous chip formation occurs, which sometimes restricts the advancement of the drill. This is very frequent for higher thickness plates. The tool life is short and after every 15 to 20 holes the tool resharpening becomes necessary. Similarly for clad material tool sharpening is required after 18-25 holes. Very low speed is prohibitive for cutting because it allows continuous chip formation and removal of chip takes a longer time. The operator also feels uncomfortable in removing the tool several times from the hole for cleaning chips. This constraining effect causes very low performance rating and hence low productive efficiency. Very high feed is also prohibitive because of high heat generation and inability of the coolant to transfer that heat. High feed has extremely adverse effect on surface finish, creates drifting problem

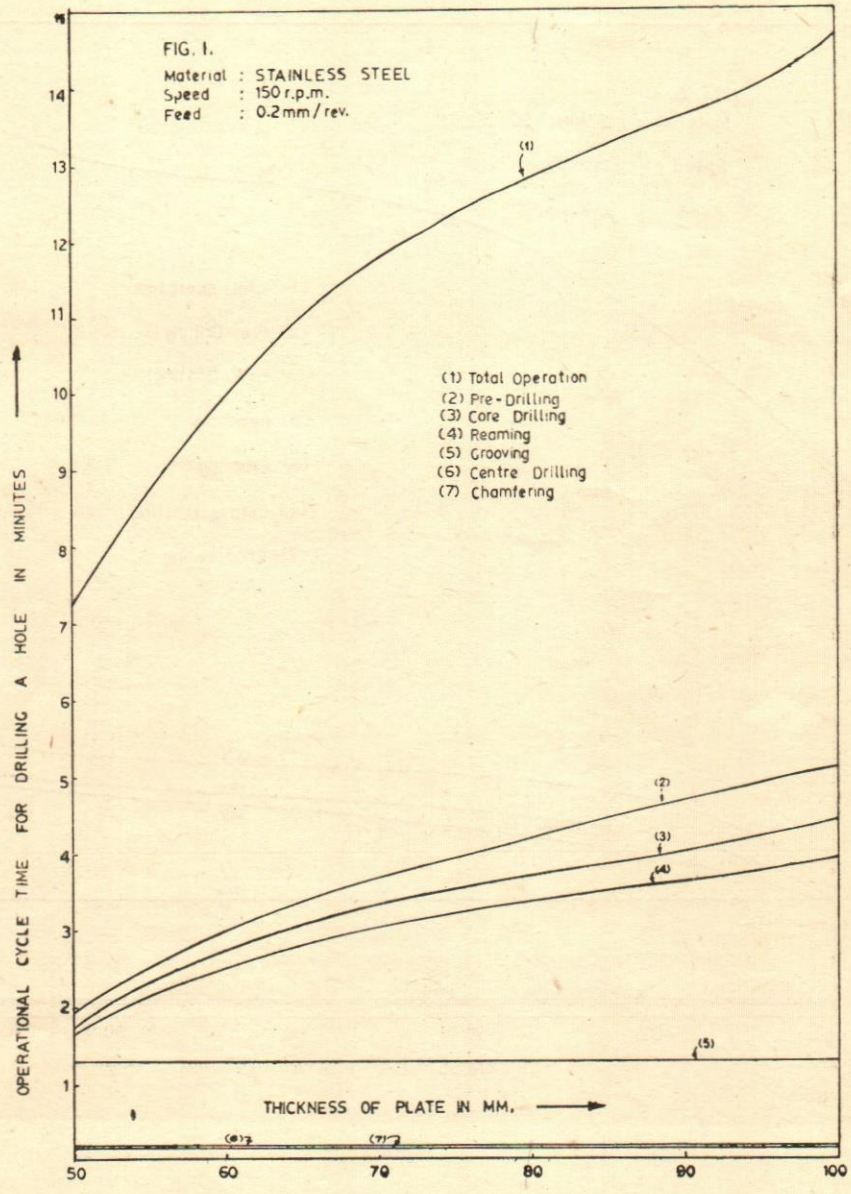
FIG. 1.
Material : STAINLESS STEEL
Speed : 150 r.p.m.
Feed : 0.2mm/rev.
(1) Total Operation
(2) Pre-Drilling
(3) Core Drilling
(4) Reaming
(5) Grooving
(6) Centre Drilling
(7) Chamfering
OPERATIONAL CYCLE TIME FOR DRILLING A HOLE IN MINUTES
THICKNESS OF PLATE IN MM.
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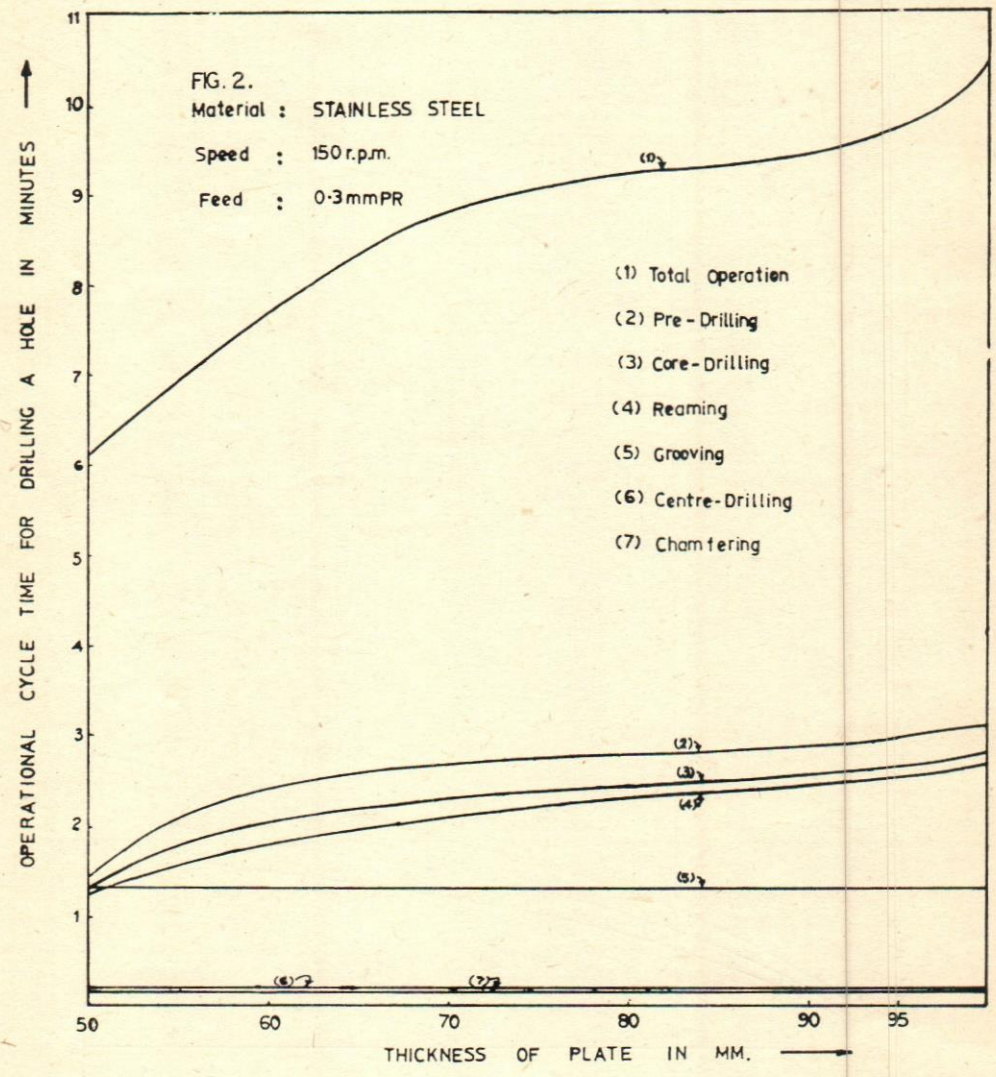
FIG. 2.
Material : STAINLESS STEEL
Speed : 150 r.p.m.
Feed : 0·3 mm PR
(1) Total Operation
(2) Pre-Drilling
(3) Core-Drilling
(4) Reaming
(5) Grooving
(6) Centre-Drilling
(7) Chamfering
OPERATIONAL CYCLE TIME FOR DRILLING A HOLE IN MINUTES
THICKNESS OF PLATE IN MM.
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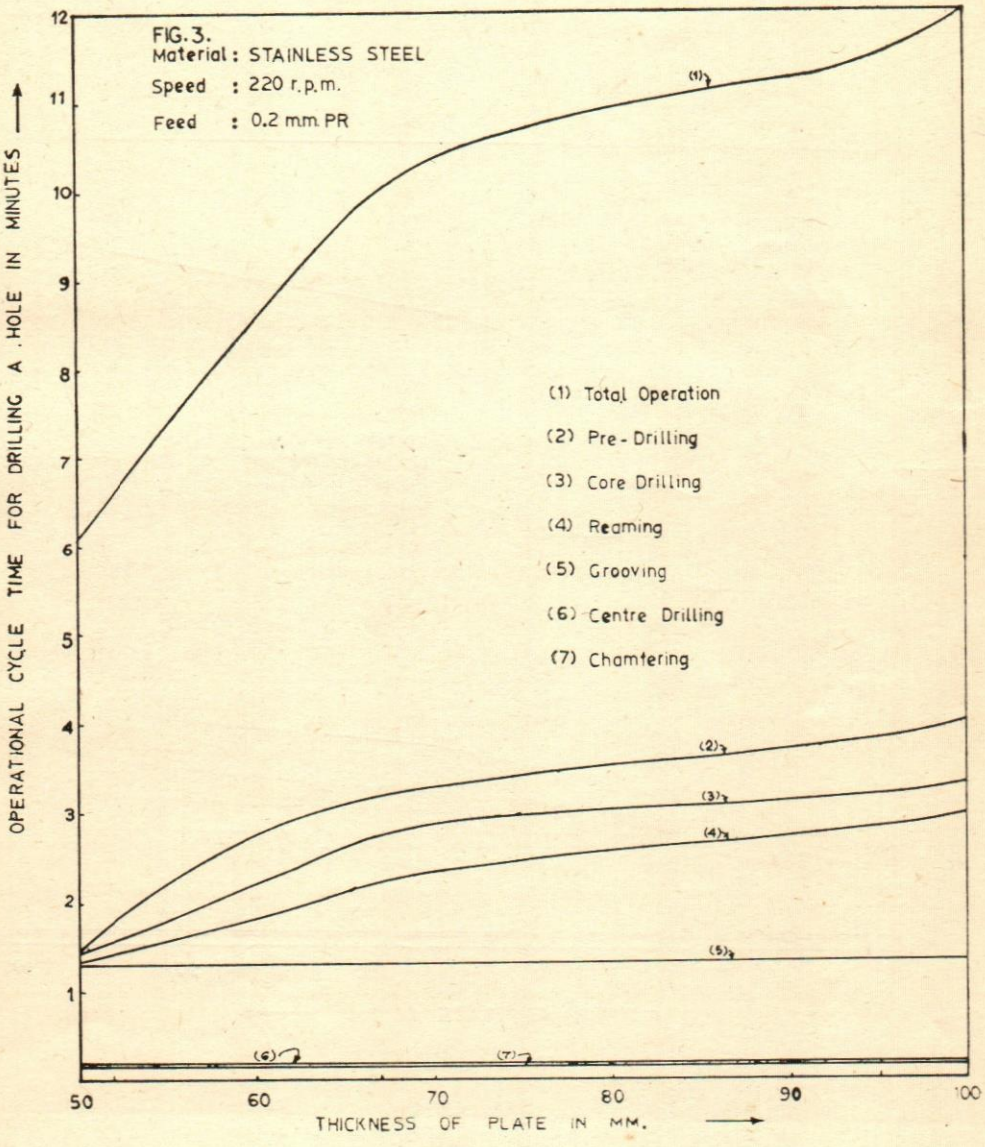
FIG. 3.
Material : STAINLESS STEEL
Speed : 220 r.p.m.
Feed : 0.2 mm PR
(1) Total Operation
(2) Pre-Drilling
(3) Core Drilling
(4) Reaming
(5) Grooving
(6) Centre Drilling
(7) Chamfering
OPERATIONAL CYCLE TIME FOR DRILLING A HOLE IN MINUTES
THICKNESS OF PLATE IN MM.
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90
100

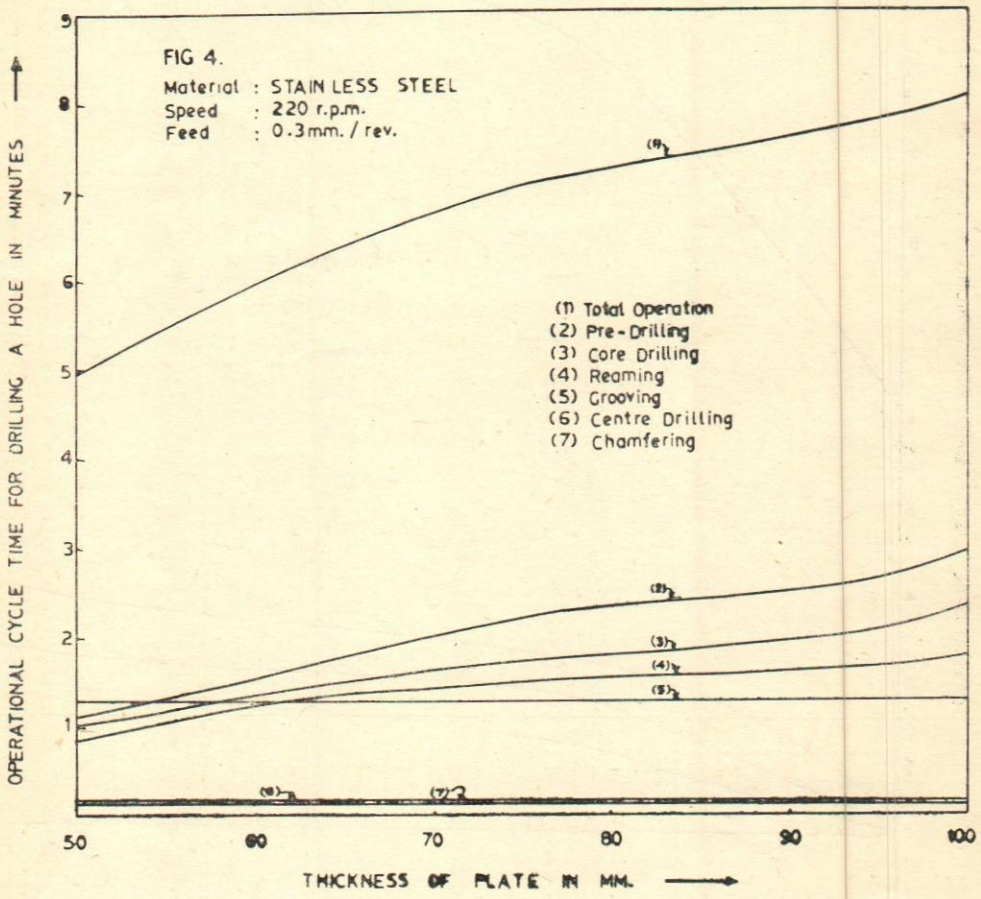
FIG 4.
Material : STAIN LESS STEEL
Speed : 220 r.p.m.
Feed : 0.3mm. / rev.
(1) Total Operation
(2) Pre-Drilling
(3) Core Drilling
(4) Reaming
(5) Grooving
(6) Centre Drilling
(7) Chamfering
OPERATIONAL CYCLE TIME FOR DRILLING A HOLE IN MINUTES
THICKNESS OF PLATE IN MM.
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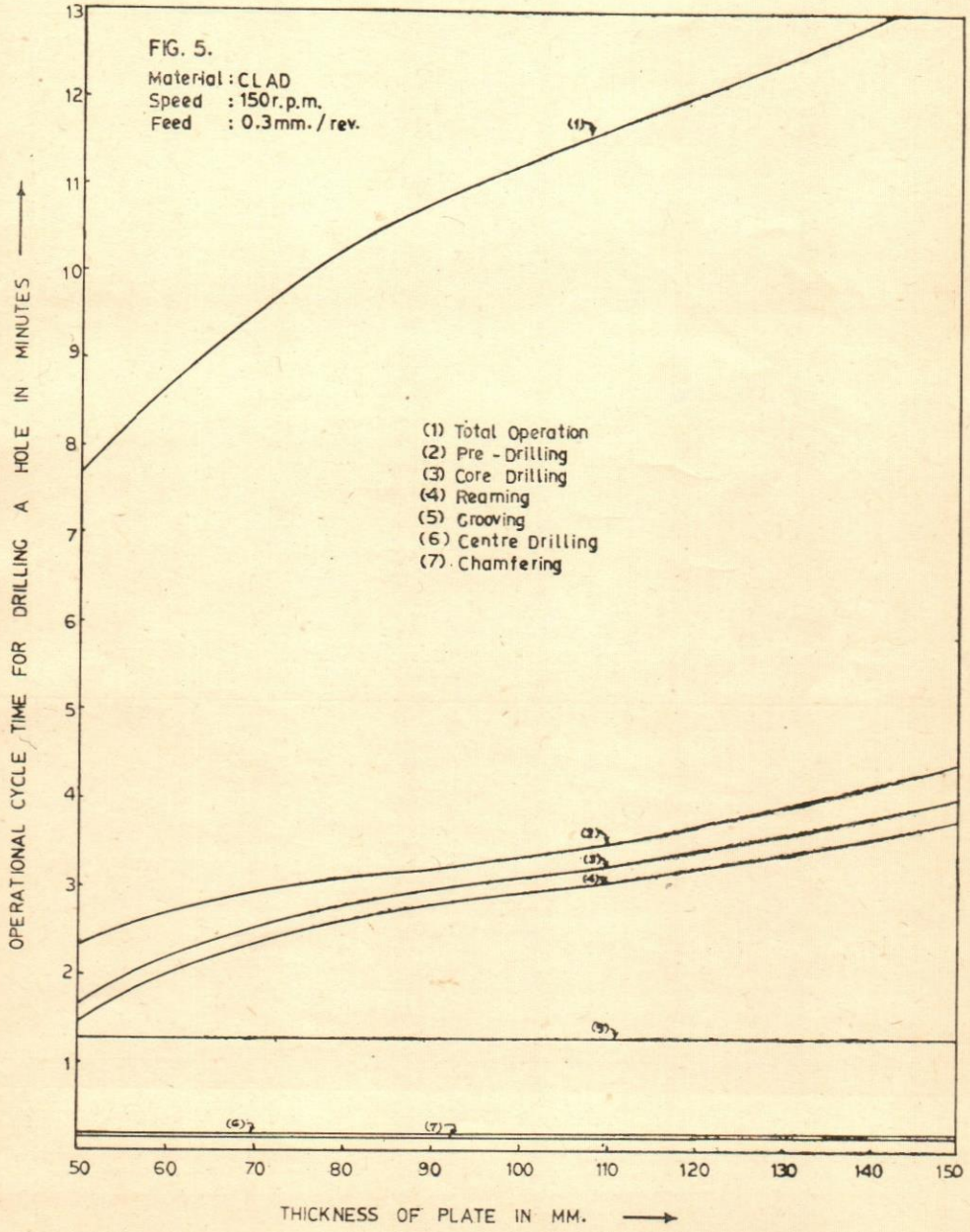
FIG. 5.
Material : CLAD
Speed : 150r.p.m.
Feed : 0.3mm./rev.
(1) Total Operation
(2) Pre - Drilling
(3) Core Drilling
(4) Reaming
(5) Grooving
(6) Centre Drilling
(7) Chamfering
OPERATIONAL CYCLE TIME FOR DRILLING A HOLE IN MINUTES
THICKNESS OF PLATE IN MM.
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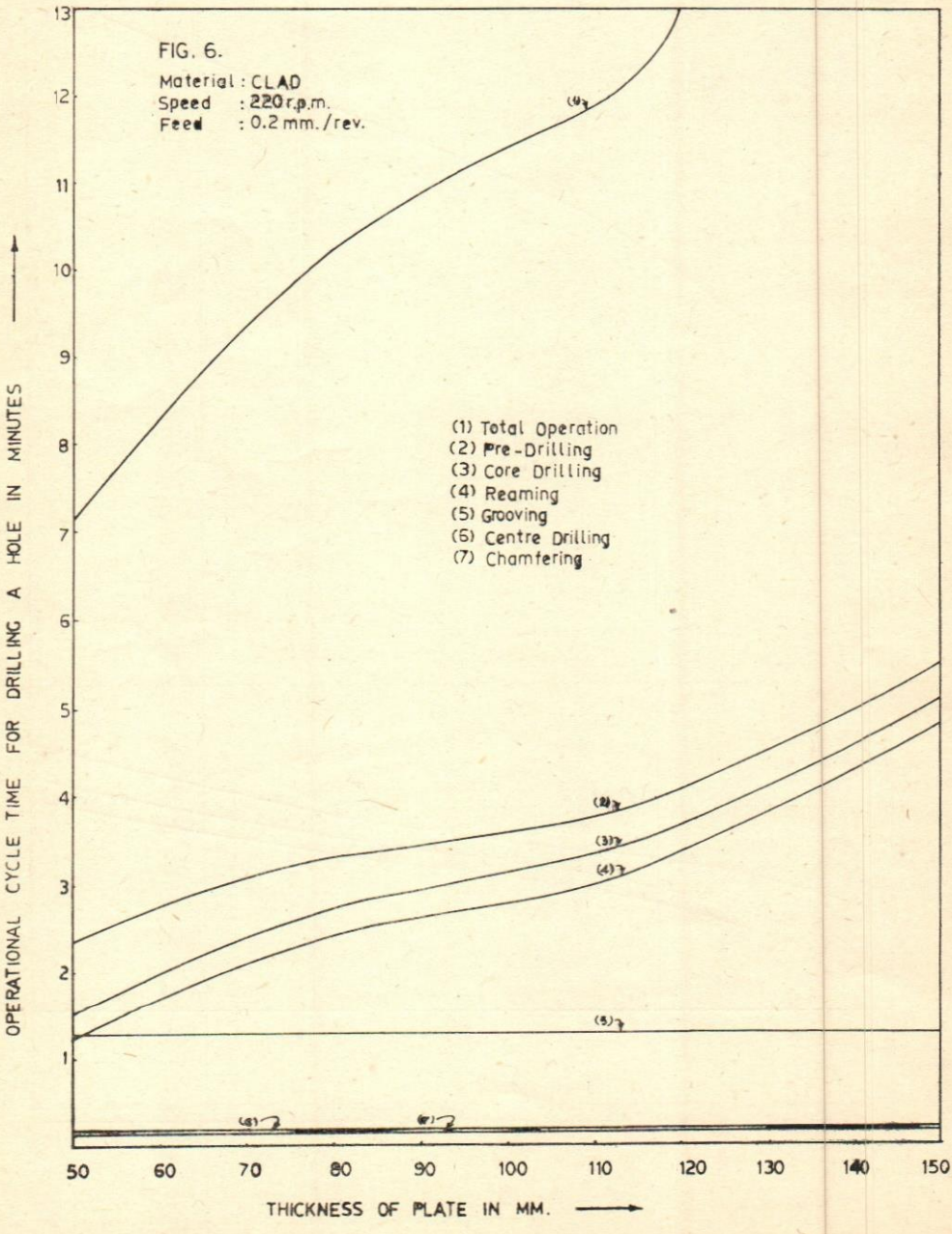
FIG. 6.
Material : CLAD
Speed : 220 r.p.m.
Feed : 0.2 mm./rev.
(1) Total Operation
(2) Pre-Drilling
(3) Core Drilling
(4) Reaming
(5) Grooving
(6) Centre Drilling
(7) Chamfering
OPERATIONAL CYCLE TIME FOR DRILLING A HOLE IN MINUTES
THICKNESS OF PLATE IN MM.
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12
11
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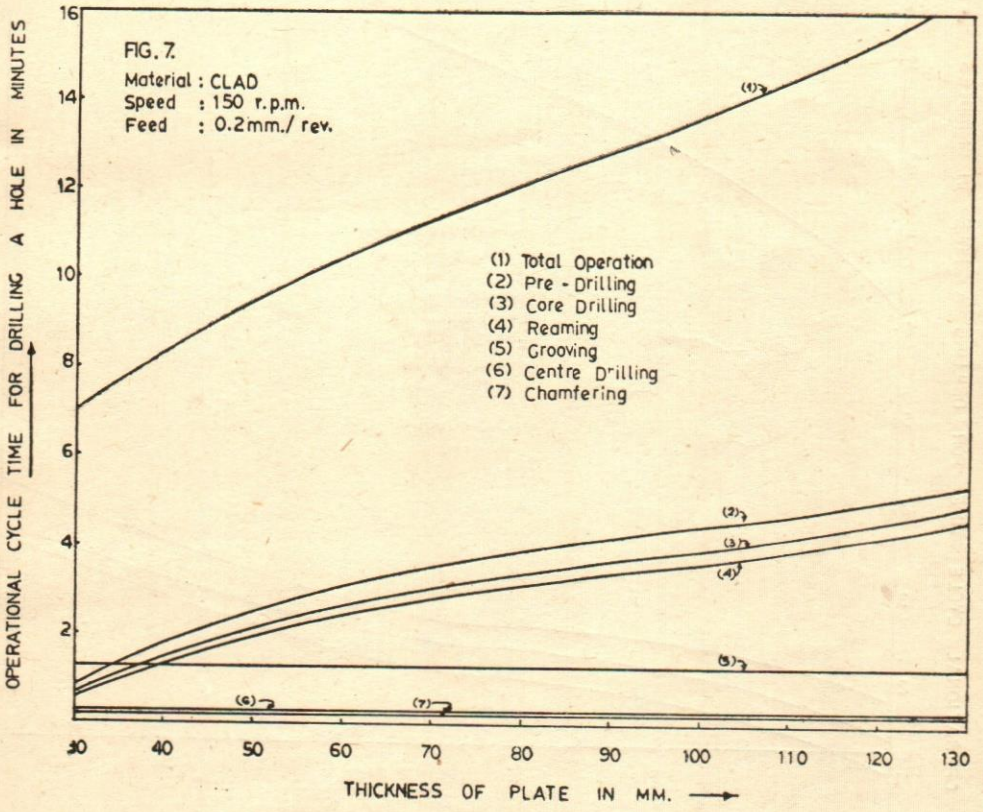
FIG. 7.
Material : CLAD
Speed : 150 r.p.m.
Feed : 0.2mm./ rev.
(1) Total Operation
(2) Pre - Drilling
(3) Core Drilling
(4) Reaming
(5) Grooving
(6) Centre Drilling
(7) Chamfering
OPERATIONAL CYCLE TIME FOR DRILLING A HOLE IN MINUTES
THICKNESS OF PLATE IN MM.
16
14
12
10
8
6
4
2
30
40
50
60
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100
110
120
130

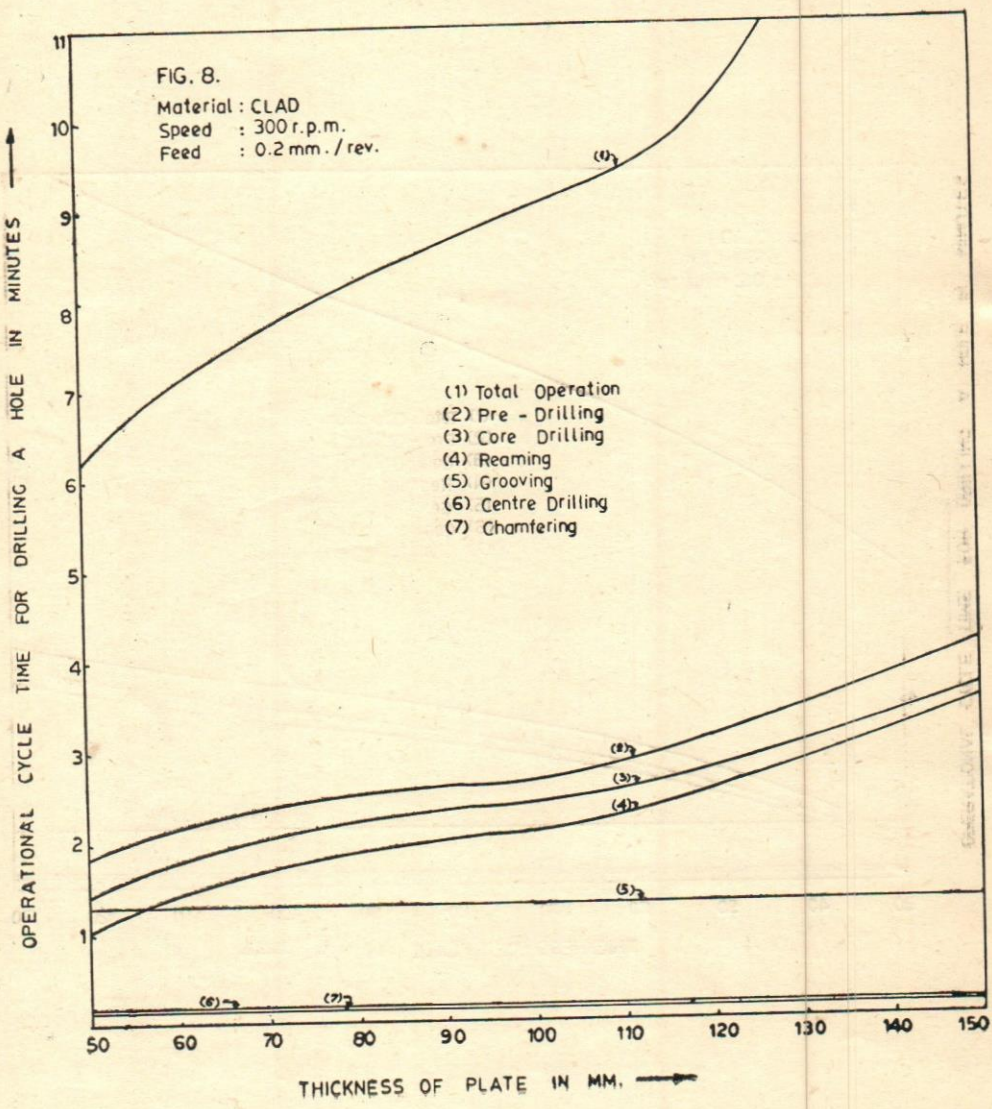
FIG. 8.
Material : CLAD
Speed : 300 r.p.m.
Feed : 0.2 mm./rev.
(1) Total Operation
(2) Pre - Drilling
(3) Core Drilling
(4) Reaming
(5) Grooving
(6) Centre Drilling
(7) Chamfering
OPERATIONAL CYCLE TIME FOR DRILLING A HOLE IN MINUTES
THICKNESS OF PLATE IN MM.
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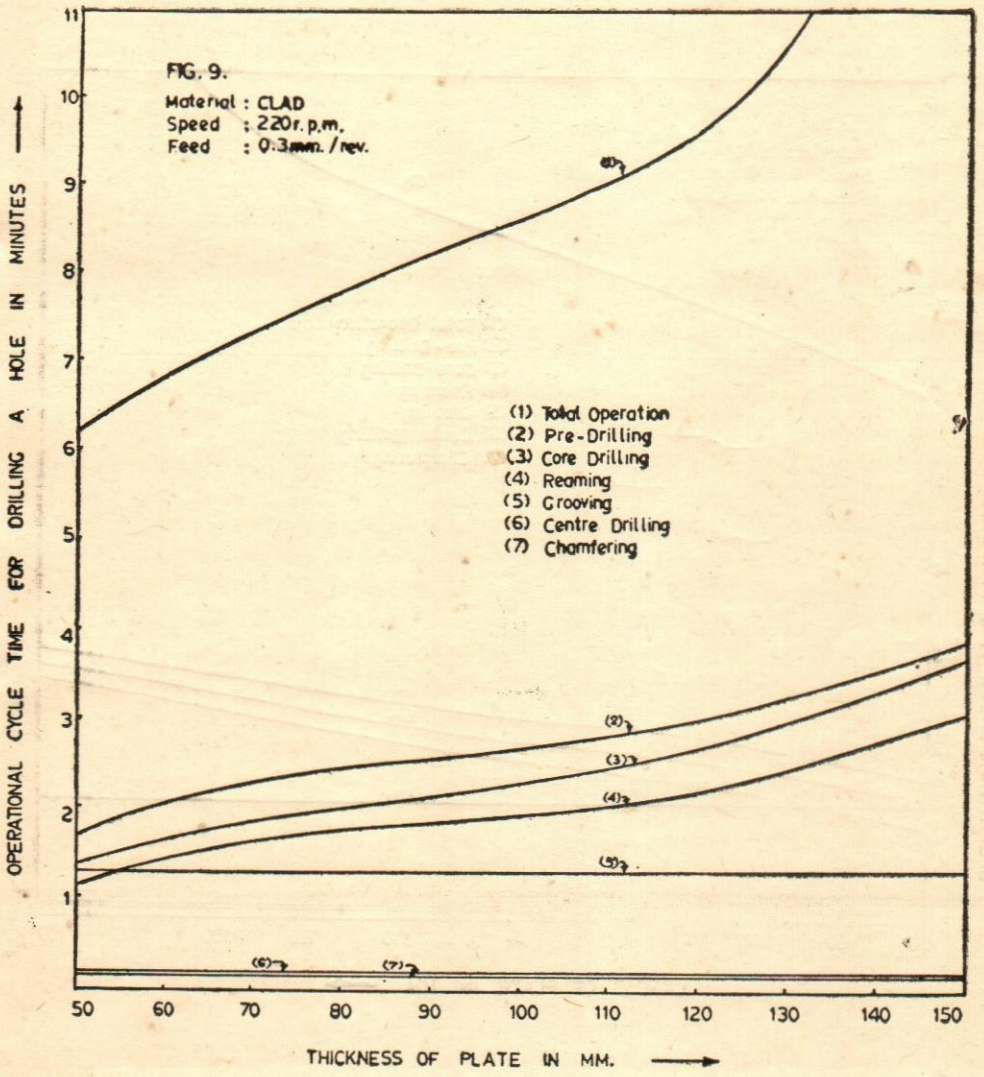
FIG. 9.
Material : CLAD
Speed : 220r.p.m.
Feed : 0.3mm./rev.
(1) Total Operation
(2) Pre-Drilling
(3) Core Drilling
(4) Reaming
(5) Grooving
(6) Centre Drilling
(7) Chamfering
OPERATIONAL CYCLE TIME FOR DRILLING A HOLE IN MINUTES
THICKNESS OF PLATE IN MM.
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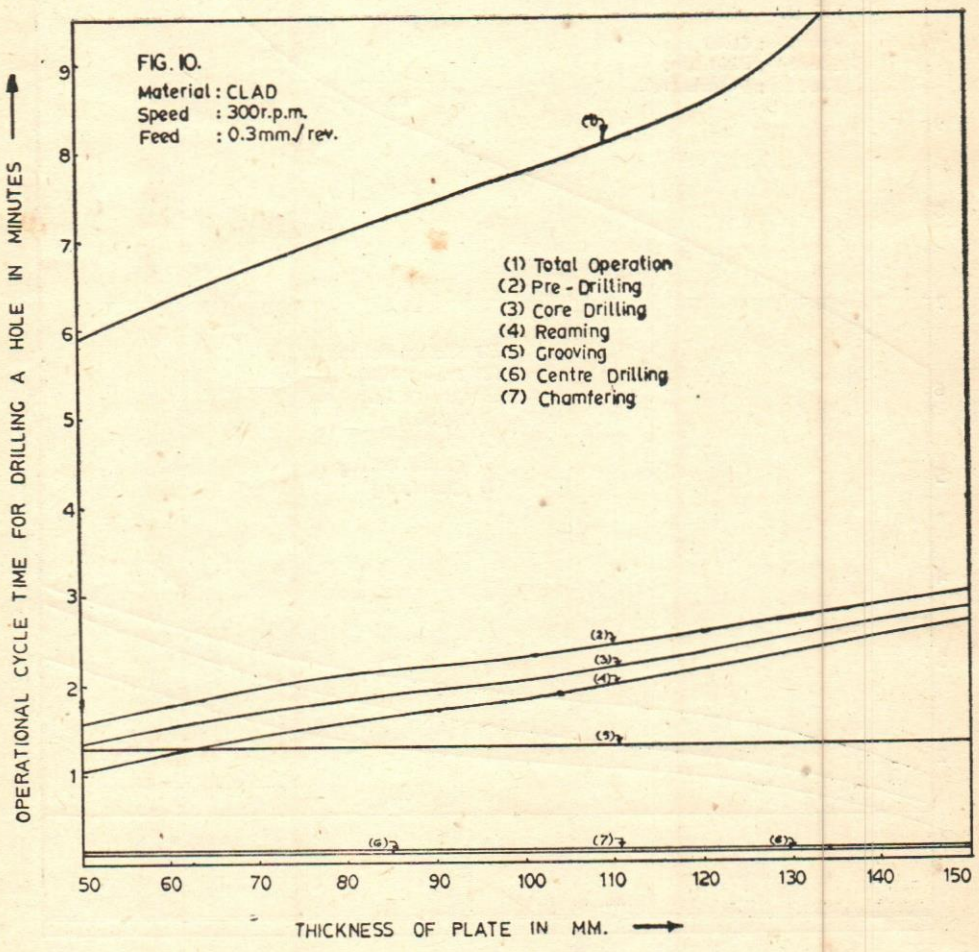
FIG. 10.
Material : CLAD
Speed : 300r.p.m.
Feed : 0.3mm./rev.
(1) Total Operation
(2) Pre - Drilling
(3) Core Drilling
(4) Reaming
(5) Grooving
(6) Centre Drilling
(7) Chamfering
OPERATIONAL CYCLE TIME FOR DRILLING A HOLE IN MINUTES
THICKNESS OF PLATE IN MM.
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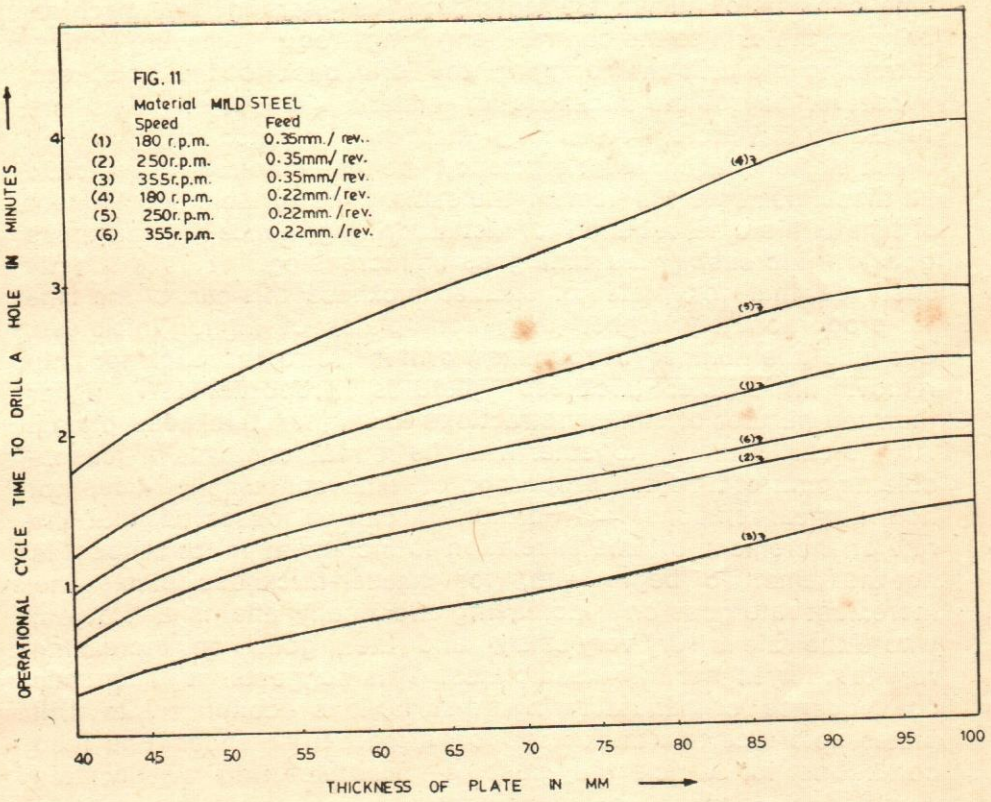

in the machine and distortion of the tool edge. High speed creates the problem of production of oversize holes and low speed produces undersize holes for which rework becomes necessary, thereby lowering the total productivity. Under the above circumstances, the study was limited to (150, 0.2) (220, 0.2) (150, 0.3) (220, 0.3) (300, 0.2) (300, 0.3) speed and feed ranges.

(ii) For stainless steel and clad materials, pre-drilling, core drilling, reaming curves and the total time curves are non-linear in nature. The reasons for nonlinearity can be ascertained as follows :

The time required for these operations consists of two components : one component is constant and the other is variable, whatever be the thickness of the plate. The constant part of the

time consists of human elements such as starting the machine, bringing the drill to the centre, engaging feed, removing chips, retreating the drill and bringing the drill back to the hole, etc. Whatever may be the thickness of material, these elements are repetitive in nature. Assuming that the operator performs all these elements at constant efficiency, the time required to complete all these elements will remain the same. The variable component of time is the time required for actual drilling; hence, as thickness goes on increasing, the time goes on increasing. It is distinctly observed that for plates of smaller thickness this part of the time is proportionately higher than for plates of higher thickness, because the number of the times drill is retreated back for chip removal in smaller thickness plate is proportionately higher than the number of similar retractions for higher thickness plates. As the chip removal together with the retreat consume a reasonable amount of time, the proportion of time consumption does not hold a linear relationship. Further, it can be observed that the rate of increment of time in relation to increment in thickness is not the same. To begin with, for smaller-thickness plates the increment rate goes on increasing and finally attains a plateau, where the rate is very very small, and then goes on increasing very fast for higher thickness plates. This suggests an economic consequence of manufacturing, that is, it is economical to drill plates upto a certain thickness for a particular speed and feed conditions for which the cost of manufacturing (associated cost of tool grinding, etc.) is minimum.

(iii) For stainless steel and clad materials, pre-drilling curve is more curved than that of core-drilling and reaming as the pre-drilling is the first operation, and hence chip removal occurs many times. Further, as the thickness goes on increasing the pre-drilling curve separates farther and farther from the core drilling and reaming curves, because the variable component of time increases more rapidly in such thickness ranges. This phenomenon is more predominant in case of lower values of speeds and feeds; but not for lower speed and higher feed.

(iv) The centre drilling grooving and chamfering operations all take constant times.

(v) For mild steel the operational time increases with thickness and rate of increase decreases slightly as the thickness is increased. The operational time increases as the speed is reduced for constant feed; and the operational time also increases as the feed is reduced for constant speed. This is an expected result, and the base formula can be seen to incorporate all parameters namely thickness, speed and feed, successfully as can be seen from Fig. 11.

(vi) The operational time difference for various speeds and feeds diverges considerably as thickness increases for mild steel.

Conclusion

The underlying theme of this paper has been to report an elegant and all-inclusive test programme for conducting time study in a job-shop environment. The primary aim is oriented to derive only a base for drilling time standard with high degree of reliability and consistency. However, it is recognised that under the system of complex causal relationships among several variables, the approach described herein emphasises the total behaviour of the production process in incorporating all the steps that are required from formulation to evaluation in the most pragmatic manner. Attempt has been made to constantly evaluate the decisions and procedures and nothing has been taken for granted without examining the grounds on which they are accepted and without being aware of their consequences.

It may be said that the results reported may serve as a methodological basis for pre-production planning, cost control and allocation in a job-shop; but for effective solutions to most of the job-shop problems involved in drilling operation, research should be oriented to calibrate computer model which should incorporate all the relevant variables that have significant effect on the measure of performance. □

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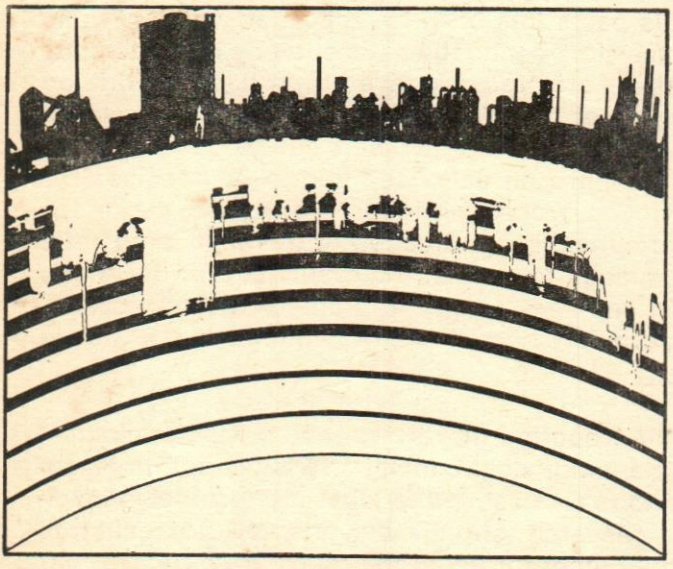

THE RIPPLES OF INDUSTRY...

Industry is like a pool of clear water: its ripples spread out in ever-widening circles—cooling, healing and nourishing wherever they spread. The ripples of the industries established by Tatas similarly have spread out all over the country—providing employment, new industries and engineering expertise wherever they have spread.

TELCO, for example, has fostered the growth of 350 suppliers all over the country for manufacturing auto-ancillaries. TISCO again has led to the establishment of the Indian Tube Company, Belpahar Refractories, Tata Yodogawa, and Tata-Robins-Fraser.

There is no end to the ripples of industries pioneered by Tatas.

TATA ENTERPRISES

Developing Special Training Programme

S. P. Lavakare*

A special training programme is always designed as an in-company programme to meet a specific type of need felt by an organisation in the area of skills, knowledge and understanding. This need is not easily fulfilled by ordinary management, supervisory or skills training programmes run by various Management Institutes and agencies. The need for developing special training programme arises due to peculiar nature of problems faced by the organisation or because of their uncommon character whereby the organisation is forced to find a solution with its own available resources. For example, the need may be in the area of communication or counselling, or report writing or production technique and may cover other functional areas beset with problems such as high absenteeism, low morale, etc. And, there lies the ingenuity and resourcefulness of the training manager[1] or training department in offering help to solve the problem. Here is an opportunity to justify the existence of the training manager/department by fulfilling its role and expectations. Such opportunities also enable him to gain acceptance and support within the organisation. When such specific needs of the organisation are fulfilled by designing a special type of training programme whereby the organisation is able to achieve its goal, the training manager may elicit valuable recognition from line managers. Of course, this does not imply that it is the only means of establishing worthiness of the training manager or department. But certainly it cannot afford to minimise the contribution it can make to the overall effectiveness of the organisation through such opportunities.

Determining the Specific Needs

The need for specific type of training programme may be generated by various circumstances which have to be identified and utilised. These circumstances may vary from organisation to organisation and it is the task of the training manager to trace such emerging needs and respond

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1The term 'Training Manager' also refers to a person in-charge of training function in an organisation.

to it with an alacrity by taking positive action through developing special training programmes. The importance of recognising such needs can be realised only through the benefits that can be accrued in future, such as increased productivity and efficiency of employees through improving their knowledge and skills and reduction in wastage of time and energy which otherwise would result by indulging individually to learn such techniques, skills or concepts in haphazard manner.

Therefore, getting clues to special training needs becomes the primary task of the training manager in the organisation. Since special training programmes are mostly designed for employees who are already working in the organisations, there are various methods which can be employed to determine peculiar and specific training needs of the organisation which are, otherwise, not fulfilled by on-going training programmes in management. One way to determine training need is through an analysis of existing problems vexing the organisation. Sometimes introduction of new equipment or adoption of new technology or procedures may call for new skills, knowledge or understanding on the part of operators. Clues to special needs can also come from an analysis of behavioural problems such as, rate of absenteeism or accidents, resistance to authority, low morale or productivity, etc. Sometimes appraisal of performance of group of people can reveal the need for strengthening some skills or competence.

It is obvious that locating or identifying the need for special type of programme is the crucial element in developing such programmes. It must be at the same time borne in mind that tracing the need for such programme and designing the required programme does not complete the task of the training manager's department, because locating the need for such programme is a continuous process owing to varying circumstances and changing time. Hence the training manager has to be continuously alert to the trends affecting the organisation economically, socially, politically and legally. He must be in constant touch with planned change in organisation's product, service technology or projected manpower requirements. For this purpose, the close and active involvement of the training manager in various committees appointed for specific purposes such as corporate planning, appraisal, manpower planning, etc., becomes critical for his effective contribution in the area of training.

Establishing Training Objectives

The major drawback in developing special training programme is setting clear and definite objectives. The objectives cannot be defined as precisely as it is possible in other types of general training programmes. Therefore, setting the targets for special programme is a complicated process which has to avoid cloudy generalisations. However, establishing objectives for special training programme has to be accomplished in order to render the task of evaluating training programme easy as they provide criteria and standards against which to evaluate. Besides, it also helps in designing training programmes aiming at achieving those objectives. No matter, how difficult the process of setting objectives is, attempts have to be made to arrive at tentative objectives, which get modified and shaped as special training programmes are being developed.

Selecting the Trainees

The process of selecting participants is beset with various impediments. The training manager has to ensure that the right type of people are chosen for special training programmes. This task is rendered difficult in view of the fact, that those employees, whom the training manager thinks fit for the programme, always presume that they are conversant with skills, knowledge or techniques proposed to be given through special training programme.

The selection of employees is always determined by the method of locating the need for special training programme. If the organisation is confronted with a problem for which training programme is designed, those being affected by such problems would be the right type of participants to undergo training. If special training programme is developed due to certain drawbacks, revealed through performance appraisal, those employees having these drawbacks would be the trainees for such programmes.

If the employees selected for special training programmes demonstrate resistance or refuse to acknowledge the need for such training, it poses a threat to the training manager. But the problem has to be solved tactfully and thoughtfully by him whereby they would be impelled to

participate. There are various ways of handling this problem and, one way is to have frank person-to-person talk with them. They should be made to look upon training as means of improving their performance or skills and as a boost towards meeting their performance standards. Such person-to-person talk will definitely help them in realising the worth of such training programmes for their own betterment.

This imposes additional responsibility on the trainer, since he has to convince the trainees of the utility of such special training programmes. On the other hand, the trainer also has to assure that participation in special training programmes would definitely result in improvement of either skills, knowledge or performance of the employees. It also entails that when employees go back to their work they are able to perceive the improvement by applying the concepts and principles learned in training programme. This calls for closer coordination and cooperation between the trainer and line managers to generate conducive climate for the trainees, wherein the process of transfer of learned skills or techniques is facililated. Failing to do so, would inadvertantly affect the response from employees in successive training programmes.

The trainer must also bear a part of the responsibility of not allowing the trainees to perceive training programmes either as a threat or a luxury. It happens that sometimes trainees tend to look upon participating in training programmes as time away from the office routine when not convinced of its need for themselves. Sometimes they also conceive their selection for training programme as a punishment for their inability to do well in the job. Therefore, it is essential that all doubts of trainees selected for participation are dispelled properly prior to the commencement of training and clear understanding prevails among them as to why they have been chosen for special training programme.

Designing the Training Programme

Once the targets for special training programmes have been specified, to that extent, the process of designing training programme is simplified. The designing or developing of training programme involves various items such as content, methodology, selection of faculty, preparation of training material, selection of teaching aids and equipment, arrangement for necessary facilities, etc.

As for the content part of the programme, much care has to be taken to relate contents to the objectives of the training programme. The contents chosen should be relevant to trainees so as to evoke their acceptance and involvement in the programmes. The sequence of various topics chosen in the contents has to be maintained in order to avoid confusion. While developing the contents for the programme, the trainer should consult line managers as well as top management and their forthcoming suggestions and views, if found suitable, should find proper place in the contents of the programme.

The methodology implies the techniques of imparting the essence of the contents to trainees. Perhaps each session or each topic may necessitate adopting different methods such as lecture, role playing, business game, group discussions, seminar, case-studies, etc. The choice of the method will be determined by the nature of the contents to be communicated to trainees. If the contents are of theoretical in nature, lecture or seminar would be the best suited method for that particular session, whereas if the contents emphasise the applicability of certain skills and techniques, management game, role playing or case-study would be the appropriate choice. It has to be emphasised that the choice of the method and the nature of the contents must be closely interrelated in order to expedite the learning process of trainees.

There can be various alternatives in selecting the faculty for special training programmes. One alternative is that the trainer conducts the whole programme without any help from outside or inside. This approach is rarely adopted since nature of the contents always need contribution from others. Second approach can be to take help of line managers whose on-the-job experience and pragmatic approach can be of great help. A third approach is to invite experts, either practising executives or academicians from outside who can bring some refreshing thoughts and new outlook with them. Lastly, there can be a combination of inside and outside experts which can be the best approach as it couples the thoughts and ideas of management with that of outside experts and trainees would get an opportunity to be exposed to both sides which would be beneficial in the long run. Of course, here the cost factor will have to be considered before deciding on what approach to adopt.

The preparation of training material is an arduous task and involves a

lot of ground-work on the part of the trainer in the form or preparing case-studies, background papers, theme-papers, etc. This work can be shared by other line managers who are also involved in the training programme. The training material would form a base of training programmes which also ensue class discussions. Since special training programmes are to serve the specific needs of an organisation, preparation of training material becomes difficult as the desired material is not easily avilable in text books. Where it is available, it needs to be moulded in the light of its increasing application to the situation faced by an organisation. When such material is not available, the least the trainer can do is to prepare a list of issues involved in a given topic around which a group discussion can be arranged.

In the Indian scene, there is not much choice in selecting teaching aids or equipment, since exhorbitant costs incurred in utilising motion pictures, film-strips and cassettes, prohibit their extensive use, nor are there any package programmes which can be used for training purposes. Hence the thoughtfulness of the trainer is required in choosing available teaching aids such as slides, charts, graphs, use of blackboard, etc. The use of audiovisual aids in training programmes becomes inevitable because of their impact in the learning process.

Since special training programmes are mostly in-company programmes, it is always economical to arrange them within the premises of the company. The necessary furniture and the room facilities have to be provided to create congenial atmosphere for trainees.

Evaluating Training Programme

The process of evaluating training programmes becomes vital in view of its advantage in assessing the accomplishment of objectives as well as determining better ways of doing it. For achieving these objectives, the training programme should be evaluated by trainees themselves. The training may contribute to the goals, but the measures to assess the extent of its contribution may not be easily accessible as numerous variables impinge on training goals. However, the targets framed as training objectives should formulate fair standards against which the success of the training can be positively measured.

The evaluation forms have to be designed by the trainer as objectively as possible, which would indicate the relevance of contents and performance of faculty and provide suggestions for improvement in future. The trainer has to approach the evaluation report with an open mind and take a penetrating look at the results and realise a need for modification in a given programme in the light of the feedback given by the trainees. This is a cyclical process which repeats itself, no matter how often the same training programmes are administered and restructured.

Conclusion

To realise full benefits of a special training programme designed specifically for the organisation which is in need of it, the programme must be as realistic as possible and must serve the needs of the organisation to the fullest extent possible. To be useful, the programme must be job-related so as to stimulate trainees' active interest and involvement and must enable them to apply learned techniques and concepts with ease. Unless it happens, any special training programme would prove itself futile, and, therefore, the trainer is urged to put in sincere efforts and hard work in developing special training programmes. To conclude, a special training programme, bearing in mind the cost incurred for developing and administering it, must justify itself by contributing substantially to overall effectiveness of the organisation. □

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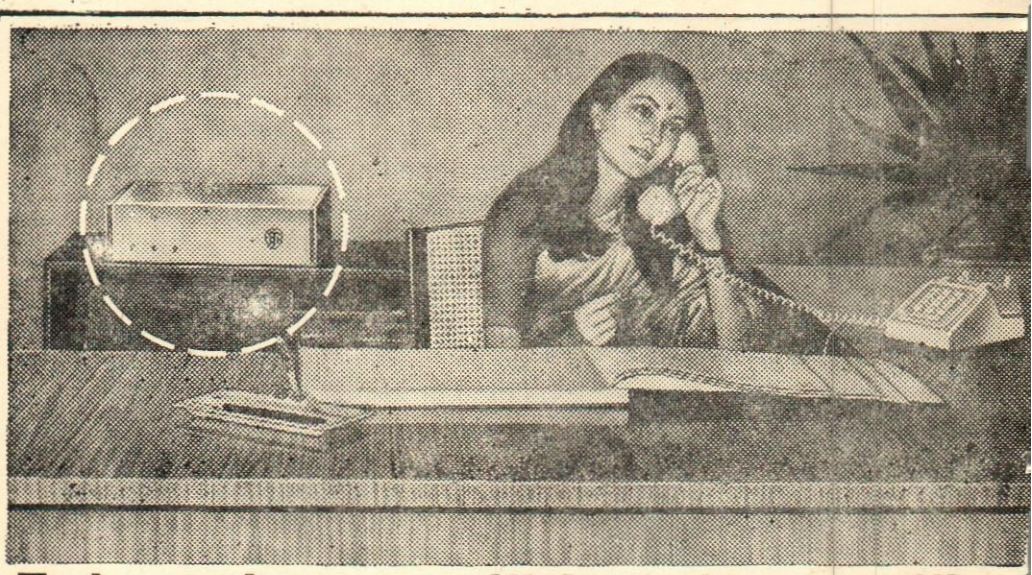

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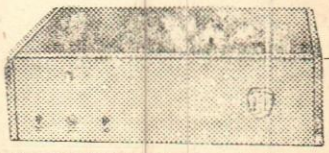

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Product Improvement

S. S. Srivastava*

Product improvement implies either a better design of an existing product to meet the requirements of the market or a new product to cater to the needs of the customer or industry. With restricted imports, we have been having a seller's market because of lack of competition from abroad. Industries in general have been producing low grade items at high costs. They are able to sell them because in most cases it has been a protected market, free from competition.

Government has now enforced some standards of quality. In electrical industry, it is necessary that goods bear the ISI certificate. Our high reserves of foreign exchange may further permit import of goods, opening the floodgates of competition in Indian market. Indian entrepreneurs setting up industrial units in 30 countries abroad, is yet another factor. Although at present these units are going to be in such traditional industries like textiles, jute, sugar, leather, food canning, light engineering products etc., more sophisticated items of technological importance like electrical, electronic, plastics etc., are not ruled out. To sell well in the international market and to meet the growing demand of a 'hitherto-neglected home-customer' highlights the importance of product improvement. Efforts should not only be directed towards improvement of the existing products but also designing newer and better ones.

Cost-Effective Approach

Attempt must be made to get best value of the money available for product development. It is assumed that different products can be made and that the decision-maker would give a cost-effective approach in choosing the product. The analyst estimates the cost that would be incurred and the quality that would result if all the alternative products were acquired. The analyst may normally discard an alternative that costs more and is poor in quality. On the other hand, if one alternative costs more but is better in quality than another, the analyst would

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present both alternatives to the decision-maker to determine whether the additional quality is worth the additional cost involved. Thus several products of different quality may be produced at different costs and the best-quality or minimum-cost alternative present only the end-points of a range of possible solutions. The task for the analyst then is to determine which product could not be considered by the decision-maker because there are more alternatives that either cost nothing or are more effective or cost less or at least as effective. However, before choosing the alternatives, it is necessary to consider the parameters which determine product improvement.

Parameters for Product Improvement

A product can be specified in terms of several factors. These could be :

(a) Performance

(b) Availability

(c) Reliability

(d) Survivability.

It is not necessary that all these parameters may be of relevance for different products. If all these were probabilities, the improved product could be represented as the multiplication of all these probabilities. The equation for a new product could be written as :

$$E(D) = [E(P) \times C_p]\,[E(A) \times C_a]\,[E(R) \times C_r]\,[E(S) \times C_s]$$

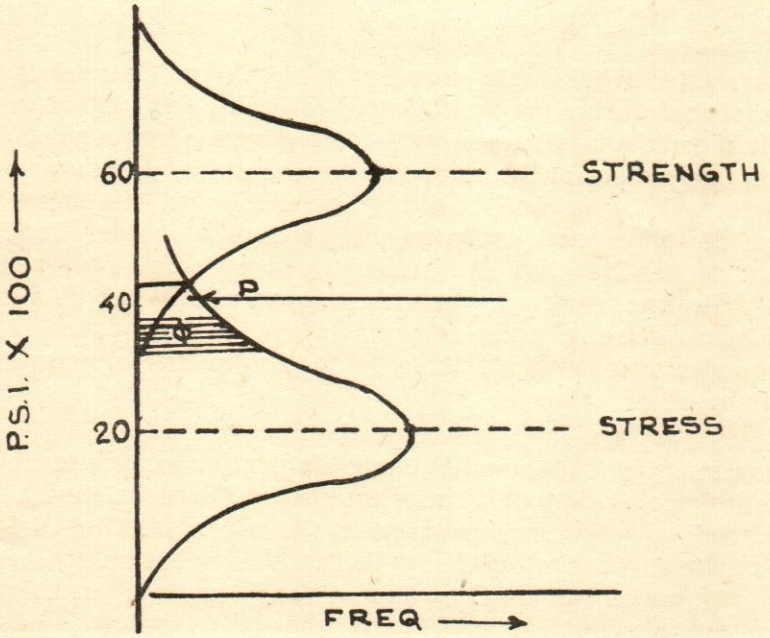
where $E(D)$ is the expected improved product

and $E(P)$, $E(A)$, $E(R)$, $E(S)$ = the expected improvement in product Performance, Availability, Reliability and Survivability respectively.

C_p, C_a, C_r, C_s = Statistical confidence in Performance, Availability, Reliability and Survivability, respectively.

Availability of a product in commercial terms is determined by the market factors of supply and demand and on the competition of similar products and their costs. However, the aspect that needs to be highlighted is the operational availability. The design for easy maintenance has to take into account dirt, rain, ice, heat, cold, vibrations and mishandling. These aspects are not normally looked into commercial products for they cost money. For the same reason, our products are sub-standard. The present-day cars of indigenous manufacture are an instance in point. How often they have to be sent to garage? The operational availability is low to poor.

Reliability is the probability at a given confidence level that the equipment will perform a specific function without failure for a specified length of time under a specified stress condition. The designer may determine that a particular component will operate at a known stress level. Since



$$\text{SAFETY FACTOR} = \frac{60}{20} = 3$$

Fig. 1 : Stress and Strength Relation

he wants a reliable component he normally uses a material of strength which has a safety factor of 3 or 4 to withstand the stress. When a large number of his components break, the designer expresses surprise and says that the user is not using the parts as intended because the design is good and he has calculations to prove it. If the designer is asked what is the mean stress, the standard deviation of his stress, the mean strength and the standard deviation of his strength, he replies that these questions are immaterial because he used the safety factor which can take into account the unknown. It can be proved that working on an *ad hoc* basis of safety factor, he can run into a problem where the stress can be greater than the strength, resulting in failure. An example is shown in Fig 1. What he has to consider is the statistically-determined distributions of stresses and strength which can reveal the probability of the material behaviour and the extent to which the desired degree of reliability has been taken care of during the design stage.

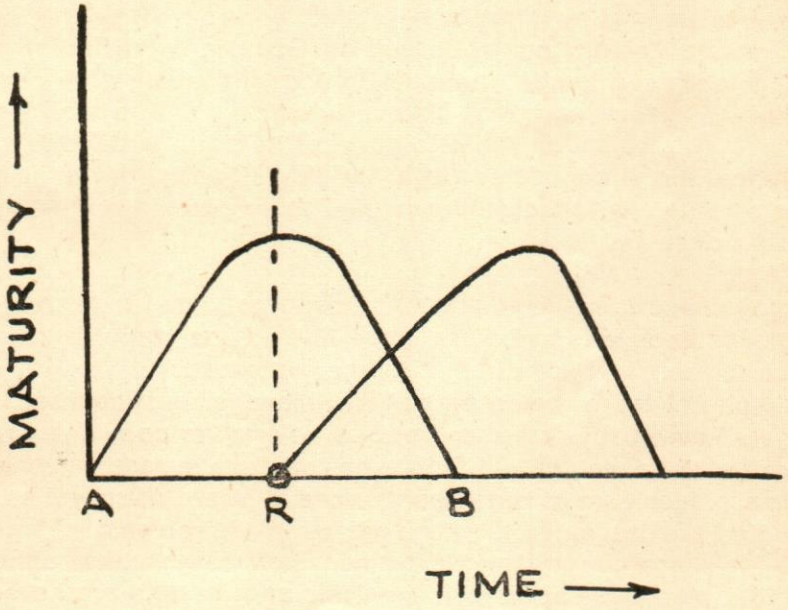
It is desirable to estimate true *reliability*. The confidence level is a measure of that assurance that the true reliability lies within the specified limit. For this, it is necessary to determine the frequency distribution of design parameters such as loading, temperature, pressures, etc., and without these it is not possible to determine the mean and the standard deviation and estimate the reliability of the product. It is important to realise that the reliability must be designed into a product. Testing merely reveals how good or bad the item is. If the probabilistic nature of the design parameter has been considered, only then there is the possibility that the quality will conform to the expectation.

The *survivability* is threatened by technological obsolescence, patent infringement or competition by better product. There is thus a constant need to carry out product improvement. In our industrial set-up, there has been little attempt to build any R&D. We spent hardly 0.5% of our GNP on indigenous R&D. Our dependence on foreign collaboration, wherever it exists, and our inability to absorb technology so as to carry out product improvement to suit Indian conditions is glaring. The National Committee on Science and Technology and the Ministry of Industry have recognised this deficiency and have advised industries to set apart at least 1% of their profits for R&D.

Performance can be spelled out in the product specifications as a function of environments. Performance and cost of an item can be chosen as one of the indices for operational assessment. It is recognised that an acceptable product must serve the customers' needs to the expected degree; that is to say, the product must attain a certain degree of performance. It is also well understood that the cost of production must be such that the customer can buy the product at competitive price. There are three stages in the product development :

(a) Research and development stage.

(b) Growth stage, in which the total sale tends to rise rapidly as the item fulfils the customer's demand. Competition enters at this stage. The product is likely to attract attention if its performance is satisfactory and acceptable to the customer.



R = Time to consider replacement
AB = Useful life of a product

Fig. 2 : Maturity of a Product

(c) Maturity stage, where the total volume of sale gets stabilised. The job of the industry is then to maintain the performance which can only be maintained if the quality control is introduced at appropriate levels from the raw material to the finished product in the factories. This is also the time to plan for replacement of product (Fig. 2).

Quality

Quality, however, should not be mixed up with the acceptability of goods. Because of the lack of foreign exchange, the import of competitive items from aboad is restricted. Today, an indigenous product does not face any competition, with the result that survival of the best is not ensured and the industries continue to produce what they can sell. The quality of goods made available to the market must be assessed independently. This can be organised by proper collection of field data and organising feedback system or by introducing quality control. However, limitations to the normal quality control based on Gaussian distribution have also to be understood since industrial process is much more complicated. For example, the mean may have a linear drift due to tool wear, it may have a cyclic variation due to daily temperature variations and it may have uncertainty connected with it, the standard deviation may have similar gyrations, and the random variables associated with the uncertainties may not be Gaussian.

Indian business is not using quantitative methods in product development. The decisions made are normally *ad hoc* and very little attempt is made to consider or evaluate other alternatives. It is equally true that in spite of there being a spurt in management courses, very few managers have really made any serious attempt to consider applicability of quantitative techniques in their areas of management. In some industries where such groups have been formed, they are usually a part of staff group and are assigned to work on certain problems at much lower levels. In these circumstances, trained staff do not have either access to the top management or their analysis and results are never brought to the manager's notice. Perhaps some efforts to organise some training programmes in selected areas may be able to create better climate for analysing the factors that go to make good and better products. □

A Practical Approach to Job-shop Scheduling for Increased Productivity

D. K. Jain*

Introduction

This article presents a new approach to job shop schedule, using the PERT/CPM Network technique, conventionally used in Project Management only. The job shop having the following shops is considered :

1) Cutting
2) Pressing
3) Drilling
4) Machining
5) Fabrication
6) Assembly
7) Testing.

A sample job of fabrication of heat exchanger is considered. Besides the use of the above shops, another activity to be considered in the manufacture is the purchasing of the bought-out items.

The various activities involved in the fabrication of the heat exchanger are shown in the Network diagram. The activities take place in the various shops as indicated. Manufacture starts with baffle cutting, tube sheet cutting, shell cutting, order of forge nozzle flange, plate cutting, etc. Various sub-assemblies are tube bundle assembly, shell girth and nozzle assembly and assembly of channel shell ends nozzle and GF, etc. The final activities are tube bundle insertion, tube expansion, SS hydro test, BS hydro test, final inspection and despatch. Each activity is shown in the diagram by an activity code. Also a trade code is allocated to each activity. For example, cutting is allocated activity code C and trade code of 1. The details are shown in the tabular form in the Network diagram.

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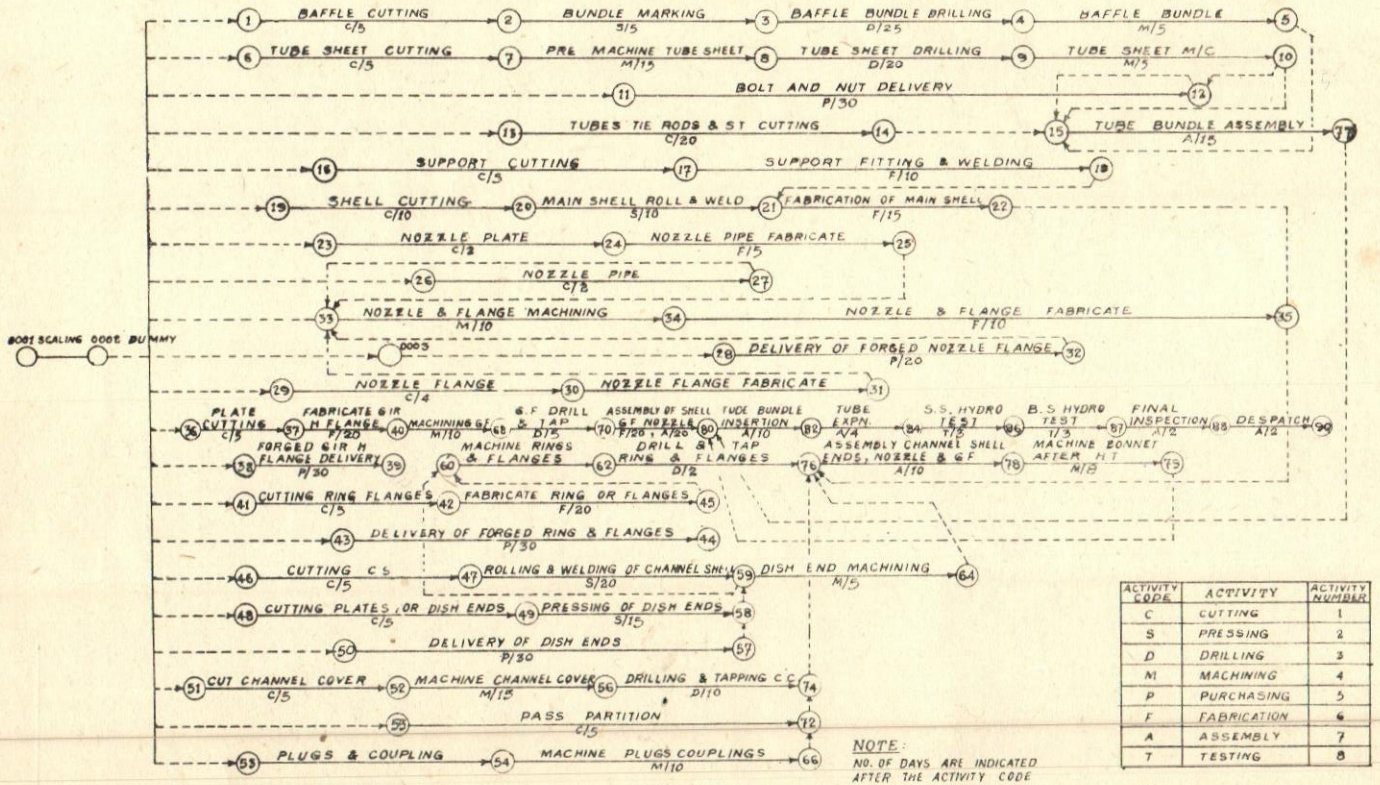
NET-WORK: HEAT EXCHANGER LOADING IN A JOB SHOP



NOTE:
NO. OF DAYS ARE INDICATED AFTER THE ACTIVITY CODE

ACTIVITY CODE	ACTIVITY	ACTIVITY NUMBER
C	CUTTING	1
S	PRESSING	2
D	DRILLING	3
M	MACHINING	4
P	PURCHASING	5
F	FABRICATION	6
A	ASSEMBLY	7
T	TESTING	8

Drawing the Network

As discussed above, for a particular job various activities take place, in the various shops and are of varying durations. A decision is taken as to which is the most critical resource/resources in a particular shop. For that the duration is computed. The duration may be in terms of shifts/days/weeks, etc., as appropriate. However, the unit of time has to be uniform for the entire planning exercise. As an example for the cutting shop, machine days (on two-shift working) may be the most appropriate measure of the workload. In such a case, the unit of time will be days for all the shops.

The network is coded, starting from 0001 onwards. First two places are kept for the job. This means networks for upto 99 jobs can be coded by this coding system. The last two digits are kept for the code numbers. Thus a job can be divided into 99 activities. As an example, the activity of plate cutting 36 to 37 for Job No. 1 will be 0136 to 0137. For Job No. 99 it will be 9936 to 9937. With this system of coding, it is possible to identify at random as to which job the particular activity belongs.

To start with, networks are drawn for all the incomplete as well as new jobs and codes are given as discussed above. Dates for completion of each job are established.

It is assumed that the durations computed for the activities will be final and are unlikely to change due to other constraints such as unavailability of material, etc. In other words, it is assumed that a job shop, otherwise well planned, is being loaded to achieve realistic delivery schedules and optimum utilisation of resources.

Loading the Shop

In case of a large number of jobs and voluminous data, use has to be made of PERT/CPM computer package and the data on the various activities—their duration, activity code, trade code, job delivery schedules, etc., can be imputed.

For all the jobs, similar networks can be drawn with different activities

in different shops, and the estimates of the duration can be made. It is necessary that the estimates of time are accurate as, in absence of the same, the planning would have little meaning.

The longest path for each Network is worked back from the delivery schedule and the starting date of each job is established. The longest path is called the Critical Path. On the other paths the slacks and early start/finish dates are worked out.

A report, as shown in Exhibit-I, is prepared which lists the work to be done in all the shops of the plant and for all the jobs in the early start sequence. This will enable the Planning Manager to immediately assess what are the jobs which should start in a specified period. As for example, in Exhibit I, fabrication of Main Shell should start on 26th April 1978. Similarly other jobs to start on 28th April, 30th April, 4th May, etc., are listed.

Exhibit 2 shows the activities for all the jobs and all the shops which are on the critical path, in the early start sequence. For these activities there is no slack available and have to start in the respective shops as per the early start data. As for example, assembly of shell GF and nozzle should start on 10th June 1978. Its activity No. is 0270 to 0280. It can be identified as an activity belonging to Job No. 2. Activity code A indicates that this is an activity for the Assembly Department.

Exhibit 3 lists trade codes for the various activities. The trade code 0001 relates to cutting; hence all the various activities to be carried out in the cutting shop are listed in the early start sequence. This chart is useful for planning the work for the supervisors responsible for the various shops.

Exhibit 4 shows in graphical form the duration of activities in the cutting shop. Similar graphical representations for other trade codes can also be prepared. The 'x' refers to the duration, '—' to slack and 'Rs' refers to critical path. Thus, for nozzle flange cutting, it is shown that this activity will start on 19th April 1978 and will continue for 4 days on a cutting machine. After that there is slack available to complete this activity upto 12th May 1978. Once such a graphical chart is prepared, then all the work to be done in a specific period (say from 19th April 78 to 30th March 78) can be added up for a particular trade

Exhibit I : Workload for all the Shops in the Early Start Sequence

I	J	Description	Activity Code	Duration (Days)	Remain Duration (Days)	Early Start	Late Start	Early Finish	Late Finish	Slack (Days)
0121*	0122	Fabrication of Main Shell	F	15	15	28 APR 78	28 APR 78	15 MAY 78	15 MAY 78	0
0134	0135	Nozzle and Flange Fabrication	F	10	10	28 APR 78	04 MAY 78	10 MAY 78	15 MAY 78	5
0160	0162	Rings and Flange Mech.	M	5	5	28 APR 78	08 MAY 78	04 MAY 78	14 MAY 78	9
0159	0164	Dist End Machining	M	10	10	28 APR 78	10 MAY 78	04 MAY 78	15 MAY 78	11
0220*	0221	Main Shell Roll and Weld	S	20	20	30 APR 78	30 MAY 78	24 MAY 78	24 MAY 78	0
0203	0204	Baffle Bundle Drilling	D	25	25	30 APR 78	12 MAY 78	29 MAY 78	10 JUN 78	11
0109*	0110	Tube Sheet Machining	M	5	5	10 MAY 78	10 MAY 78	15 MAY 78	15 MAY 78	0
0115*	0177	Tube Bundle Assembly	A	15	15	15 MAY 78	15 MAY 78	02 JUN 78	02 JUN 78	0

**Denotes Activities on the Critical Path*

Exhibit II : Critical Items (for all jobs) in Early Start Sequence

I	J	Description	Activity Code	Duration (Days)	Remain Duration (Days)	Early Start	Late Start	Early Finish	Late Finish	Slack (Days)
*0270	0280	Assembly of Shell GF and Nozzle	A	20	20	10 JUN 78	10 JUN 78	03 JUL 78	03 JUN 78	
*0182	0184	Tube Expansion	A	4	4	14 JUN 78	14 JUN 78	18 JUN 78	18 JUN 78	
*0184	0186	SS Hydro Test	T	3	3	18 JUN 78	18 JUN 78	22 JUN 78	22 JUN 78	
*0186	0187	BS Hydro Test	T	3	3	22 JUN 78	22 JUN 78	25 JUN 78	25 JUN 78	
*0187	0188	Final Inspection	A	2	2	25 JUN 78	25 JUN 78	28 JUN 78	28 JUN 78	
*0188	0190	Despatch	A	2	2	28 JUN 78	28 JUN 78	30 JUN 78	30 JUN 78	
*0280	0282	Tube Bundle Insertion	A	10	10	03 JUL 78	3 JUL 78	15 JUL 78	15 JUL 78	
*0282	0284	Tube Expansion	A	4	4	15 JUL 78	15 JUL 78	20 JUL 78	20 JUL 78	
*0284	0286	SS Hydro Test	T	3	3	20 JUL 78	20 JUL 78	23 JUL 78	23 JUL 78	
*0286	0287	BS Hydro Test	T	3	3	23 JUL 78	23 JUL 78	27 JUL 78	27 JUL 78	
*0287	0288	Final Inspection	A	2	2	27 JUL 78	27 JUL 78	29 JUL 78	29 JUL 78	
*0288	0290	Despatch	A	2	2	29 JUL 78	29 JUL 78	31 JUL 78	31 JUL 78	

*Denotes Activities on the Critical Path

Exhibit III : Activities of a Particular Trade Code (Particular Shop)

Trade Code : 00D1

I	*J*	*Description*	*Duration (Days)*	*Remain Duration (Days)*	*Early Start*	*Late Start*	*Early Finish*	*Late Finish*	*Slack*
*0106	0107	Tube Sheet Cutting	5	5	24 MAR 78	24 MAR 78	30 MAR 78	30 MAR 78	0
*0119	0120	Shell Cutting	10	10	24 MAR 78	24 MAR 78	29 MAR 78	16 APR 78	0
0129	0130	Nozzle Flange Cutting	4	4	24 MAR 78	12 APR 78	29 MAR 78	16 APR 78	17
*0219	0220	Shell Cutting	10	10	19 APR 78	19 APR 78	30 APR 78	30 APR 78	0
0229	0230	Nozzle Flange Cutting	4	4	19 APR 78	07 MAY 78	23 APR 78	12 MAY 78	17

Exhibit – IV : Graphical Representation of the Work Load for a Particular Trade Code (Particular Shop)

Trade Code : 0001 (Cutting)

I	*J*	*Description*	*15 APR 78*	*26 MAR 78*	*7 APR 78*	*19 APR 78*	*30 APR 78*	*12 MAY 78*
*0106	0107	Tube Sheet Cutting	Rs Rs Rs Rs Rs					
*0119	0120	Shell Cutting	Rs Rs Rs Rs Rs Rs Rs Rs Rs					
0129	0130	Nozzle Flange Cutting	xxxx— — — — — — — —					
*0219	0220	Shell Cutting	Rs Rs Rs Rs Rs Rs Rs Rs Rs Rs					
0241	0242	Cutting Ring and Flanges	xxxxx— — — — — — — —					
0229	0230	Nozzle Flange Cutting	xxxx— — — — — — — —					

Rs—Critical, x—Duration, —Positive Slack, N—Negative Slack.

code. Where the activity is on the critical path, as an example shell cutting (0119 to 0120), it cannot be delayed as there is no slack on it. However, the other activities can be slided forward if it is found that the total workload is increasing beyond the available machine time. This will not lead to any delay in the delivery schedule as the shifting will be only within the slack time available. The delivery schedules can be met and at the same time the optimum utilisation of resources can be made.

For smaller shops and a lesser number of jobs, the aid of the computer may not be necessary and the Exhibits 1, 2, 3 and 4 can be easily compiled manually by a technical assistant under guidance. However, it is necessary to establish first the critical path, the slacks and early start/finish dates for the activities of the various Networks. The loading schedules should be worked out at regular periodicities which will depend on the nature of the shops/the nature of jobs and may vary from bi-weekly to monthly to quarterly. □

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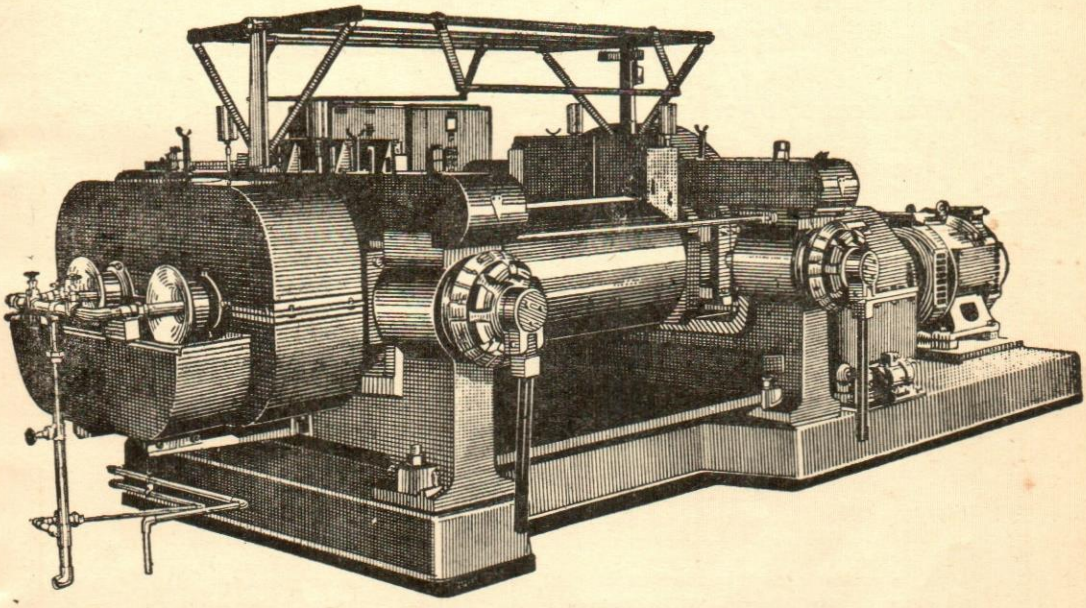

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Book Reviews

Amidst Heat and Noise : Durgapur Recalled

Bagaram Tulpule

All India Management Association, New Delhi, 1977, pp. 133

Reviewed by S. K. Warrier*

Bagaram Tulpule's account of his experience as General Manager of Durgapur Steel Plant (DSP) is a welcome addition to managment literature for more than one reason. It gives a first-hand account of public sector management in India and the various factors that inhibit its efficient functioning. In spite of his personel involvement in the events narrated, the author has maintained a high degree of objectivity which bespeaks of his professional orientation. The neat structuring of the subject matter divided into brief, compact chapters and a style that is crisp and free from cant and hyperbole together make the book an extremely pleasant reading experience.

After presenting in Chapter 1 the events leading to his assumption of office, in the following three chapters is painted, in its historical perspective, a lucid picture of the scene of action, that is DSP. Chapter 5 discusses the author's early efforts to restore order in the chaotic labour-management relations. This is immediately followed in Chapter 6 by a discussion of the organisational set-up of the public sector steel plants which appears to be, according to the author, the prime source of DSP's problems. The trade unions which entered the stage in Chapter 5 again take the centre of the stage in chapter 7 which describes how some degree of management effectiveness was restored in the face of chaotic employee protest. Chapter 8 deals with the third source of DSP's problems, i.e., the technical state of the plant. Chapter 9 deals with problems of the township and Chapter 10 with some major confrontations which, one feels, could have more appropriately formed part of Chapter 7. Chapter 11 rings the curtain down by narrating the events leading to the author's resignation of office and his depatrure from Durgapur.

What attracted this reviewer more than the interesting and dramatic story of DSP are the generalisations and conclusions drawn in Chapter 12. Although the author quite appropriately sounds a caution about the limited generalisability of a single experience, there are occasions

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when considerations of scientific rectitude must give place to more urgent considerations. Inadequacy of data may be a lame excuse when the performance of a significant part of the national economy represented by DSP and other public sector undertakings has been so dismal as to prompt a prominent social thinker to lament: "When this poor country has created certain production capacity in steel, fertilizer or coal, not to produce to that limit is a matter of deep regret. It is almost a natural calamity contributed by diverse participants... managers..... and workers." Calamities are occasions for quick thinking and quick action, not for paying obeisance to scientific rectitude !

The author traces the problems of DSP as much to certain cultural aspects of public sector management as to organisational and technological factors. Thus the multiplicity of superordinates of enterprise management—the Secretariate, the Minister, various organs of Parliament, the State Government, etc., which tends to hinder rational problem-centred action at the enterprise level receives a good deal of critical attention. So also do the technical problems of the plant and machinery not infrequently exacerbated by human neglect. The bureacratic norms that provide cover and protection to a good deal of apathy, inactivity and mediocrity as well as hinder speedy decision-making in disciplinary and industrial relations matters have also received the author's critical attention.

There is yet another area of public sector enterprise culture which from the author's own account appears to inhiblt efficiency and on this the author is practically silent. Reference here is to the goals of Public sector. In Chapter 11, the author has stated these objectives at length which may be summarised as (1) the goal of providing the infra-structure for economic development and generation of surpluses for future investment and (2) ensuring equity and justice as between different regions in the country and different sections of the population. As to the relative importance of these two objectives, the author states : "Indeed, when the two become irreconcilable, as does sometimes happen, the social objectives have to take precedence over the commercial objectives." (p. 118). Thus, at the level of the enterprise. social objectives assume primacy over commercial objectives.

Doesn't this lie at the root of the human problems of DSP) as narrated by the author in Chapters 5, 7, 11) and perhaps of some other public

sector enterprises ? When, at the enterprise level, social objectives are believed to have primacy over commercial objectives, isn't it natural that these will tend to be defined too narrowly to imply only the interests and welfare of labour ? Isn't it then likely to generate the kind of worker and trade union behaviour described in chapters 5 and 7 as well as the kind of apathy and inaction seen on the part of managers ? And there is no wonder if production and productivity recede to the background of everybody's concerns. The important point to note is that relentless pursuit of this narrowly defined social objective will defeat some of the larger social purposes for which the public sector was established, creating and re-investing surpluses in order to create more employment, opportunities and thereby help the weaker sections of society.

What is needed, then, is a clearer definition of goals to be pursued at different levels in the public sector. The social goals must be pursued at the level of the government in its role of policy maker and resource allocator and not in overseeing how a particular official in a public sector undertaking is promoted or punished. At the enterprise level, efficiency must be unequivocally defined as the primary goal to be pursued. Such a redefinition of goals will inevitably imply changes in the structure of the organisation and the norms that guide behaviour of individuals and groups. This aspect or the problem has not been highlighted in the conclusions and generalisations which may be cited as one of the book's rare inadequacies. Apart from this, two minor printing errors may be cited for correction in the next edition of the book : Against "General administration and township" on page 11, the figure should be 8,500, not 85,000 and in the last line on page 27 "Bhava" should be spelt as "Bhaya." □

Backward Area Development : Strategies And Policies

Management Development Institute, New Delhi, Nov. 1977, pp. 303, Rs. 30.00

Reviewed by Dr. Ram K. Vepa*

During the last ten years, there has been a great deal of interest in the problem of the development of Backward areas in the country. The National Development Council—the highest forum for planning and development in the country—was seized of this problem as early as 1968 and constituted two Committees headed by senior officials—one to determine the criterion of backwardness (and identify the areas which are backward) and the second, to outline the specific incentives that should be given to help the growth of such areas. It is on the basis of the Reports of these two committees that various measures were announced such as the capital subsidy, concessional rates of interest, rebates on incom-tax, concessions in sales-tax and subsidy on transport charges.

Nor was such interest merely academic; the history of development planning in the first two five-year plans has indicated that small as the growth has been, it masked a wide spectrum of growth rates—within the country and, sometimes, within a State itself. While some States such as Tamil Nadu, Maharashtra, Gujarat and Punjab forged ahead rapidly taking advantage of the many new incentives offered, the relatively-backward States such as Bihar, Orissa, Madhya Pradesh, Rajasthan, Uttar Pradesh etc., remained so—and even fell back relatively. Within a State, too, there were variations which led to violence and unrest—as in the Telangana region of Andhra Pradesh in 1969—culminating in demands for separation from the parent State. Even in the comparatively more advanced states such as Maharashtra, the bulk of the money went to the metropolitan regions—the Bombay-Poona Complex—while Marathwada, Vidarbha and Konkan suffered neglect. The late Prof. Gadgil once revealed that in Maharashtra, more money was being spent on roads in Bombay city alone than in the rest of the State put

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together. Such disparities tend to be specially accentuated when increased amounts become available for the developmental effort.

Now that a concerted attempt is being made to tackle this problem—and this has been going on for the past 5 years—it was appropriate that the Management Development Institute (set up by the Industrial Finance Corporation of India) organised a Seminar (the first it undertook) in April 1976 at Bangalore to take stock of the situation and to critically review the existing policies and measures that have been formulated to overcome the regional imbalances and to accelerate the growth of the less-developed areas. The Seminar was attended by the representatives of the financing institutions, Commercial Banks, State level Development Institutions, Consultancy organisations as well as senior officials of the Ministry of Industrial Development and the State Government. The book under review is a record of the proceedings of this Seminar.

The subjects specifically discussed at the Seminar were : (i) A critical assessment of the achievements of the various measures undertaken so far, (ii) The need for a new strategy for development of Backward areas, and (iii) The specific role of financial and developmental institutions in such a strategy. Panel discussions were organised on : (i) Growth Centre as a tool of area development, (ii) Economic Rationale for Incentives and Subsidies, (iii) Linkage effects of large units for Ancillary Development, and (iv) Experience concerning Lead District Development.

Many interesting points were made during the Seminar discussions. Dr. Madan, Chairman of the Management Development Institute and himself a development banker of international repute, wondered how the areas and districts selected as backward some years back stand today, judged by the same criteria, and further, what should be the norms for judging the growth of such areas. He also posed the question whether the district was not too large a unit for being designated as backward and whether a taluk would not have been better—as, in fact, was adopted by Tamil Nadu and Andhra Pradesh. Dr. Madan drew a distinction between areas which had a potential for growth as against those which, for the present at least, would be unable to respond to stimulii: it is doubtful, whether, in practice, such a distinction would be politically acceptable, however desirable it might seem from the point of view of developmental administrators.

Delivering the key-note address, Mr. Baldev Pasricha, Chairman of the Industrial Finance Corporation of India, regretted that the various measures undertaken by the various institutions do not seem to have the desired effect. He felt that the instrument of licensing has not been used effectively to discriminate the type of projects that ought to be set up in backward areas. Many of those that did go to such areas did not have the desired 'multiplier effect' and were like oases in a desert. Many such projects came up on the periphery of metropolitan areas which were only nationally backward. Mr. Pasricha emphasised the critical importance of appropriate project identification and projects selected on the basis of resources and skills available in the area which would, therefore, have a relevance to that region.

During the panel discussions that followed, it was noted that even in respect of the Capital Subsidy Scheme there was a tendency for the entrepreneur to go to the backward districts of the more developed States rather than those of the less-developed ones. This, again, gives, a clue that a mere 'package of incentives' is not enough but much more depends on the way they are actually impemented. The Seminar could, with profit, have spent more time on the inadequacy of the implementation of the Schemes announced and the administrative bottlenecks that have been found in practice. Since the Seminar was attended by many officials engaged in that task, it would have been interesting had it gone in more depth into the problems of implementation rather than talk of a new strategy of development which was bound to face similar problems in execution.

An interesting point made was that all too often Backward Area Development is conceived in industrial terms while, in reality, the concept should be much wider and include agriculture and other developmental programmes. In fact, what one is looking for is to improve the 'quality of life' and to develop the human resources existing in the area. In the ultimate analysis, the difference between the so-called advanced areas and those which are relatively backward is not in the lack of natural (or even human) resources, but in the ability to realise their full potential. The fact that many of the areas now called backward—such as Orissa, Rajasthan, Uttar Pradesh, etc.—were once the centres of flourishing kingdoms testify to the fact that they are not inherently backward but only temporarily so. The Seminar did not dwell adequately on the problem of developing entrepreneurship, which

may well be the key to the growth of backward areas, if the momentum for growth is to come from within. This is an area where much more thought needs to be given in promoting measures which will identify suitable entrepreneurs and give them adequate encouragement so as to formulate and implement projects.

It is here that the role of the developmental and promotional institutions becomes one of importance. It is a pity that in some of the Papers included in the book, sweeping statements about the so-called failures of the IDCs have been made; one wonders what norms have been adopted to arrive at such judgments or are such opinions purely subjective? If there is a failure—and there has indeed been to some evtent—it is one which the Central financing institutions and the Commercial Banks should share since the development of backward areas is a national problem that is the responsibility of all.

The fact of the matter is that financal institutions that assume the role of developmental agencies seem to operate constantly under a dilemma: how far they should dilute the strict 'financial' norms at the altar of development. It is almost as if they suffer from a guilt complex that although they do propitiate the goddess of development, it is strictly not what they should be doing—and one wonders whether in their anxiety to seem correct, they are not unduly rigid in implementing the development programme. It seems to be the classic case—one step forward and two steps backward, which certainly does not take one forward—and the Seminar organised as it is by a leading financial institution would have done well if it had been more critically self-introspective in assessing how far financial institutions are able to bring a new approach to the schemes emanating from the backward areas and States.

Anther area which did not receive as much attention at the Seminar, as it should have, is the technological relevance of many of the Schemes in the backward areas. The point was hinted at in the keynote address of Mr. Pasricha, but it was not sufficiently explored in the discussions. Are the projects coming up on the backward areas really relevant to those regions or are they pale imitations of what are put up at Bombay, Delhi or Madras? Is sufficient account taken of the completely-different parameters that operate in the backward regions; one wishes that financing institutions, instead of worrying unduly about financial viabili-

ties (which at the best of times are somewhat elusive) and cash flow statments (which rarely are realised in practice) spend more time on the technological appropriateness of schemes which alone can lead to satisfactory linkages with the envionment in which they operate.

The Management Development institute is to be commended for organising the Seminar on an important and topical theme and in bringing out the proceedings in the shape of a book. However, one cannot help feelng that the utility of the book would have been greater if it had been edited more rigorously avoiding a great deal of repetition which would have saved time instead of the 18 months that have elapsed since the Seminar was held. It is a pity that in spite of three decades of experience of organising seminars, we do not yet seem to have acquired the skill (so happily present in the UK) of being able to present the proceedings in a readable and cogent form without being unduly reptitive. A book of half or even a third of the size would have been adequate and, incidentally would have been cheaper so as to make it possible for a larger audience to profit by it. □

Profile of Indian Managers

Mirza S. Saiyadain & Arun Monappa

Vidya Vahini, New Deihi-57, pp. 54, Rs. 15.00

Reviewed by Kewal Soeny*

Not long ago, the foreign companies in India were 'reputed' to select men with blue blood and pick them young—who after a bit of training joined the covenantal ranks of the firm. Others with blood not so blue joined as clerks and rose at times to become office superintendents and sales supervisors. Good family background, good connections, education abroad, etc., etc., were the criteria for success.

Independence brought with it opportunities and more Indian youngmen found jobs in commerce and industry. Gradually they replaced the

*Education Officer, All India Management Association, New Delhi.

European manager. The company structures changed colour and with it change in attitude towards personnel. And since then attempts have been made to study the personality profile and the style of the Indian manager. An early attempt was Sagar C. Jain's *Indian Manager: His Social Origin and Career*. This survey concerned the upper and middle level personnel employed in Indian industry and dealt with their personal, occupational and religious background, their caste and regional origin, their educational training, how they rose to managerial positions and the influence of their social origin on industrial relations. Professor V. Subramaniam's study, *The Managerial Class of India* concerned two different groups of managers, those belonging to the top five management-conscious firms and those serving in twenty other firms at the next level. Arabinda Ray's *Indian Manager in Search of a Style* was another study on the life-style and personality of the Indian manager. A number of other research workers, too many to be mentioned here, have also contributed to our knowledge on the subject.

Why then another study ? According to the authors:

1. Managers contribute to the economic well-being of the nation.

2. Recent studies in behavioural sciences show that the relationship of the managers with their colleagues determines the effectiveness of their role. Therefore, it is necessary to identify the personality variables which help them to relate meaningfully to others to perform their job more effectively.

3. They can make the public aware of the fairness of management policies and practices.

This study is based on data collected on 172 managers who attended management development programmes conducted by the Indian Institute of Management, Ahmedabad, between April and September 1976. They were from 14 industries, had functioned for 10 years as managers and comprised almost an equal number from public and private sectors.

Some of the findings of this piece of research are : Over the years, the number of managers in the young age has increased; the number of managers whose fathers were agriculturists has decreased. In 1967, a

majority of managers came from Maharashtra. While Maharashtra and Tamil Nadu produced more managers over the years, Gujarat, Punjab, Haryana and West Bengal lost their share, More Sikhs have come into the management profession; the number of Jains has decreased. In 1963, 80% of the managers had an urban background. The trend was more or less the same in 1976. Indian managers in 1976 sample had a minimum of bachelor's degree, unlike the earlier counterparts

This study indicated that 67% of the sample read on an avarege 2-3 business journals and periodicals, mostly related to their field of work. (Is this a correct observation?) Most managers embarked on their career as teachers, researchers or by promotion from within, while 38.3% started as managers or management trainees.

Obviously, this study breaks some pre-conceived notions about managers. It does suffer from insufficient causal explanation, but indicates areas for further research. □

Industrial Jurisprudence

Mahesh Chandra

N. M. Tripathi Pvt. Ltd , Pp. XI+176, Rs. 28 .00

Reviewed by M. J. Naik*

As claimed in the blurb, the author does not want his present publication on "Industrial Jurisprudence" "to be limited to mere discussion of growth and development of the basic principles of industrial law; rather, it must, of necessity, include the study of important questions of social justice, industrial justice and judicial control". The author has tried to cover in a brief span of 170 odd pages the vast panorama of Industrial Jurisprudence under various heads.

In the chapter on "Industrial Jurisprudence" he has given, apart from

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the various authorities, his own interpretation of the development of the concept of Industrial Jurisprudence, as it evolved in other countries, the need for Industrial Jurisprudence and its growth. As stated on page 13 by him "The cherished objectives of harmonious and amicable relations between the employer and the workmen could not in these circumstances be achieved within the framework of the then-prevailing juristic thought, legal principles or legal traditions; it called for altogether new approach, based on new legal thought and philosophy so that new legal traditions could come up so as to pave the way for social justice and for an equitable distribution of profits and benefits accruing from the industry between the industrialist and the workers, which alone could afford real protection to the workers against harmful effects to their health, safety and morality, rather than mere compliance with the contract of employment". He thus claims that the need for Industrial Jurisprudence was, therefore, imminent and imperative; it was a sociological necessity so that the dominance of the *laissez faire*, based as it was upon the so-called natural rights of the individual, could be bid a goodbye. He has also dwelt at length on the recognition of the new jurisprudence which ultimately led to the establishment of the International Labour Organisation as a part of Treaty of Versailles in 1917-18. Subsequently he has also given an outline of the growth of Industrial Jurisprudence in India in the same chapter. On pages 40 and 41 he has described the scope of industrial jurisprudence and the limitations of the scope.

Under "Social Justice" he has given a broad outline of the philosophy and concept of social justice and the relationship between social justice and legal justice.

In Chapter III, under "Industrial Law", while describing the various kinds of Industrial laws, the author has classified them on the basis of territory as 'local industrial law' and 'general industrial law', distinguishing the difference between the two. He states on page 59 that we may distinguish local or specific industrial law where there is a fundamental difference between actual conditions of work and industrial life in certain industries which may call for special protection or special provisions and he gives examples of such special industries as mines, railways, docks and plantations.

On the analogy of private and public international law, he has also differentiated between what he calls as 'public industrial law' and

'private industrial law'. This distinction, however, he has picked up from Foenander from his book 'Better Employment Relations' wherein the 'private industrial law' and the 'public industrial law' can be dealt with on the basis of the objectives which in the first case are the protection of a person from the possible or apprehended, effects of economic weakness when bargaining to enter into a legitimate contract of employment, or the safeguarding of a person from the detrimental incidents, or risks attaching to the work that he has undertaken to carry out in the furtherance of his contract of employment and in the latter case those laws, the chief aim of which is the protection of the community as a whole from the possible or apprehended dissension and disorder, or the deprivation of goods and services deemed necessary to existence or their welfare, resulting from collective action by employers, by employees, or by a combination of both; or the safeguarding of sections of the community from occupational dangers to life, limb and health. After discussing this classification by Foenander he, however, says that this categorisation of industrial law "is more superficial than real". He, therefore, further tries to classify industrial law into "contractual" and "protective' according to the contents. Further, he gives us another way of classifying where he claims that the classification in its very nature being too broad would not suffer from the defects of overlapping and, therefore, classifies them into "substantive industrial law" and "procedural industrial law". However, he further arrives at the conclusion "it is best not to attempt a clear-cut classification of the industrial law inasmuch as it does not admit of such a classification. ". He enumerates sources of industrial law as industrial agreements, precedents and legislation. Though he does not mention specifically as what in India has come to be known as "case law", the concept of precedence as defined by Salmond in "Jurisprudence" more or less can be equated with the Case Law in India.

Chapter IV describes the various rights in detail, giving the background of the I.L.O's contribution as well as the impact of the Universal Declaration of Human Rights 1948 on the various rights which emanated in various countries. The author unnecessarily repeats on page 78, 79 and 80 what he has already reproduced earlier in the first Chapter, the preamble to Part XIII (Labour) Sections I & II. This repetition could have been avoided.

Under Industrial Justice, he has given the background of justice in

general, compared to the concept of industrial justice which also partakes of two forms, namely industrial criminal justice and industrial civil justice. And he has described in detail apart from the need for industrial justice, the nature and scope of industrial civil justice and the machinery for administration of industrial justice and the characteristic features of such machinery. He has also described the twin principles of natural justice, but he could have added the background of how the principles of natural justice arose in U.K. which also would have been of interest to the readers. He has further described the various principles of determining industrial disputes like discretion, *Res judicate*, Estoppel and acquiescence, limitation, and has laid emphasis on speedy justice. Under industrial criminal law he has dwelt at length on the principles of *mens rea*, vicarious liability and burden of proof.

While describing the appellate authorities under industrial law he has described the labour appellate tribunals. However, the reviewer feels that he could have given the reasons for the failure of the Labour Appellate Tribunal in India and its subsequent abandonment which resulted in the appellate authority being vested with the Supreme Court.

In the last chapter on "Public Undertakings" the author has tried to give the genesis of the growth of public undertakings as well as of industrial disputes in public undertakings quoting profusely from the report of the study group on Labour Problems in Public Sector, of the National Commission on Labour. However, one feels that he could have highlighted the earlier failures of the public sector undertakings in implementing industrial law as "a model employer". He himself, on the last page, admits that "industrial jurisprudence has, therefore, a very important role in the process of evolving new concepts and ideas which should regulate industrial relations in public undertakings and thereby help the establishment of an overall industrial harmony, which in course of time has to function as an ideal for the private enterpise". Perhaps he indirectly also admits the failure of the public sector undertakings in implementing the various labour laws not only in letter but also in the truest spirit behind such enactments. He, therefore, advises "it must strive to evolve a self-contained code and machinery for the regulation of industrial relations and other questions of labour interest in public undertakings...." This is to the reviewer too pious a hope in public sector undertakings which are, to some extent, as good or as bad as private industries when the question of industrial jurisprudence comes.

On the whole, the book is a good attempt mainly for students interested in understanding the the principies behind industrial jurisprudence. □

Report on a Study of the Debt–Equity Ratio Norms

B. K. Madan

Management Development Institute, New Delhi, 1978 Rs. 40.00

Reviewed by P. Chattopadhyay*

The Management Development Institute conducted a survey on debt-equity ratio norms in response to need. It has been felt for long that in the absence of acceptable norms, the practices tend to go centrifugal, assessment of financial viability by financial institution remains unsure and uncertain and the managements of the enterprises are not afforded necessary yardsticks against which their financial structure could be appraised. This study thus seeks to cover a gap and raises expectations in both official and non-official circles. A stamp of authority is naturally anticipated, coming as it does from the MDI. The outcome of the exercise is rather disappointing from both these points of view.

The study was entrusted to the Institute by the Department of Economic Affairs, Ministry of Finance, Government of India. The major focus of the study has been on the development of debt-equity ratio norms as followed by the financial institutions, government agencies, industry and others. It must be mentioned that the Institute has approached the subject in an objective manner and the points argued and recommendations made have been addressed to financial institutions, and the recipients of loans in the corporate sector. The object is rather limited, from this point of view. The study has thrown up a considerable amount of first-hand information collected through questionnaires. If adequately linked up with the mainstream of thought on the subject and

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literature already available, one could appreciate the significance of the subject much better. There are different issues that are required to be considered in the context of finding one norm for all purposes. It is not the intention of the study to underline such a norm. It throws considerable light on the rationale that should be followed in considering issues of financial management.

The debt-equity ratio has been spotlighted in the course of examining financial viability of projects by banks and the financial institutions in varied contexts. Overtime, different institutions have evolved different approaches for this purpose and practices have hardly been uniform, to say the least. It is from this standpoint that the discussion on the rationale behind the evolution of such norms should be found appropriate both from the point of view of internal management and of external agencies. The points of view of large and medium scale industries, small scale industries, enterprises coming under the MRTP Act and their expansion projects and technician-entrepreneurs have been underlined with specific reference to the need for relaxation in debt-equity ratio norms. Their relevance for backward areas, technician-enterpreneurs, high capital-intensive projects and exports has been examined, underscoring the pros and cons of acceptance of a norm. The variations that should be allowed in different cases have been considered in detail.

While each of the twentynine recommendations emerging out of the study deserves serious consideration by all those concerned, several of them are not beyond dispute or disagreement. Some of them also do not quite follow from the analysis; at least the discussion does not afford proof enough for carrying convication. For instance, it has been mentioned that "Inasmuch as a higher debt-equity ratio implies a lower direct tax incidence, this could be considered as part of the package of incentives for exports, as a possible useful device for lowering the high tax incidence on industrial units in general, in relation to the export part of industry. But not having ourselves looked at the entire package of export incentives, rebates, concessions and reliefs, which is a subject outside the terms of reference of the present enquiry, we do not, for our part, make a specific recommendation in this regard." (p. 125).

It should also be mentioned here that certain loose statements have appeared in the study which could have been avoided; for instance, a firm has been said to have shareholders whereas in contradistinction

with corporate or unitary concerns, firms have only partners. The thrust of the study is on the apporaches by financial and other institutions for the purpose of extending loan assistance to needy units. Lopsidedness is easily traceable in the treatment aspects of the subject, undermining its value. Thus, one has to look to other sources for a detailed discussion on debt-equity norms on objective grounds. Comparative costs and benefits of the alternatives are required to be computed for empirical support. However, the study correctly emphasises that debt-equity ratio cannot be rationally considered in isolation from the other factors. It, therefore, suggests that "Thus, if difficulties in regard to the financing pattern of concerns are observed, it may not be the right approach to seek a way out, on a long term basis, merely through an alteration of the debt-equity ratio of concerns, new or existing. The better approach would seem to be to look at the whole package of measures and policies impinging on the sources of financing for enterprises—equity as well as debt—and consider the debt-equity relationship in the context of a durable and tenable composition of the package of policies and the appropriate environment for investment and growth. In other words, the effort at the Governmental end should be not to look upon the debt-equity ratio problem in isolation but to seek ways and means of improving the total operation of policies, including, in particular, an appropriate debt-equity ratio, with a view to subserving the objective of better and more efficacious financing of new investment in private sector concerns." (p. 112). These are, however, tautologies and figure more as *obiter dicta*. □

Books Received

Text Book of Principles of Management and Personnel Management : A.S. Deshpande, Published by Vora & Co., Publishers Pvt. Ltd., Bombay, 1977; Rs. 17.50.

Corporate Capital Structure and cost of Capital, S.K. Chakrabarty; Published by Institute of cost and Works Accountants of India. Calcutta, 1977; Rs. 50.00

Agriculture : A Bibliography; Satya Prakash' Indian Documentation Service, Gurgaon, New Delhi, 1977, Rs. 125.00

New Books : Annotated List*

Collective Bargaining

Jenkins, Clive & Sherman, Barrie

London, Routledge & Kagan Paul, 1977, pp. 156, £ 1.95

This book explains the nature of trade unionism and trade unions, emphasising the collectivity aspect. It goes on to discuss a union's work at local and national levels, when dealing with an employers' federation, and with various types of employers. Among the subjects covered are the failure of conservative legislation affecting collective bargaining, the legal processes involved, the topics about which collective bargaining takes place (recognition, the salary package, pensions, for example), and the back-up services necessary to conduct effective bargaining and industrial action. □

Critical Incidents in Organisational Behaviour and Administration : With Selected Readings

Bridges, Francis J. & Chapman, James, E.

New Jersey, Prentice-Hall, 1977, pp. 82, $ 9.95

A total resource book for those interested in learning more about organisational behaviour and administration. Through familiarisation with the 45 critical incidents and 14 readings included in the text, the reader gains a balance of knowledge of the practical and theoretical aspects of organisational behaviour and administration. An easy-to-understand set of readings that professionals and beginners will find of service and value. Partially structured incidents make readers more aware of the need for further knowledge in the field of organisational behaviour and administration. □

*Prepared by S.N. Vig, Documentation & Information Officer, National Productivity Council, New Delhi.

Decision-Making for Small Business Management

Young, Jerrald F.

New York, John Wiley, 1977, pp. 248, $ 11.95

This book is intended for the would-be enterpriser, particularly for instructional use in the college class-room and for use as a self-help or "HOW TO TEXTBOOK". Also, it can be used as a reference book by anyone who is striving for a successful endeavour. If it is properly used, it will assist the small businessman in making successful analyses and decisions. These analyses can lead to an immediate and steady climb to success or to a decision to refrain from or delay going into business at a particular moment. Decisions arrived at through the analytical process described in the text may save irreplaceable time and perhaps a considerable investment of money.

This textbook would not have become a reality without the inquiring students and eager enterprisers desirous of success who constantly asked the types of questions this book answers. □

Finance for the Non-Financial Manager

Spiro, Herbert T.

New York, John Wiley & Sons, 1977, pp. 256, $ 15.95

This book originated in a series of seminars and short course conducted for managers who sought to increase their understanding of financial management. The book attempts to address the needs of mature and motivated readers. It is an exposition of relevant financial concepts coupled with selected demonstrations of their application to solve the problems of financial management. The book is geared to meet the needs of managers who wish to broaden their understanding of decision-making processes within their organisations. □

An Introductory View of Management

Drucker, Peter F.

New York, Harper & Row, 1977, pp. 588, $ 13.95

This book includes those facets of management which a Manager should know and is presented in a form which is accessible to even those who have not yet worked as managers. Consisting of 39 chapters, the book deals with *tasks* of management, like performance in business in a service organisation; to make work productive and the worker achieving; managing social impacts and social responsibility; the manager's work and jobs; managerial skills; and managerial organisation. The latter part includes a discussion of the innovative organisation and of the job, work and organisation of top management. The concluding part tries to project on the job of the manager of tomorrow. □

Productivity in Service Organisations : Organizing for People

Heaton, Herbert

New York, McGraw-Hill, 1977, pp. 233, $ 13.50

In organisations that produce services—associations, hospitals, schools, government agencies—successful management and supervision requires far different skills than in organisations which produce physical goods. This important and provocative book is the first to provide an in-depth discussion of the management needs and opportunities in service organisations - the fastest growing segment of post-industrial society. The author introduces the concept of a Hierarchy of Organisation Methods, Force for unskilled labour, Authority for efficiency in using machinery, and Fusion (confrontation, consensus, etc.) and Development (understanding, feedback, etc.) for delivering services. □

On the Move: Communication for Employees

Blicq, Ron

New Jersey, Prentice Hall, 1977, pp. 259, $ 5.95

How do you present yourself in a job interview or gain promotion, once on the job? How do you communicate your suggestions or give instructions to other employees? This book answers all such questions concerning jobs—whether you are seeking work, trying to improve your position, or starting a business of your own. The examples and explanations show the importance of communication, both oral and written, an essential key to success. □

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Measuring Environmental and Economic Impact of Alternative Technologies

James Pickett*

In defence of the proposition that there is nothing new under the sun, two quotations may be offered. Thus :

> "A device has been discovered. . .called social valuation and consists in replacing the conception of social welfare defined as the sum of individual satisfaction by the dictate of some agent who decides what relative weights are to be attached to the (unmeasurable) desires of the members of society. That this agent is nothing but the *volonte generable* of the 18th century should be clear; so should the danger that this agent may become but a name for the interests and ideals of the analyzing individual."[1]

and

> "Of all the quacks that ever quacked, political economists are the loudest. Instead of telling us what is meant by one's country, by what causes men are happy, moral, religious or the contrary, they tell us how flannel jackets are exchanged for pork hams, and speak much of the land last taken into cultivation."[2]

In further emphasis of the antiquity of the concerns of the present paper, an additional thought can be invoked, that :

> "The story of man's relationship with the natural environment dates back to the dawn of man's emergence as the dominant species on our planet. It is indeed inseparable from the story of man's own development."[3]

---

* Director, David Livingstone Institute, University of Strathclyde, Glasgow, U.K.

1. J. A. Schumpeter, *History of Economic Analysis*, Oxford University Press, New York, 1955, p. 1072.
2. Quoted by Jacob Viner in "The Economist in History" in *American Economic Review*, December 1962.
3. Maurice F. Strong, in the *Introduction to Development and Environment*, Mouton, Paris/The Hague, 1972.

The long-standing character of the concerns and difficulties, with which this paper wrestles, established, a number of caveats are necessary. One of these may be entered graphically and briefly by reflecting that the Parthenon has substantially survived the vicissitudes of time and activities which span the period from Periclean Athens to the present. In this century the remains of the Parthenon have been, increasingly, one of the most splendid and inspiring of all tourist attractions. Very recently, however, the Greek government has been forced to take a number of measures to ensure the continued preservation of the ancient temple. These measures have been made necessary, for the first time in over two thousand years, by at least three distinict but related factors : industrial pollution, vibration caused by low-flying aircraft, and the sheer increase in the number of visitors. This example suggests that the scale of the problems discussed in this paper have increased greatly in the recent past.

Indeed one way of illustrating the fact that the relationship of man to his environment is "inseparable from the story of his own development", is to see that development in terms of an increasing command by man over the environment and trace out some of the consequences of that phenomenon. It is true that man—distinguished by his capacity for thought and even forethought—has always in one sense been the active partner in the relationship between himself and his surroundings. It is still true, of course, that the 'elements' are far from being under man's complete control. Drought in sub-Saharan Africa in recent years and the difficulties of the 1976-77 winter on the Eastern seaboard of the United States testify to this. Out with the realms of theology, however, the influence of the environment on man has been random and permissive rather than purposive. It would, however, be possible to write the history of man in terms of an increasing and increasingly purposive control over his natural environment. Such a history would, *inter alia*, make distinctions between the natural and man-made environments; and would, in a related way, note that man as an individual in modern societies lives substantially in a physical environment that is man-made and in a social environment that reflects the character of his contrived physical surroundings.

To recognise this, and to accept that man's effort to control his environment is now so far-reaching and so rapid and rapidly changing in its impact as to raise some substantial questions to a degree not previously

relevant, need not obscure the point of the two initial quotations and the first thought on man and his environment. The element of novelty, the extent of present problems notwithstanding, the quotations serve as useful reminders of the difficulties and dangers of seeking to measure complex outcomes in a summary way—and, indeed, quantitatively speaking, at all. They also serve as a reminder, in their different ways, of the longstanding scepticism of many (naturally mostly non-economists) towards economics and economists. In particular, the implied separation—to the detriment of the economist and his 'science'—of the material and the more-worthy-than-the-material made by Carlisle has a familiar ring to even a casual student of much of the recent literature on environment. It is doubtful if the suggestion that economists have particularly narrow vision is either accurate or helpful. Even at this early stage two things may be said in defence of economics. The first is that since resources are limited and aspirations infinite, then economics (as a 'science' of choice) is necessary. The second is that (without prejudice to particular arguments about the relevance or otherwise of economics to the environmental debate) most economists have seen their subject as being concerned with the eradication of poverty and the enlargement of the range of human choice.

Nevertheless, Carlisle's view for many puts economics and the economists in their place. On a more objective view, however, not the least of the difficulties in dealing with the subject matter of the present paper is that of deciding the scope for economic analysis. This difficulty is compounded by the fact that much contemporary economic thought aspires to the status of a positive science; whereas the problems of the environmental and economic impact of alternative technologies are to a substantial extent normative.

The problems of the relevance of economics is further compounded by the association between economic growth, on the one hand, and science and technology on the other. Thus, in the words of Professor Kuznets, the distiguished anatomist of modern economic growth, "science-based technology and the broad views needed for its successful exploitation by human societies were so dominant in the countries that sustained modern economic growth as to constitute a distinctive feature of the modern economic epoch". The 'broad views referred to are worth cataloguing, even if only *en passant*. They are suggested by three terms : secularism, egalitarianism and nationalism. The first means

concentration on life on earth and consequent assignment of high rank to economic attainment. Egalitarianism is the denial of any innate differences among people except as these manifest in human behaviour. Indeed, again in the words of Kuznets, "one could go further and, at the danger of over simplifying sociology, argue that it is the increased power of man over resources provided by science that constituted the basis for the view of man as captain of his destiny in this world (secularism) and erase the need for mythological basis to justify the otherwise necessary higher economic returns to an upper-class minority (egalitarianism), since the general rise in per capita economic product made the remaining inequality tolerable on purely rational grounds". Nationalism is basically the claim of community of feeling on a variety of grounds. Having said this, the essential point is that modern economic growth has resulted from the application of science and technology to the problems of production. Some insight into what this has meant can be had quickly from a brief glance at technological progress in the textile industry. The production of textiles formed the leading sector in the British (and first) industrial revolution. The original expansion of this production was based on a series of fairly crude mechanical improvements in shuttles and looms. In the present century, technical progress in the production of textiles has been based increasingly on a scientific understanding of the properties of fibres, on electronic rather than mechanical improvement and in the application of computers to the problems of production and design.[4]

The connection between science and technology and economic growth has been emphasised because the scepticism about economics has been repeated (often with interest—in the economic sense!) about the effects of science and technology. Certainly there is, many think, a case against contemporary technology. It depletes non-renewable resources at an unacceptably rapid rate, it pollutes and it dehumanises. At its most lurid, this case leads to the inference that "Faustian man will be dragged to death by his own machine".[5] Less luridly and nearer to home, "the

4. A convenient statement of Kuznets' views are to be found in his *Modern Economic Growth*, Yale University Press, New Haven and London, 1966, pp. 1-33.

5. The quotation is from Spengler's *Decline of the West*. It has been widely quoted including by David Dickson in his *Alternative Technology*, Fontana/Collins, Glasgow, 1974. The case against contemporary technology is made out in this latter work (pp. 15-40).

poisoning of one's local river by industrial effluent, the lung-disease induced by working with asbestos over many years, the sclerosis of our cities caused by the privnte motor car or the sight of a Vietnamese child permanently scarred by the pellets of a fragmentation bomb" have all—properly—been laid at the door of modern technology. There is, however, another side to the coin The detrimental effects of technology notwithstanding, life expectation is everywhere greater than it was 50 or 200 years ago, and, for many, levels of living are quantitatively and qualitatively better than those of their forefathers. This contrast between the advantages and disadvantages of science and technology-based economic growth raises the question of the extent to which the application of science and technology to the problems of production can be made more purposive than hitherto. In a thoughtful essay, one critic of the growth approach as embodied in the convention that economic welfare can be measured by the gross national product per head, has conceded that the GNP does serve as a faithful indicator of the "aggregate supply capacity of the country". He further concedes that, this being so, the subsequent question is whether it would be possible to devise ways of improving the uses to which this capacity is put. He himself sees the answer to this question largely in terms of the institutional limitations of capitalism ; but others see it differently.[6]

In such circumstances of controversy and complexity, to elaborate objective measures of environmental *and* economic impact of alternative technologies is clearly an extremely difficult undertaking; to have such measures accepted as objective is probably impossible. In the hope, however, of steering a course between unrestrained polemics and sterility, the remainder of this paper is in three parts. The first discusses briefly the problems of the environment in the context of developing countries; the second considers the conceptual and practical limitations of economic analysis in the appraisal of alternative technologies; and the third, in the light of this, searches further for guidelines which might illuminate project appraisal in the developing countries when alternative technologies are considered and when environmental and economic considerations are taken into account.

6. Shigeto Tsuru, "In Place of GNP", in the *Political Economy of Environment*, Mouton, Paris/ The Hague, 1972. pp. 11-25.

I. THE ENVIRONMENT

As could be inferred from the foregoing discussion, the debate on environmental questions was initially a phenomenon of the now developed countries. This was partly because the levels of affluence attained in these countries made it possible for eyes to be raised, as it were, from the hard grinding task of wringing a living from nature, partly because the technological underpinnings of the affluence had themselves deleterious effects, and partly because the social consequences such as urban decay and congestion of development were also unpalatable. Given this origin, developing countries were in the beginning suspicious and concerned. Part of the concern was that developed-country efforts to improve the 'quality of life' in such countries would be undertaken to some extent at the expense of efforts to improve standards of living in the developing countries. Moreover, it was natural to believe that the environmental problems being discussed were largely those that were manifest in the richer countries of the world.

Further discussion and reflection lead to a realisation that the developing countries also had their environmental problems. To some extent these were problems that they had in common with the developed countries. For this there are two explanations. On the one hand, much development that has taken place in the poorer countries of the world has been consciously or otherwise modelled on the developments of the richer countries. This has resulted in an economic and social dualism of which one manifestation has been extremely rapid urbanisation. As a result of this, the developing countries, it has been pointed out, suffer from the environmental problems of both medieval and modern European cities—they lack clean water, and often proper sewage facilities at the same time as they experience growing traffic congestion;[7] and on the other hand there are some environmental problems which are global in their impact—nuclear fallout being perhaps the most graphic case in point.

Again, it has to be recognised that traditional activities in the developing countries also have their environmental hazards. This is perhaps particularly true of traditional agriculture which "in many tropical

7. This and many of the other points discussed in this section are made in *Development and Environment. op. cit.*

regions is characterised, particularly under stress of expansion, by a large range of environmental hazards".[8] The hazards are serious. Thus, "the fragility of tropical ecosystems may cause environmental deterioration to proceed rapidly and their recovery to be slow. In one instance, the establishment of an agricultural colony failed when deforestation resulted in the hardening of lateritic fields within five years; restoration on the other will take decades. In another case previously ungrazed savanna was destroyed by overgrazing in two to three years, and will probably be lost to production for a very long period."[9]

To be reminded of these obvious links between the physical environment (natural or man-made) and development is useful. Perhaps, however, the most useful outcome of the period of reflection on the relationship between the environment and development has been the opportunity it afforded to stress that the main environment with which the developing countries should be concerned is that of poverty itself. In the developed countries it is appropriate to talk of improving the quality of life. In the developing countries the question is still much more of sustaining life itself.

The environment of poverty is one which if it is to be replaced by a better environment requires that economic growth takes place. To be sure, economic growth without development is to be avoided. There is, however, a very sharp limit on the extent to which development without economic growth is possible. This emphasis on the growth element in attempts to improve the developing country environment is extremely important. At the very least it makes it clear that the *status quo* is not acceptable; and that, when all due regard is paid to tradition, distributional requirements and a strong emphasis on the basic needs (however these are defined) of the mass of the population, it is still necessary that economic activity should be so organised as to produce, year in and year out, a surplus available to add to the size and sophistication of the capital stock, the skills of the labour force and the arability of the land.

With this in view, it is convenient now to recognize that the distinction between the environmental and the economic in the context of the developing countries is somewhat artificial. It, nevertheless, serves

8. *Op. cit.*, p. 15.
9. *Op. cit.*

analytical purpose to maintain it and in what follows a distinction will be drawn, at least to some extent, between the economic and the environmental, where the latter adjective will be used to refer largely to the physical surroundings in which developing country people live and work.

II. RELEVANCE OF ECONOMICS[10]

One of the most impressive intellectual achievements of neo-classical economics is the perfectly competitive model. Given the distribution of income and consumer tastes, and granted certain critical assumptions concerning knowledge and foresight, this model 'predicts' something like an ideal allocation of resources and consequently output from both an individual and social point of view.' The model took a long time to build and it has never been without its critics. Even Alfred Marshall, who contributed much to the foundations of neo-classical economics, conceded the theoretical possibility that the distribution of resources and output resulting from competitive equilibrium could be 'improved' if industries subject to decreasing returns were taxed and those subject to increasing returns were subsidised. Marshall's recognition of externalities—the fact that costs might be incurred by and benefits accrue to individuals and institutions other than those originating them—came subsequently to play an important part in the thinking of economists about the social implications of resource allocation. In his *Economics of Welfare*, Marshall's famous pupil, Pigou, invoked the example of the smoke belching forth from the industrial chimney stack. This smoke clearly represents a cost. It is, however, one which in normal circumstances would not be borne by the industry which generated it. Thoughts of this kind led to the distinction between social costs and benefits and private costs and benefits.

Although it may seem like an abrupt shift in the discussion, it is nevertheless now appropriate to note that in the context of project appraisal

10. The discussion in what follows is confined to joint appraisal of environmental and economic impact. For a discussion of the methodology and difficulties of purely economic evaluation see J. Pickett, *A Report on A Pilot Investigation into the Choice of Technology in Developing Countries*, University of Strathclyde, 1975, Chapter III and for an economic evaluation of alternative sugar technologies see R. Alpine, *Impact of Different Sugar Technologies on the Economic Environment*, UNIDO/UNEP Seminar, Nairobi, 18-22 April, 1977.

(of which comparison of alternative technologies can be taken to form a part) the most widely-known economic technique is that of cost-benefit analysis. In the present century, at least, this form of analysis owes more, in terms of its origin, to administrative necessity in the American public sector than it does to economic theory.[11] In its most general form cost-benefit analysis informs project appraisal by seeking answers to the following questions: which costs and which benefits should be included in the appraisal? How should these be valued? What should the rate of discount be? And what are the relevant constraints?

There are at least two links between the competitive model and cost-benefit analysis. If perfect capital markets are assumed and are, as is logical, embodied in a perfectly competitive economy with a market rate of interest, then this rate can be taken as a measure of individual's (equal) time preference, and hence adopted as the social discount rate. In this circumstance, market prices could also be used to put values on costs and benefits and on some views there would be no need for social, as distinct from private, cost-benefit analysis. Neither capital nor product nor factor markets are perfect in developing (or indeed in developed) countries. There are consequently some powerful limitations on the relevance of the competitive model. Nevertheless, there is considerable temptation, sometimes yielded to, to simulate the competitive in order to seek to determine the prices at which costs and benefits should be valued. Such simulation underlies, at least implicitly, some guidelines widely used in project appraisal and it also underlies one of the first attempts (by Tinbergen) to estimate shadow prices.[12]

The problems of valuation and discount rate apart, it is necessary to ask whether the general method of seeking to identify all relevant costs (regardless of by whom they are to be incurred) and all relevant benefits (regardless of to whom they are to accrue) and make them commensurate so that a single measure would be available either to yield a stop-go decision for a single project or to make possible the choice among

11. For a brief account of the origin, character, problems and applications of cost-benefit analysis see A. R. Prest and K. Turvey "Cost-Benefit Analysis : A Survey" in *Survey of Economic Theory*, Vol. 3, Macmillan, London, 1966, pp. 115-203.

12. For a critical consideration of this and other questions see A.K. Sen, *Employment Technology and Development*, Oxford University Press, 1975, Chapter 11

methodology. In the meantime, it may be suggested that, particularly given the importance of the economic environment in developing countries, alternative technologies can be compared first by means of extended and explicit cost-benefit analysis and subsequently examined for particular environmental effects that escape—necessarily—the net of such analysis. In this approach the question of valuation is, of course, left open and the more straightforward environmental impacts could be accommodated in the analysis. Thus accommodated, they should, of course, remain explicitly before the decision-taker at the point of decision. The coverage of the cost-benefit analysis would clearly vary from case to case. In principle, however, the method—with, to repeat, due emphasis on making as much explicit as possible—amounts to choosing the economically-viable technology subject to a somewhat informal constraint that it is also an environmentally sound one. Much subsequent work could be directed to increasing the formality of the constraint. □

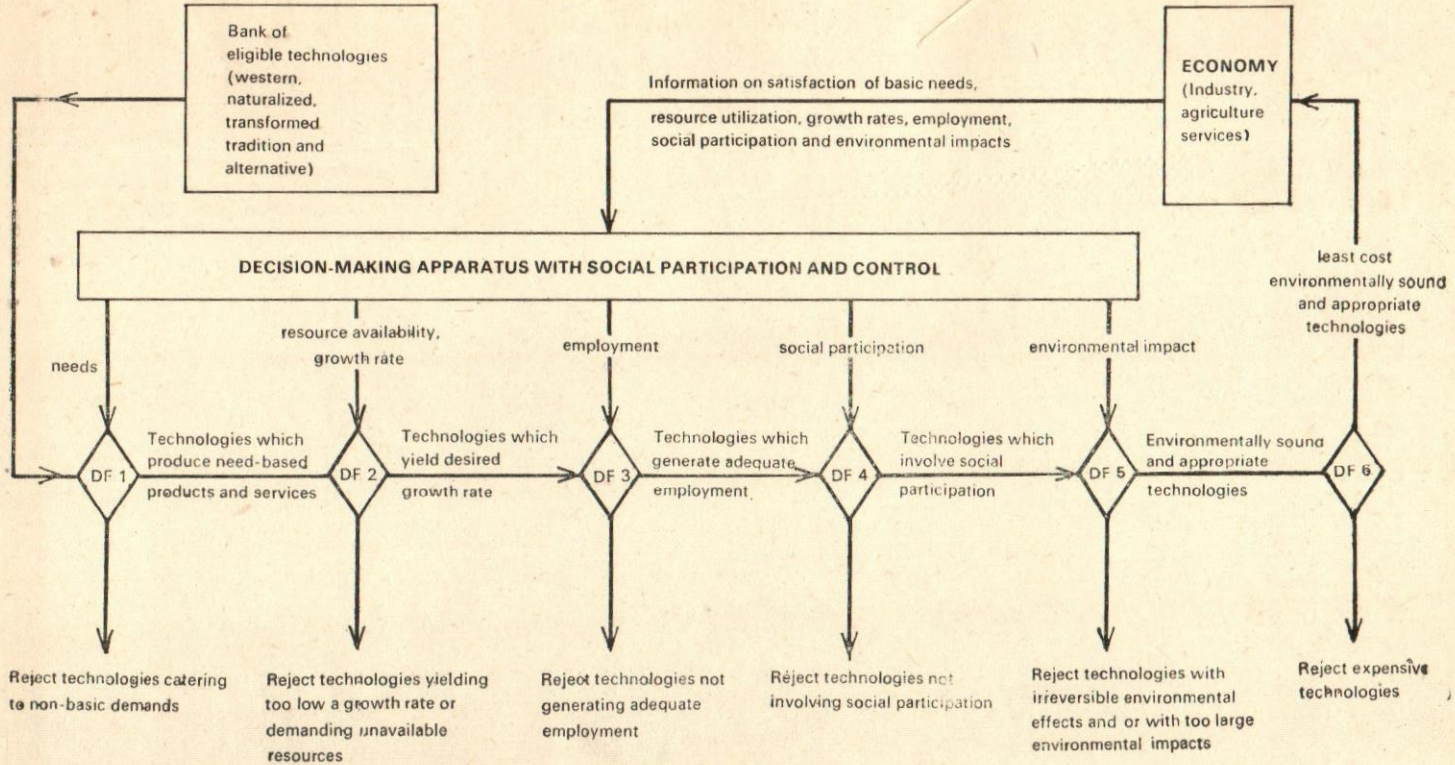
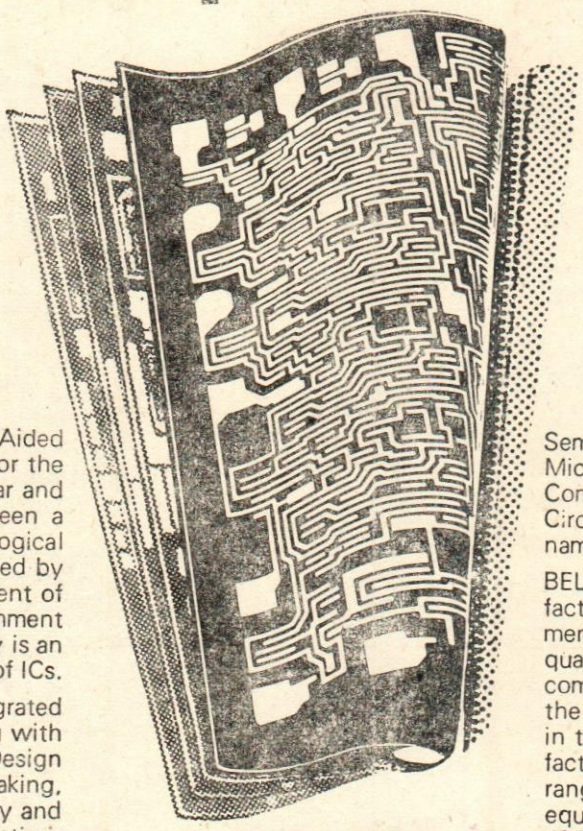


Figure 1 : Design Filter approach to the selection of environmentally sound and appropriate technologies

State-of-the-art electronics in India-I

IC technology starts with Computer Aided Design



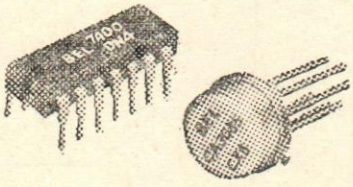
Computer Aided Design facility for the manufacture of Linear and Digital ICs has been a major technological achievement. Funded by the Department of Electronics, Government of India this facility is an aid in the design of ICs.

BEL makes Integrated Circuits starting with Computer Aided Design followed by Mask making, Diffusion, Assembly and Testing.

Yet ICs are just one facet of BEL's component capability.

The other well-known components that professionals all over stake the performance of their equipment on are: Receiving Valves, Transmitting Tubes, X-ray Tubes, Cathode Ray Tubes, TV Picture Tubes, Microwave Tubes, Germanium and Silicon Semiconductors, Hybrid Microcircuits, Passive Components and Printed Circuit Boards—just to name a few.

Indigenous design and in-depth manufacture of Integrated Circuits



BEL's contribution in fact goes far beyond the mere supply of high quality, high reliability components. It constitutes the pioneering work done in the design and manufacture of the widest range of components and equipment conforming to JSS, MIL, BSS and DEF standards employing the latest trends and state-of-the-art technology.

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Market Intelligence as a Tool for Effective Marketing

K.S.V. Menon*

Introduction

Of late, there is a growing realisation in India as elsewhere that focus solely on what the factory can produce makes little sense than determining what consumers want and then designing, manufacturing and marketing products capable of satisfying those wants. With this shift in orientation, radical organisational changes have occurred. Market intelligence has become a decisive input of marketing effort. This has helped product research and development which has gained in organisational stature as customers have become steadily more sophisticated in what they would buy.

The sudden fluctuations in demand for various goods which, in recent years, have assumed a new dimension in the Indian economy, have brought to the fore the imperative need for an effective system of market intelligence, which if properly built up and maintained, can act as a powerful catalytic agent in marketing. Small scale units, dependant as they are, to a great extent, on the progress and prosperity of other end-using industries, are also equally subjected to different phases of business cycle. They *can, however, hardly* be expected to absorb shocks of a prolonged or periodical recession. The growing incidence of industrial sickness has not spared small units and if reports are any indication, the picture is quite blurred. It cannot be attributed to any single factor. A closer analysis would, however, reveal that market is one of the major bottlenecks. According to a recent study (though confined to Maharashtra and with a limited sample of small scale units), 50 percent of the units surveyed were faced with acute marketing problems. This means that there is a need for a constant watch on the developments affecting demand and monitoring these trends for corrective action. To do so, a proper system of market intelligence is a must.

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It is generally felt that modern management practices and techniques are relevant and useful only to big enterprises and the small scale units, with limited resources, and other constraints, can ill-afford to go in for them. An objective appraisal would, however, indicate that because of these reasons, market intelligence has become all the more necessary to face the problems boldly and imaginatively. A small scale unit, with a turn-over of around one million, cannot be expected to build up and maintain a market intelligence system of its own. An institutional arrangement for this purpose, therefore, would be desirable so as to provide this key input for effective marketing. Whether it should be at the State level or at the Central level, what should be its set up, how the network of organisations—both at the Central and State levels—can be fitted and coordinated within the organisational framework, etc., are some of the wider issues which should receive the attention of all those concerned with the orderly progress of the small industries in the country. This paper seeks to outline a format of a market intelligence system to be put to use by the State Small Industries Corporations (SSICs) as a part of the marketing services provided by them mainly to small scale units under their jurisdiction Since SSICs are concerned with both new and existing units, Market Intelligence should be designed in such a way as can meet the needs of both.

Why Market Intelligence?

When market intelligence is properly used, a number of benefits would accrue to the management in general and marketing in particular. Decisions taken with the backing of Market Intelligence would be more realistic and appropriate with respect to the problems they seek to solve, like the scope for a new unit, new product(s), expected sales trend of the product(s) of the units, if already in operation; production scheduling, procurement programme, working capital tie-up, etc. Without effective market intelligence, industrial units can have only a vague idea of the nature of their market, and the behavioural pattern of final buyers. It helps to identify the final customer for a product; communication channels are opened, through which needed information may be siphoned back to the unit to take appropriate decisions releating to the designed level of output, product quality, product adaptation, pricing policy, etc.

Market Intelligence may help in exploring newer ways to increase sales volume, gross margin and net profits. It can throw up ideas for product development, newer uses and applications of established products; additional markets for products both in the sense of different types of customers and geographic areas that could be cultivated, old products that should be discontinued, products needing improvement in performance, in appearance, or in both and means by which to step up the productivity of personal seliing and/or the physical distribution system. This is only an illustrative list. There are many other equally-important areas where market intelligence becomes necessary for effective decision-making at different levels of management, irrespective of the size of the enterprise. Though the points mentioned above are relevant both to the domestic and export markets, the latter may call for a particular strategy for initial penetration and consistent development. The distinct characteristics of these markets and the socio-economic conditions of the countries concerned should be studied continuously which can be done only through a proper system of market intelligence.

Market Intelligence Input

In any system of market intelligence—as in other areas of operations—there are two elements—input and output. In fact, they are two sides of the same coin; input requirements are influenced by the output desired to tackle a given set of situations at a point of time and/or on a regular basis. Market intelligence inputs are generated from different sources both internal and external. Internal sources provide the major input, flows of a routine nature, originated in various functional areas like purchase, sales, accounts, etc.

For example, from sales records it is possible to know the trend in past sales by product seasonality, if any, price trends, key markets, channels of distribution, etc. To obtain full benefits of these records, additional breakdowns can be done—analysis of sales by (a) specific customers, (b) size of order, (c) delivery frequency, (d) gross margin or net profit realised on each order, to name a few. When such information is available, it can readily provide cross-tabulation that may lead towards more efficient marketing and production-programming.

Sales records, if properly used, can be employed to detect marketing

strengths and weaknesses. Each main type of sales analysis sheds light on different aspects of these strengths and weaknesses. Analysis of sales i) by regions, answers the question of how much is being sold where, ii) by products, indicates how much of what item is being sold, and iii) by customers, shows who is buying and how much. All segments of sales analysis thus relate to the question of how much is being sold, but each answers in a different way.

There are many other types of useful information that is being generated continuously in an organisation, whether small or big. From these data it can also be possible to trace the price movements as well. The purchase records and corresponding documents will also constitute yet another important source of information.

External sources include virtually the entire environment in which the enterprise operates These may be received in different ways through personal discussions, business journals, Government agencies, semi-official and other non-official institutions like the chambers of commerce, industry associations, trading centres, etc.

Information Outputs

Indentification of desired information output is the most critical component of a market intelligence system. Since the basic purpose of market intelligence is to make possible more and better information-based decisions, the system should be focussed on decisions each unit in its marketing operations must make to achieve its corporate objectives. Analysis of each unit's requirements, should indicate information requirements, thereby identifying the information output that market intelligence should provide to it. The composite of the marketing information requirements for the entire organisation thus identifies the variety and nature of specific information-outputs that market intelligence should be able to supply.

Another important aspect of market intelligence system relates to tailoring information outputs to fit each unit's individual information needs. Each unit would like to receive certain information-output at regular time intervals. One unit, for example, may want to receive report on sales by main classes of products and by marketing areas while

another may require a specific information about particular product in a given market. Quite a few may be interested to keep abreast of developments in the end-use industries. Mainly export-oriented companies would like to keep themselves informed of the market developments in select countries of their interest. Thus, the desired information output is a function of a number of variables and controllable and uncontrollable factors. A proper blending of these requirements and designing the system accordingly becomes ultimately an art with resultant problems and challenges.

The real challenge in designing a market intelligence system for the small scale sector thus lies in determining what kind of and how much of information is required how often by each unit. The problem has been dealt with in the following section wherein an attempt has been made to design a market intelligence system for an organisation at the State level like the Small Industries Corporation, dealing with a number of products and equally large number of industrial units spread over various parts of the State.

MI System and Small Scale Industries

We have thus seen the importance of market intelligence for effective marketing and the various inputs and outputs which together constitute, what we may call, the total system of market intelligence. State Small Industries Corporations, no doubt, as they are constituted and functioning now, are concerned with a wide range of products. At a moment of time, it may not be possible for them to clearly identify all products they are dealing in as also to list the small scale units, which are their existing clients. They are also required to assist the new entrepreneurs in different phases of a project cycle. Apparently, the building up of a proper market intelligence system to cater to these diverse needs becomes a rather exacting task. That is precisely why it is more necessary to make a sincere attempt in that direction.

Identification of Products

Every State Small Industry Corporation deals in a number of items. The customers or the small scale units which are coming in contact with them

will be at least 5 times of the product-number, if not more. Hence, a pertinent question may be asked as to how to collect, sift and maintain the large volume of information generated by these diverse clients and others in fhe field.

A closer examination would reveal that though the number may apparently be found to be quite substantial and unwieldy, if an attempt is made, it is possible to reduce the volume of work to manageable proportions.

Every State organisation has got some product specialisation determined by the industrial pattern of the State. For instance, the All-India Report on the Census of Small Scale Industries revealed that metal products, basic metals and alloys and chemicals constituted 43 percent of the products spread over only in five States, namely, Maharashtra, Punjab, Tamil Nadu, Uttar Pradesh and West Bengal, which accounted for 52 percent of the units, 46 percent of employment, 62 percent of investments in fixed assets and 59 percent of the gross output. Truely there are many products in the same group. The major groups would indicate the basic structure and the sub-groups can accordingly be classified. In fact, a number of industries are concentrated in a few Districts in each State (Exhibits I and II). Hence, the first task is to identify the products which account for say, 75 to 80 percent of the business/or production in the small scale sector in the State. Having thus identified the products, market intelligence work can then be concentrated on them.

The next step is, what is the relevant and pertinent input which SSIC can generate internally and externally, keeping the ultimate output requirements of small scale units in view.

Desired Intelligence Output for SSUs

The desired information outputs taking into account the needs of their clients, namely, the small scale units (SSUs), should then be listed. The next step is to design input flow which will cater to these basic output requirements. The desired market intelligence outputs, from the small scale units' view-point, may be put thus : capacity of production, number of units, their location, past trends in output, expected demand for a

given period, specific markets, price trends, prospects of end-use industries, product characteristic and developments, assessment of the specific marketing environment in the target market segment, etc.

Various units are mainly interested in keeping themselves abreast of demand for the particular product/products which they are manufacturing What is the total volume of output expected to match this demand, or whether whatever is produced can find a market in the particular reference period? At what price they can sell and where they can sell, in the domestic market or overseas? How many units are in the line and what is their capacity? What would be the likely performance of the industries which are using their products, in the case of industrial goods, and if they are consumer durables, the factors which are likely to influence their consumption at a given period, e.g., excise and other levies, the substitute products, the general level of prices, the movement of the index cost of living, changes in fashions and tastes, etc.

Input

If the above is the desired output, the input flows have to be ensured. The system should be such as to maximise results with minimum costs. A proper proforma may perhaps be introduced which should provide information—product-wise—about the number of units in the product line, their location, production-capacity, trends in production, major end uses, the norms of consumption of the particular item in the end-use industries, raw material supply sources, price trends of both the inputs/ outputs etc.

Once such 'Product Proforma' (Exhibit III) is devised, it becomes easy to fill in and update it depending upon the flow of relevant information/ as identified above. The information/product may also be added or deleted according to the experience of the user and utility of the particular piece of information and the product covered.

A further analysis would show that the information, as narrated above, can be broadly classified under (a) Industrial Intelligence, (b) Product Information, (c) Prices, and (d) Government Policy. Let us then briefly trace the basic sources of input for such a market intelligence set up, particularly in the context of admittedly-formidable problem of data gap

in the decentralised sector of the Indian economy.

(a) *Industrial Intelligence :* Under this head may be covered (a) number of units, (b) their location, (c) products manufactured, (d) capacity, (e) trends in production, etc. Apparently, the readymade answer would be that it is difficult to get this information in the small scale sector. However, it is not the lack of information or data which is the problem but the organisation of the same and market available to those who really need it. Without the knowledge of the concerned State Government, to be more precise, the Directorate of Industries, no industrial unit can come up any where in the State concerned. The Census of Small Scale Industries conducted by the Development Commissioner for Small Industries has brought into light many a useful information. However, what is published is only a fraction of what has been collected. The first attempt should, therefore, be to make use of this information which has already been obtained through the census. A persual of the questionnaire used for the purpose (Exhibit IV) would reveal that if this is properly used, it would go a long way in filling the information gap in the small scale sector.

Once this data is properly organised, product codified, then it has to be updated. The State Directorate of Industries can do an excellent job in both these tasks. The census data are lying with the respective State Industries Directorates. And as far as new units are concerned (set up after 1972), the Directorate should be in a position to provide the information sought for, from the available records. Having done this job, it may then be published in the form of a Directory of Small and Ancillary Industrial Units in the respective States. Yearly supplements to this Directory may be brought out. It is the Directorate of Industries which is in an ideal situation to do this work without much difficulty.*

Similarly, the State Financial Corporations (SFCs) too get a lot of information. Virtually all units which seek financial assistance from them are expected to provide the information listed above. They can also codify this information and make available to the concerned SSIC periodically for its use. Besides SFCs, there are a number of other agencies at the State level who too generate a lot of data relevant to

*This aspect has been gone into in detail in the Author's book, *"Market Study for A New Industrial Project : Concepts, Techniques & Cases"* pp. 106-109, Vora & Co. Bombay, 1977.

the purpose in view. A coordinated attempt by all these institutions operating at the State level will go a long way to tackle the problem of data gap in the small scale sector.

(b) *Related Products :* As is well known, many products manufactured in the small scale sector are found to have their ultimate application in medium and large industries. Hence, the performance and prospects of these industries have a direct importance to the orderly progress of the small scale units in the country, particularly ancillary units. In fact, as happened in the recent past, a slight fall in demand from automobile industries will bring the wheels of production of a number of ancillary units to a grinding halt. It is found that as much as 50 to 60 percent of the requirements of the automobile industry are met from ancillary units. Thus proper and timely assessment of the development of the end-use industries assumes a crucial importance for scheduling the production programmes of small and ancillary units.

The process of ancillarisation is likely to get a further boost in the years ahead. Most of the public sector undertakings have identified the products which could be manufactured in the ancillary sector. The Government, in its Industrial Policy Statement announced on December 23, 1977, has extended the list of products reserved for development in the small sector to 504.

Incidentally, it may also be mentioned that the Industrial Finance Corporation of India has recently introduced a scheme to promote the ancillarisation in its assisted concerns. The scheme envisages granting financial assistance to the Corporation assisted concerns for organising special divisions for promoting ancillary industries. It has also decided to subsidise assignments taken up by the Technical consultancy organisations, sponsored by the Corporation, from new and small entrepreneurs. These assignments may include preparation of pre-feasibility studies, detailed project reports, market studies or preparation of documents for seeking assistance from financial institutions, technical guidance, etc.

Reverting to the sources of data, they are diverse. Since most of the medium and large units are required to obtain industrial licences, the concerned Central Government Department—mainly the Directorate General of Technical Development—will constitute a major direct source.

SSICs can identify the complementarity of the products concerned and then coordinate the activities with DGTD so as to ascertain the trend of licensing in the related industries. With this information, it will also be possible to identify the scope for the addition to the capacity in the small scale and ancillary units. Certain amount of coordination with other State Small Industries Corporations and other State level institutions is also necessary, so that the problem of excess capacity is reduced to a considerable extent.

(c) *Prices :* This is one of the areas where a lot of difficulties are experienced. Published data is scanty, informal discussions will not be of much help in many cases, and a regular collection of price data for a variety of items regularly from different trading/business centres is time-consuming and costly. All the same, some efforts can be made to fill this information gap. The internal input will be the major source for this purpose. Many of the items which are intended to be covered under the Market Intelligence system discussed in this paper are the products which SSICs are already dealing directly or indirectly. If most of them come under the broad umbrella of the marketing assistance, the problem is reduced to a considerable extent.

Both internal and external sources can be employed to maintain the price data. The trade invoices which flow to the Accounts Departments contain precisely what one is looking for. If the invoices are many, a sample may be selected, and month-wise price movements recorded regularly. SSICs should also be able to estimate the costs of production of the products and calculate the trends in margins as well.

These internally-generated data may be supplemented by field investigations at random. Field investigations may frighten many. But what is envisaged here is to contact a few major dealers in the product(s) concerned regularly and ascertain the ruling prices. This may be confined to major markets and products and the principal manufacturers/dealers in that line of activity. Thus the most complex task of price intelligence is not so difficult as is generally conceived, given the will and direction.

(d) Government Policy : Under this head can be covered the entire gamut of developments affecting the small sector. However, it is necessary to precisely indicate the information requirements for the

specific purpose in view. Decisions and announcements regarding excise/customs duty, other fiscal policies, economic trends, etc. should constitute decisive fields which would be kept track of. The sources of information, quite naturally, vary but mainly the concerned departments will be the reliable and authentic sources.

Sales Forecasting

A pertinent question which may be raised is :

What can SSIC's do to help the small scale units, once set up, to schedule their production programmes on the basis of expected demand for the products for a particular period, say, three months, six months, a year, etc. No doubt, this is a very difficult task. But this is precisely what small scale units, which are in operation, look forward to and which they are not able to get from any source, official and non-official. The result is decision based on intuition and the resultant problem of over-production, large-scale inventory, financial crisis and many direct and indirect losses both to the small scale units concerned and ultimately to the nation as a whole.

To overcome this basic problem, Small Industries Corporations, on the basis of the products identified for a market intelligence system, should be able to keep abreast of developments in the concerned product groups, the performance and prospects of the end-use industries, domestic economic trends affecting the industries concerned, and advise the units accordingly as and when assistance is sought for by them.

If the domestic market is not favourable, they should also try to identify the probable export markets and customers. A timely flow of information will thus be helpful to small scale units to schedule their production programmes. The reported move of the Trade Development Authority (TDA) to provide SSICs with relevant export information, which, it will disseminate to the small scale units in the respective states is a step in the right direction and, if properly organised, will go a long way in keeping track of prospects in markets abroad.

On the basis of this general trend, other relevant parameters, and with

the help of accepted techniques, SSICs should be able to prepare sales forecasts for the products coming under their purview. These forecast figures, product-wise, should be disseminated to the units so as to enable them to schedule their production programme and other related activities. Once the demand situation is properly assessed, the problem of over-production or under-production can be effectively tackled. Here, there is an implicit assumption of co-ordination among various SSICs, particularly, when identical products are involved and the products command all-India market. Because income from sales constitutes the life blood of any business organisation, a logical starting point in the planning of marketing activity is the sales forecast. The sales forecasting should, therefore, be an important function in the market intelligence system, as conceived here, for the small scale units in the country.

Summing Up

To sum up, market intelligence should constitute a key element in the total package of marketing service. Irrespective of the nature of the product and scale of operations, it can play a vital role in marketing management. The type of organisation for market intelligence, output-input components, etc., are influenced by a variety of factors, external and internal. The size of the enterprise, the product(s) covered, the competitive structure of the industry etc., are some of the basic aspects which decide the precise scope and significance of an effective market intelligence system.

In the context of the admittedly-poor market intelligence available to the small scale units and its growing importance, there is a pressing need for an institutional arrangement to provide this service to them as a part of the total package of marketing assistance. State Small Industries Corporations and their apex coordinating body may perhaps give some thoughts in this direction so that the small scale units, which are being given increasing emphasis and decisive role in the Indian economy, may emerge, in course of time, as vital a sector as large and medium industries, in the country's industrial set up.

Exhibit I

Number of Units and Important Industries in the States/Union Territories

Sl. No.	*Name of State/ Union Territory*	*No. of Units*	*Important industries in the State/Union Territory Figures in brackets indicate percentage of units in the State/Union Territory*
1.	Andhra Pradesh	8091	Utensils (6%), Weoden furniture and fixtures (5%) Printing of books, journals etc. (5%).
2.	Assam	1648	Printing of books, journals etc. (10%), candles (9%), Wooden furniture and fixtures (9%), Repair-motor vehicles and motor cycles (8%), Washing soap & soap powder (5%).
3.	Bihar	5260	Sawing and planing of wood (7%), Agricultural hand tools & implements (5%), Repair-motor vehicles & motor cycles (5%), Wooden furnitures & fixtures (5%) Printing books, journals etc. (5%).
4.	Gujarat	9904	Parts & accessories of food & textile machinery (5%).
5.	Haryana	4591	Utensils (14%), Agricultural hand tools and implements (10%), Steel trunks (8%).
6.	Himachal Pradesh	1495	Wooden furniture and fixtures (13%), Sawing and planing of wood (13%), Leather shoes (10%), Wooden boxes, barrels (10%), Agricultural hand tools and implements (8%).
7.	Jammu & Kashmir	1039	Utensils (27%), Enamelling, electroplating (13%), Wooden boxes & barrels (7%), Steel Trunks (6%).
8.	Karnataka	5618	Agricultural hand tools & implements (11%), Printing envelopes, picture cards etc. (5%), Utensils (53%).
9.	Kerala	6205	Wooden furniture and fixtures (7%), Printing books, journals etc. (5%), Ayurvedic medicines (5%), Structural metal products (5%).
10.	Madhya Pradesh	7701	Agricultural hand tools & implements (10%), Utensils (7%), Wooden furniture and fixtures (6%), Sawing & planing of wood (6%).
11.	Orissa	1779	Utensils (10%), Sawing & planing of wood (7%), Wooden furniture and fixtures (5%), Repair-motor vehicles and motor cycles (7%), Readymade garments (5%), Printing books, journals etc. (5%).
12.	Punjab	13675	Agricultural hand tools & implements (9%), Mill knitted woollen ware (7%), forgings of iron & steel (6%), Parts and accessories of bicycles (5%), Steel trunks (5%).
13.	Rajasthan	7062	Leather shoes (15%), Agricultural hand tools and implements (8%).
14.	Tamil Nadu	16002	Mill-knitted cotton ware (6%), Utensils (6%), Printing of books, journals etc. (5%).
15.	Uttar Pradesh	12851	Agricultural hand tools, and implements (9%), Utensils (7%).
16.	Chandigarh	284	Structural metal products (11%), Steel trunks (7%).

Source : All-India Report on the Census of Small Scale Industries. Vol. I, pp. 17-18

Exhibit II

Concentration of Industries in Different Districts

Sl. No.	*Industry*	*No. of Units in the Industries*	*Districts having 5% or more of total units in the Industries*	*% in these Districts*
1.	Cotton knitted ware	1810	Coimbatore (Tamil Nadu), Ludhiana (Punjab), Calcutta (West Bengal), Delhi.	82%
2.	Woolen knitted ware	107	Ludhiana (Punjab)	92%
3.	Readymade garments	2053		
4.	Printing envelopes, cards etc.	1590	Greater Bombay (Maharashtra) Ramanathapuram (Tamil Nadu)	31%
5.	Leather shoes	3229	Nagaur (Rajasthan) Sangrur (Punjab)	39%
6.	Candles	2229	Madras (Tamil Nadu)	5%
7.	Ayurvedic medicines	1024	Cannanore (Kerala)	8%
8.	Washing soap & soap powder	2305	Delhi	6%
9.	Iron & Steel castings and forgings	3465	Jullundur (Punjab), Ludhiana (Punjab) Howrah (W. Bengal)	21%
10.	Drums & other metal containers	2245	Greater Bombay (Maharashtra)	7%
11.	Metal furnitures and fixture	1148	Ahmedabad (Gujarat)	6%
12.	Bolts & nuts	1038	Ludhiana, Jullundur (Punjab) Howrah (West Bengal) Greater Bombay (Maharashtra)	52%
13.	Electroplating, enamelling etc.	1119	Greater Bombay (Maharashtra) Srinagar (J & K), Ludhiana, (Punjab)	42%
14.	Utensils	7215	Ambala (Haryana), Moradabad (U.P.) Howrah (West Bengal)	21%
15.	Auto Parts & accessories	2491	Greater Bombay (Maharashtra) Ludhiana (Punjab), Delhi	24%
16.	Bicycle parts & accessories	1160	Ludhiana (Punjab), Delhi	63%

Source : *Ibid.* pp 18-19

Exhibit III

Suggested Proforma for Product Sheet

A : GENERAL

1. Name of Product
2. Major uses
3. No. of Units in Production
4. Total Capacity of the Units in Production :
   (a) With the Directorate of Industries
   (b) Under Factories Act
5. Additional Capacity Registered
6. Targets of Production, if any, fixed by official/non-official agencies
7. Trends in Production (for the last five years)
8. Trends in Export
9. Government Policy on Capacity Creation :
   (a) Reserved for Small Industries
   (b) Addition to Capacity banned
   (c) Linked to export commitment
   (d) Any special features like priority, banned for imports, import substitution etc.
10. Government Policy on :
    (a) Distribution
    (b) Pricing
    (c) Production
    (d) Supply of raw material
    (e) Any other (Please specify)
11. Fiscal levies/Concessions :
    (i) Duties :
        (a) Excise duty
        (b) Import duty
        (c) Export duty
        (d) Sales tax
        (e) Other Central/State/Local duties
    (ii) Fiscal Concessions :
        (a) Export cash assistance
        (b) Other fiscal concessions (Income tax deduction, excise rebate etc)
12. Raw Material Required
13. Sources of Supply :
    (a) Indigenous
    (b) Imports
14. Any other relevant additional information

B : SSIC PORTFOLIO

1. No. and Names of Units dealing with the Corporation in the Product line
2. Total Capacity of (i)
3. Production trends
4. Sales through SSIC for the last 5 years :
   (a) Domestic
   (b) Exports
5. Major clients : Public Sector
   Others
6. Price Trends for the :
   (a) Domestic
   (b) Exports

P. S. : This is an illustrative proforma and it can be suitably modified depending upon the precise scope of the market intelligence system.

Exhibit IV

Questionnaire used for National Census of Small Industrial Units

Block	I	:	Identification Particulars
Block	II	:	Average Employment and Emoluments
Block	III	:	Capital
Block	IV	:	Borrowings
Block	V	:	Fuels, electricity and water
Block	VI	:	Particulars of Important machinery and testing equipment installed, having bearing on capacity
Block	VII	:	Capacity and Actual Production

Units of Quantity

(a) Product/by-products

(b) Job work, servicing

Repairing

Production Job work

Process Job work

Repairing

Block	VIII	:	Materials and bought-out components consumed
Block	IX	:	Exports
Block	X	:	Problems faced and suggestions, if any, made by the unit

Note : Under each "Block" there are a number of sub-items which are not shown above except in the case of Block VII which proposes to show the products manufactured and the capacity. Similarly Block I would provide particulars of the unit regarding location, organisational set-up, registration particulars etc. Thus, these two Blocks would provide the basic industrial information identified for the 'Product Sheet'.

Source : *All-India Report on the Census of Small Scale Industries.* Vol. I, pp. 61-68, New Delhi, 1976.

Corporate Planning : Perspective and Problems

A. G. Padhye*

Indian managers must appreciate the use of corporate planning because the knowledge gained will significantly enrich the contribution they must make to this important area of management activities. It is often not fully appreciated that corporate planning comprises a series of exercises aimed at developing policy heuristics which manifest the attitude of the management towards the contingencies faced, or likely to be faced by the firm. If the business conditions are rich in contingencies, the uncertainty element is on the higher side and the management would have to be more dynamic, entailing the adoption of a much more flexible policy. On the other hand, if the conditions are not quite as uncertain or admit of prediction with a reasonable degree of accuracy and the business variables are not highly interactive, the firm may survive even without a very able management team.

The Corporate Plan would seek to evaluate the effect of planned programmes on the company's future economic and social viability, on its growth and stability and to formulate such planned programmes as would lead the company to its cherished goal. A policy for a business organisation would take the form of a loosely-bound set of guidelines for the different functional areas, e.g., marketing, finance, personnel, etc. For instance, a company may have a high rate of return on capital employed, coupled with an up-or-out personnel outlook and rigid quality enforcement knit loosely to yield a corporate policy. Needless to say, the priority attached to each dictum *inter se* will be a function of the circumstances obtaining in the environment, and also subject to other influences.[1] It can neither be said that a particular set of priorities will hold at all times, nor that *inter se* priorities of functional areas are rigid. As a matter of fact, the parameters of one particular area may be critical at one time but may interact with external factore or between themselves, resulting in an entirely new set of priorities. To illustrate the point, one can consider market competition as an environmental factor, which may lead a firm to ascribe prime importance to this area, but if market

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1. D. Moore, "Managerial Strategies" in Industrial Man : Businessmen and Business Organisations, New York, Harper, 1959.

competition is accompanied by price competition as well, the firm may attribute the greatest importance to an entirely new area, product development. The net result will always come out of a complex interaction of considerations and factors, which may be economic, social or legal. It can be said, nevertheless, that the priority attached to each will be positively related to the management's perceived importance of decisions of that field. Invariably, the priority attached to each could be gauged by two criteria. One would be in terms of the tenacity of application of a dictum : the higher the priority attached to it, the bigger the limiting contingency it will withstand. Differential priority would also be evident in the differential allocation of financial and managerial resources to the particular area. If an organisation attaches high value to quality control, a liberal allocation will be made for sufficient equipment and the quality control manager's post will be very remunerative.

Rather than defining problematic situations and decreeing the firm's response to it, a corporate plan would purport to delineate the domain of decision-making areas that are perceived to be of critical importance under likely contingencies. Without this broad purview, a corporate plan will spell out more specific guidelines for each functional area. As an illustrative case, the finance department may be considered. A particular company may want to lay down policy with regard to :

1. *The quantum of risk to be borne* : In particular, what will be the liquidity of the assets in possession of the company? Will it suffice to meet the company's requirements at every stage in the future?
2. *Finance for growth* : The policy set will govern dividend payout, cashflows and also rate of return, so as to achieve the end—say, growth on ploughed back profits—or alternatively, to attract equity or procure debt on favourable terms.

Any laying down of polices along the lines stated above would entail a comprehensive capital investment appraisal on three accounts :

a. Capital committments involve long periods of time in implementation.
b. Capital projects commit big chunks of scarce financial resources and also bring in enduring changes in the cost structure of the company.
c. The long gestation period of capital-intensive projects calls for intensive planning to ensure availability of cash to service debts and pay reasonable dividends.

All its goodness notwithstanding, one criticism levelled against corporate planning off and on, and which needs a logical resolution, is of a perceived preoccupation, or in fact, even obsession with contingencies which will not materialise for several years. The inherent uncertainty in the majority of such cases is so high or governed by such a dense matrix of considerations and factors that, it is held, long range planning loses its precious little of virtue and realism, so that a lot of convincing has to go into perusuading top management to devote some time and effort to it. Justification is adequate, but what is generally lacking is conviction. There is also a strong viewpoint that competition may force management's hand in unpredictable directions and these cannot be easily accommodated in corporate plans. This, of course, is incorrect. The only real difficulty is that, notwithstanding the wide use of the term, an universally-accepted definition of corporate planning is conspicuous by its absence. To game theorists, a plan of action would be a strategy in which every move would be contingent on some opponent's move.[2] A corporate plan based on this concept would adequately accommodate the flexibility that is needed in dealing with unpredictable opponents.

More difficult to answer though, is the objections some people have in their minds when they say, 'Corporate planning is asking what's for supper, before it's time for lunch'. Under conditions of extreme financial stress, these views are understandable, because it is difficult to make a person listen to plans for the more distant future when the near future itself is not particularly reassuring. However hard to take it, the fact remains that changing business conditions enjoin managements to have more foresight and take a longer range view of the future than currently in vogue. Not that managers are not accepting corporate planning at all. Despite the resistance, there is an awareness that Corporate Planning is not just a restorative; it can be applied with equal potency in conditions of organic growth, and at times of stresses when the firm is hard pressed to consider cutbacks. Further, environmental conditions like rapid tehno-economic changes, massive capital outlays, and organisational complexities have taken the business set-up to the stage where budgetary control ceases to be of sufficient tactical utility, and that in itself is good reason for planning the future. Especially in larger organisations, there is a particularly strong case for adopting

2. Shubik Martin *"Game Theory and Related Approaches to Social Behaviour"*, New York, Wiley, 1964.

corporate planning, since their cost structures are invariably characterised by a high proportion of fixed cost and a relatively smaller proportion of costs related to current volume. An identical case is seen in the swelling of the number of workers paid on salary basis as distinct from wage basis, since the direct implication of this tendency is the metamorphosis of a sizable chunk of variable cost into a fixed one. Deep entanglement in intractable financial complexities would inevitably ensure if such expenditure is not planned at the decision-making stage with the requisite diligence, because a company committed to capacity costs binds its management into a particular set of constraints, which, once the decision is taken, become extrinsic and uncontrollable.

What is necessary is a general acceptance by people in the higher rungs of organisational heirarchy, of the potential utility of corporate planning and an awareness that everything that can be done without corporate planning can be done better with it. Once, we have this conviction, we will wonder how we managed business for so long, without it. And the question will remain—did we? □

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Thirty Years of Linear Programming Application : An Enquiry

Nesa L'abbe' Wu*

Introduction

Despite the restriction that relationships must be approximately linear, linear programming as an OR technique has been recognized and widely used in industry as an effective tool for solving business problems during the last three decades. It is known that millions of dollars are spent for computer time in the United States alone to solve linear programming problems.

In a paper written by R.E. Shannon and W.E. Biles, "The Utility of Certain Curriculum Topics to Operations Research Practitioners," published in the July-August 1970 issue of *Operations Research*, Volume 18, No. 4 [13], the authors present the results of a statistical survey conducted among full members of ORSA as to the utility to practitioners of curriculum topics that commonly appear in a Master's degree programme with a major in OR. They present the practitioners' viewpoint towards education for operations research. Linear programming received a comfortable fourth place amongst twelve topics. Probability theory, economic analysis and simulation techniques showed a slight lead over linear programming. Based on a later survey of Operations Research activities at 475 companies selected from *Fortune*'s list of the top 500, as reported by T. Turban in "A Sample Survey of Operations Research Activities at the Corporate Level," in *Operations Research*, Volume 20, 1972, pp. 708-21 [14], linear programming is the third most widely-used OR technique in business. Statistical analysis and simulation took the first and second place respectively. Finally, in "Are OR Techniques Being Used?", by W. Ledbetter and J. Cox, published in the February 1977 issue of the *Journal of Industrial Engineering* [10], highlights from a recent OR utilisation survey of 176 Fortune 500 firms show which quantitative methods are used a lot—and which are not. The 500 largest US industrial firms were selected for the study on the assumption that they were most likely to represent "state-of-the-art" utilisation

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book, *Goal Programming for Decision Analysis* [11], presents "goal programming" as a modern decision—analysis technique for problem solutions with multiple goals in an environment of complex constraints. He refers numerous practical applications of this technique as it relates to the business and industrial world.

Presently, computer companies are spending approximately half a million dollars on developing software for solving linear programming models. Computer code was first developed in 1950 for the transportation problem for the National Bureau of Standards SEAC computer. The first simplex code was developed in 1951 for the Air Force and the Bureau of Standards. Orchard-Hays developed in 1952 a simplex based code for large scale commercial applications for the IBM systems. As a result of the computerisation of the simplex method and the use of decomposition algorithms, large-scale industrial linear models have been solved in a relatively fast and inexpensive way.

Linear Programming Applications

The simplex method, as developed by George B. Dantzig, was first used in the Air Force in 1947. After the Second World War, it was necessary to concentrate on the development of a model that would define the optimal and efficient coordination of a nation's energies in the event of a total war. This task was entrusted to the Comptroller General, Ed Rawlings, who headed this project, and it was officially named, Project SCOOP (Scientific Computation of Optimum Programs). The proposed large-scale project SCOOP could only be solved by the use of a scientific programming technique. It was towards the end of the summer of 1947 that George B. Dantzig, who was on the team of the SCOOP Project, developed the simplex method for deriving an optimal feasible solution. Since then, the military has been building linear programming models for crew training, for scheduling of routine maintenance activities, for personnel assignments, for contract bidding, and others.

The use of linear programming in business and industry has been tremendous since 1951. It was initially introduced and heavily used in all phases of the petroleum industry : exploration, production, refining, distribution and pollution control.

Next in line is the food processing industry that is the second most active user of linear programming. For thls industry, examples of the use of linear programming are : to determine the optimal mix of dog-and-cat feeds; to determine the optimal allocation of cats up from six plants to approximately 70 warehouses (1953); to determine which bakeries should fill orders for cookies at different locations (1976), and many others.

In the heavy industry, linear programming has been used in the iron and steel industry and the metal working industries. Linear programming has been employed in the British steel industry to define the optimal production allocation in their rolling mills. Paper and textile industries have used linear programming to define the optimal cutting method in order to minimise trim losses.

Linear programming has also found its applications in the service industries. Accounting firms have used linear programming for asset valuation and for assigning auditors to tasks in an optimal way. Financial institutions and firms have used linear programming for evaluating investment plans, for the selection of Bond or Mutual funds Portfolios, for capital budgeting, for long-range financial planning, and others.

Similarly, linear programming has been employed for assigning advertising dollars to different media plans.

Administration, Education and Politics have also employed linear programming to solve their problems : in planning political campaign strategies; for allocating resources in education; for making school assignments in large districts; for optimal city administration; and for resource allocations in local election campaigns. This list of applications of linear programming can go on forever.

The most recent applications, however, have surfaced themselves as a result of the energy crisis. Linear programming is now used to assess energy options. This work is now being done in Stanford in the PILOT Energy Project and is conducted by W. Hogan at F.E.A. and K. Hoffman at Brookhaven.

A non-comprehensive list of applications of linear programming as published in various journals is given in the following section.

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Solving Food Problem Through Post-Harvest Technology

T. P. Ojha*

Introduction

The global food shortage that developed in the 1970's has drawn attention forcibly to the world-wide process of food production, distribution, and consumption. It has become an accepted fact that a decade witnesses 3 favourable years, 3 unfavourable years and 4 average production years for agriculture crops. The Indian agricultural production strategy has, therefore, to be in tune with the above facts. The creation of high-yielding varieties and multiple cropping systems appears to be more attractive a venture to the scientists and others for solving the chronic food shortage in developing countries. However, the limitations of pre-harvest technology have become quite evident in a very short span of time resulting in that of the appropriate attention in reduction of losses through post-harvest technology. Post-harvest losses in many countries exceed 30% of the crop harvested. In India, it is estimated to be about 15% of the total expected production.

One of the unfortunate attributes of the post-harvest system, as it is now constituted, is the large amount of wastage it involves. If these losses could be prevented, the effect on the world food picture would obviously be enormous. It is no exaggeration to mention that improved varieties of seeds and other inputs have made substantial contributions in increasing the foodgrain production. However, it is equally important to emphasise that all gains that could have been possible through pre-production technology has not been achieved due to poor post-harvest operations practised by producers and processors of the foodgrains.

Reports of many Research Institutes in South-East Asia indicate that losses in the post-harvest rice operations range from 1 to 3 percent for harvesting, 2 to 7 percent for handling, 2 to 6 percent for threshing,

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1 to 5 percent for drying, 2 to 6 percent for storage, and 2 to 10 percent for milling. This suggests that the losses cummulatively could reach as high as 37 percent even where *more-than-usually* advanced agricultural techniques are used.

In semi-arid Africa, the situation is much worse : storage losses alone have been variously estimated to range from as low of 10 percent in cereals to as high of 75 percent for the pulses. With some crops, insect infestation occurs before storage, and losses run to 50 to 60 percent by weight, and at times the entire crop suffering kernel damage.

Types of Losses

In general, the losses include (a) weight loss (b) loss of food value, (c) loss of economic value, (d) loss of quality or acceptability and (e) actual loss of seeds themselves. These losses may be brought about in many ways : (i) chemical change may occur, (ii) micro-organisms, insects or mites may proliferate in the crop, (iii) rodents may feed on it (iv) mishandling by ineffecient storage conditions or exposing it to extremes of temperature and moisture.

Weight loss can result from spillage or a portion of it may be eaten by insects, rodents or birds. In just one city of Bombay, it is estimated that at least 3,600 tonnes of cereals are lost annually from rodent damage alone. If one tonne of cereal is enough to feed 6 persons for a year it can be calculated that the above quantity is adequate to feed 3,600X6=21,600 persons for one full year.

Loss of food value can be caused by over-exposure to the sun, which destroys certain vitamins. Use of high temperatures during artificial drying causes thiamine loss in rice. Loss of food value also occurs by growth of fungi or by insect attack. Infestation, for example, can cause a loss of about 12 percent of available protein in peas and beans. In some areas, where protein-deficiency diseases are prevalent, up to 80 percent of the pulses in farmer's store are damaged by insects in a year. The most harmful effect of Aflotoxin can be avoided by proper post-harvest operations.

Causes of Losses

A whole variety of causes contribute to this enormous loss of food. These include inefficient harvesting and drying methods, poor processing techniques, inadequate methods of storage and distribution, and even at the consumer end, poor use of food stuffs at home. Traditional methods of grain distribution and storage in sacks are more susceptible to leakage and spillage, insect damage and moisture migration. In some places, grain is heaped on mud floor or mats; grain is dried on the road side and is subjected to spillage due to vehicular traffic or damage due to birds and stray animals.

Harvesting and Threshing : Many research workers, in the past, have observed that the average grain loss at different harvesting times varied from less than 1 percent a week before maturity to about 6 percent a week after maturity and risinng to 60 percent in about 4 weeks after maturity. Therefore, time of harvest and the moisture content at harvest are very important for achieving maximum yield and quality of grain.

In the tropical countries such as India, interest in mechanising the harvesting and threshing operation is high due to the increasing cost and seasonal shortage of labour and the timing problems involved in double cropping. In the double cropping areas, the harvesting and threshing of first crop and the land preparation for the second crop comes so close together that it is often difficult to handle these operations with traditional methods.

The predominant methods used in the tropics consist of manually harvesting the paddy plants and then threshing either by manual, animal, or mechnical means. In the advanced countries however, harvesting and threshing of paddy has almost entirely changed to mechanical methods and this has resulted in tremendous labour saving during peak season of labour demand.

Timely harvesting of crops soon after it has attained the physiological maturity, gives 5 to 15 percent extra yield under normal conditions of weather and crop growth. It has been observed that under large-scale field trials of paddy harvest that the maximum field yield is obtained if the paddy crop is harvested between 28th and 36th day after the flower-

ing (Fig. 1). The same period is also favourable for high-head yield and less brokens in case of paddy crop. Perhaps, similar favourable periods for harvesting all other crops (sorgham, pulses, oil seeds etc.) have also been worked out. Early harvest reduces shattering losses in the field as well as while transporting from the field to the threshing yard.

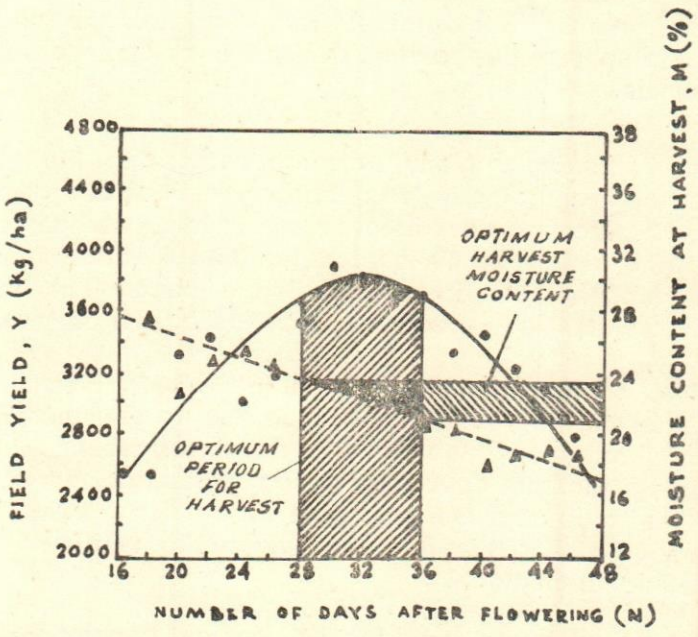

Fig. 1 Effect of date of harvest on moisture content at harvest and field yield

Drying of Crops : The main purpose of grain drying is to prevent damage in storage. The moisture content of the grain after drying is as important as ambient storage conditions such as temperature and relative humidity surrounding the grains. Drying may be achieved either by natural or artificial (mechanical) means. Mechanical heated air drying makes iteasier to maintain the good quality of dried grain even under adverse climatic conditions. Mechanical drying has the advantages of minimising harvesting losses, and increasing the head rice in milling operations.

There are many kinds of drying systems, but none of them is the best for all situations. Indian farmers usually partially dry the crops in the field in windrowing or in bundles or both. The final stage of drying grain is achieved by exposing the threshed grain to the sun. The mechanical drying is generally practised for parboiled paddy at rice milling complexes where adequate open-yard drying facilities are not available. Mechanical drying for drying freshly harvested and threshed grains is still not practised in adequate measures in India.

Inadequate drying facilities coupled with rains at the time of harvest of high-yielding varieties of paddy, and jowar have caused considerable damage to these crops. In some parts of the country, this has discouraged the farmers from growing high-yielding varieties. Kurvai paddy of Cauvery delta in Tamil Nadu and high-yielding short-duration variety of Kharif paddy in West Bengal suffer a great deal due to inadequate drying facilities. Some parts of Maharashtra and Karnataka, jowar crops get damaged due to untimely rains when it coincides with the harvesting of the crop.

Thus, if the full advantage of the high-yielding varieties have to be taken including 2 to 3 crops per year from the same land, then it is essential to have mechanical drying facilities. The type of dryers to be used and proper locations of drying centres will have to be given considerable thought. The location of dryers poses a serious problem of multidisciplinary nature-economics, engineering, sociology, etc. Take for example paddy crops. If the dryers are located close to the mill, they may be too far away from the paddy production centres. In that case the high-moisture paddy will get deteriorated by the time it is transported from the villages to the drying centres. Out of the 30 drying centres established in Tamil Nadu State in the late 60s, most of them did not prove to be viable units due to poor selection of sites and improper coordination. Probably, community dryer(s) located in a village to serve all or few farmers may be considered as a realistic solution to such a problem. Undoubtedly, each case, with respect to particular crops has to be considered separately to find the right solution as no single dryer can be recommended for universal use for all the crops. The Agricultural Engineering faculty of the universities must work out the type of dryers required for different drying conditions to solve the local problems and fulfil the local needs.

Processing and Milling of Grains : All foodgrains are covered with an outer protective layers consisting of husk or bran or both which are generally inedible. Removal of these outer layers to make the grains edible, is generally achieved by a combination of operations called milling, e. g., rice milling, flour milling etc. Sometimes, premilling treatments are performed on the grains either to enrich the grains or to facilitate the subsequent milling operations for higher head yield.

Many premilling techniques have been developed and practised and have been found suitable to increase the milling yield, nutritional, cooking and eating qualities of cereals, pulses and oil seeds. For paddy crops, parboiling is considered to be the most effective and economical premilling treatment. Sometimes, cold or hot soaking in combination with drying treatments have been successfully employed for many crops in different countries.

The traditional methods of milling of paddy, pulses, cereals etc., are quite wasteful. Modern technology has to be adopted for all grains to achieve higher outturn as well as to obtain better quality products and byproducts. For example, by using modern mills (Rubber Roll type), it is possible to get higher yield and pure bran and husk separately. Both of these byproducts can be further utilised to extract oils and to make many industrial products.

Most of the rice mills in India are of traditional steel huller type. They, invariably have the capacity of milling 300 kg. per hour. Rice mills typical of larger Japanese and Western enterprises that are designed to process well-graded paddy of uniform grain size, frequently prove totally inefficient when applied to the widely heterogeneous mixture of varieties that customarily is delivered to many small Indian Mills. However, among the different sizes of such mills tested in India 1 to 2 tonne/hr. capacity units proved to be quite promising. But there is an attempt to design a $\frac{1}{2}$ tonne per hour capacity mini rice mill to replace the single huller type units (72,000 in number) installed in India. Considerable success has been attained in this respect by now. Similar attempts have to be made in processing of other cereals and pulses.

Storage and Transportation of Grains : In spite of modern methods now in use for storing grains in India, losses up to 10 percent have been

recorded. Storage losses in case of pulses are higher than those for cereals. In addition to the physical losses, the losses in quality and nutritional aspects of grains are also quite substantial. The predominant factors responsible for such losses are (i) poorly-designed storage structures, (ii) high moisture of grains during storage, and (iii) insect infestation. It is highly desirable and physically possible to avoid such losses by adopting scientific methods. Air-tight structures suitable for storing foodgrains made of locally-available materials would be more suitable for small and marginal farmers. A few such structures made of bamboo-cement, bamboo-concrete, bamboo-plastered with linseed oil and ash, etc., have been succesfully tried out at Indian Institute of Technology, Kharagpur. These structures are insect and rodent proof, moisture proof and suitable for fumigation before and after storing grains.

Transportation is an important activity for both producers and consumers of the foodgrains. Due to inadequate transport facilities, producer is unable to recover all his produce from the fields. Transportation losses in a harvested crop may vary from 2 to 5 percent. Such losses could be easily avoided by selecting suitable transport system under a particular condition. Even indigenous bullock cart can be suitably modified to transport crops, grains and their byproducts without losses.

In the absence of a suitable transport system, many a time, the producers have to sell away their produce at non-remunerative prices. They are not able to take the advantage of gains that might be obtained by selling the foodgrains in the markets where exploitation by the middleman is the minmum.

Problems of Post-Harvest System

The magnitude and complexity of system vary from country to country according to the crop involved.In India where the marginal farmers predominate,it is only a question of harvesting, storing, transporting, and processing the crop on the farm itself. But there is an obvious need, particularly with the growth of rural towns, to produce more than the individual farmer needs. Then the crop has to go through a more complex system

namely harvesting and threshing, drying and storage, processing, transportation and distribution, marketing, grading and quality control, pest control, packaging, etc. Most of these operations under such a system demand serious considerations of economic, social and climatic factors. For example, where should the storage points established for surpluses in the districts, or in the regions? This question is not simply, how big a storage place is needed or of what kind? At times when rain coincides with the harvest, the grain must be transported to the storage points quickly. Many a time the roads become unnegotiable after the rains resulting in complete spoilage of grains. Thus, transportation aspect of some post-harvest systems is a factor of maximum constraint.

Conclusion

It is apparent, that losses can and do occur at all points in the post-harvest system, and that, in order to cut down these losses, the system must be examined as a whole. Post-harvest system should be thought of as encompassing the delivery of a crop from the time and place of harvest to the time and place of consumption, with minimum loss, maximum efficiency, and maximum benefit to all concerned.

In India, foodgrain industry is predominantly an-on-the farm industry and virtually the whole set of post-harvest activities such as harvesting, threshing, drying, transportation, handling, storage processing, market, ing etc., is performed by the farmer himself. In performing these activities, the farmer derives assistance mainly from his family some hired labour, animal power, etc. He is handicapped due to ignorance about the modern techniques of post-harvest operations as well as his poor economic condition. About 30% of the farm produce which the farmer has to sell, is generally sold as distress sale. The remaining 70% of the produce which he has to retain for his family need and seed is considerably damaged in the storage. Commercial pest control chemicals are rarely used by him. Either he is ignorant about the use of the chemicals or finds it prohibitively expensive.

It would be desirable to organise a well planned farmers' extension programme to advise them in post-harvest operations so that the losses

may be minimised. Training facilities for the field worker, extension officers, farmers and others should be organised in the disciplines of post-harvest technology. Existing international, national and regional facilities for post-harvest research, training and infomation must be considerably strengthened. Adequate facilities for technical guidance and exchange of information through literature, mass media such as radio, television etc., must be created for the benefit of the producers as well as consumers. □

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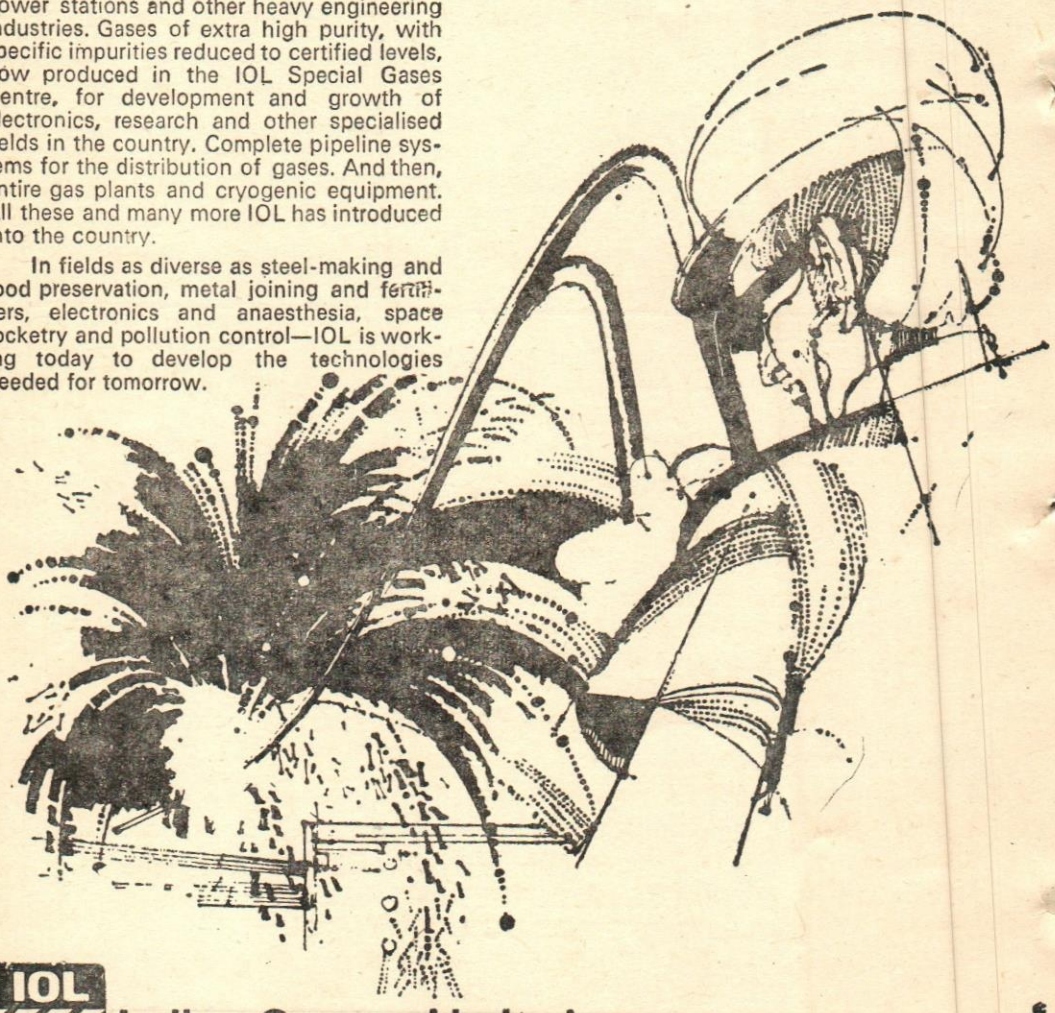

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Conservation of Soil and Water Resources of Hills : Problems and Possible Solutions

Ghanshyam Das*

Problem

The problem of conservation of soil and water resources, in general, is more economical and institutional than technical. Especially in the plains of India the technologies for improving water management, soil conservation, and related problems are easily available. However, enough attention has not been paid to modify or substitute the available technologies according to the needs and the investment capacity of the Indian farmers. In the hills, in addition to the economic and institutional problems, an improvement in the technical skill of the human resource is also required.

Thus, some important questions arise whose solutions need attention. They are :

a) What are the basic reasons resulting in soil erosion?

b) Is it due to bad farming practices or due to denudation of forest resources ?

c) Why is the local population not adopting conservation practices ? Is it economical, institutional or a technical problem ?

d) What tehnical measures are required for the purpose ?

In the hills of Uttar Prdesh agriculture is, by and large, at subsistence level. The population pressure on land is high and the terrain is rough and adverse to farming practices. The farming is being done on steep slopes without any proper conservation practices, resulting in heavy erosion of soil. Stoevener (1976) observes that while some land on the U.P. hills may be incapable of crop production in an absolute

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physical sense, yet, some land would be capable of sustained intensive use if properly managed. Proper management requires the knowledge and application of soil water management techniques. The application of these techniques requires substantial investment of labour and capital by the farmer, the returns of which may be insufficient to justify it from his perspective. Hence farmers are reluctant to make the necessary sacrifices, and soil erosion continues.

The major part of U.P. hills are under forest. In a forest ecosystem water is the principal carrier of sediments. The soil of a forest watershed is an important factor in the inter-relationship between run off and erosion. Plants are important, and play a decisive role in the hydrology of forest watersheds. Climate, an important variable in the run off process, also influences the erosion rate. Forest roads are a significant source of sediment in forest, because of surface run off. Road surface inhibit infiltration of precipitation and interdict normal subsurface flow patterns. As is generally understood, light fires and logging do not cause much erosion. However, heavy fires and yarding of logs to the landing cause exposure of soil surfaces and soil disturbances, which lead to soil erosion. Naturally sparse vegetation, short growing season, shallow and poorly developed soil, and occasional droughts lead to rapid deterioration of the plant cover under heavy grazing in forest lands.

Mass soil movement in forest watersheds is a catastrophic event often triggered by road construction. One landslide or slump can place several times more material into a stream than is normally carried during a year. The impact of mass soil movement goes far beyond increasing stream sediment loads or turbidities. It leads to serious channel degradation, may scour bed materials to the bed-rock base in steep channels, eliminating productive aquatic communities and scouring the channel banks and thus providing a site for future instability and erosion.

The problems of uncertainty of returns to hill farmers from conservation efforts have been discussed above. These uncertainties may be due to lack of technical know-how, non-predictable weather conditions, and nature of markets for products and input supplies. The effectiveness of government programmes in hills may have to be increased to reduce these uncertainties. Group efforts are important for the success of soil conservation programmes. Not much work seems to have been done

in this area. Development of technologies which would economise the use of necessary organisational inputs is required. It may be necessary to conduct an economic study which may emphasise accounting for all costs and benefits which would accrue to various affected groups. Most of our programmes overlook this important analysis which should be done critically for longer and sustained effects of the programmes. Many of the dams and reservoirs constructed in India are facing an unprecedented problem of siltation of the reservoirs. The same problem exists in the Ramganga catchment of the Uttar Pradesh hills. It has been estimated that about 20 hectare centimetre sediment per square kilometre flows out of this catchment every year because of soil erosion. Because of this silt transport from the catchment, it is expected that the reservoir of the Kalagarh dam being constructed on the river Ramganga may get filled with silt within 48 years. Thus, the questions raised above are important, and their solutions necessary. The agriculture resource base of the hill needs full protection, and at the same time the public investment on the reservoirs and dams also needs protection.

Wantrup (1968) observes that conservation of a resource does not mean non-use. It is economically meaningful when the use of resource is considered. In conservation, the redistribution of use is in the direction of the future; in depletion, in the direction of the present. Conservation always implies comparison of two or more time distributions of use. It is to compare expected use if new practices are adopted with what use would have been if the old practices had been continued. In the Naurar Valley of the Ramganga catchment some action research was conducted with this in view to study the impact on social and economical structure of the area by the introduction of new technologies for conservation of soil and water resources of the valley.

Conservation of Land Resources

The Bhikhiasen block consists of approximately 17,000 hectares with 7,500 hectares under cultivation. The soil consists of essentially parent material, the top soil having been removed long ago by water erosion. Farming is being done on bench terraces. These terraces are being constructed without any technical considerations. They are generally outwardly sloping with or without the shoulder bunds. This is resulting in heavy erosion of the fertile top soil.

The technique of construction of these terraces is very old. These terraces are generally constructed with manual labour. Heavy machinery like bulldozers can be effectively used for construction of these terraces, but it is not practicable. Heavy machinery can be used only for large areas, and if the terracing is being done on a watershed basis, and for planned designs. The people here are poor and a majority of them live on a sub-subsistence level. The farm holdings are fragmented. There is no contiguity in a farmer's land and the steep slopes of the hills further aggravate the problem. The farmers under these circumstances, therefore, use manual labour for the construction and reshaping of terraces which is expensive and tiring.

There are two state government agencies—the Department of Agriculture and the Department of Forestery—working in the area to assist the farmers in adopting conservation practices. As it is, these agencies operate on the target approach of conserving a certain amount of area which is arbitrarily fixed in the state capitals by the bureaucrats. The field workers try to fill their targets by whatever means they can. Generally, some good areas are selected by them and with minor modifications are included in their achievement of target. Ths technique of construction adopted by them also remains to be manual labour, though the designs are better.

New Terrace Construction Technique : Bullock power may be effectively used to construct bench terraces. This power is widely available in the hills, which is being used mainly for ploughing operations. Suitable bullock-drawn equipments can be used for terrace construction, and the operation can be made simple, economical, faster and less-tiring as compared to manual labour.

Three types of equipments are required for construction of bench terraces with bullock power, in addition to the hand-operated tools which are required to be used to remove boulders, deep roots, bushes, etc. These equipments are a plough, a modified buckscraper, and a modified bund former.

Either a country plough or a mouldboard plough can be effectively used. A buckscraper is used to move lossened soil from one place to another. The commonly-used buckscraper was provided with special features. It was made lighter in weight and its size was

reduced in the multiples of the thickness of width of the bench terraces. To make it easy to transport on the hills, a pin was provided in the bolt joining its tailboard and the mouldboard so that these may be separated while transporting on steep slopes. Two clamp handles were provided one each on the tailboard and mouldboard respectively, to lift the scraper while making short turns on bench terraces.

The existing metallic bundformer was modified to make it lighter and less expensive by providing a wooden mouldboard with a steel share.

Economics of Operation of Buckscraper : The output of the buckscraper was estimated by determining the capacity of the implement. The capacity of the implement is a function of its size and the type of soil. It was found that the capacity of the scraper is approximately 0.0784 cu.m. The output of the scraper is a function of type of bollocks, length of time of operation, and the condition of the soil. For the local conditions the output of the scraper was estimated to be approximately 3.5 cu.m. per hour (loose volume).

It was found that the cost of 100 cu.m. (bank measure) of earthwork done with scraper comes out to be approximately Rs. 44 for the local conditions. If compared with the existing rates (Rs. 110) of the Divisional Forest Office, Ranikhet, for similar work by manual labour, the earth work done with the scraper is cheaper by Rs. 66.

Generally, the levelling operations are done during the lean season. If the farmer owns a pair of bullocks, he may get this work done with no extra investment except his own and bullock's labour. The farmers generelly have less farm workload and are relatively free during these periods. Since the women folk share a large portion of the farm work also, the men have enough time at their disposal which may be fruitfully utilised. The farmers can also cash for this labour, by taking the amount of subsidy provided by the government for the soil conservation work.

Conservation of Water Resources : The Naurar catchment is a sub-watershed of the Ramganga watershed. This catchment is drained through a perennial stream running through its middle. This stream is fed through innumerable small streams. The sources of water in these streams are the springs scattered all over the valley and the precipitation. The precipitation is about 880 millimteres, which is generally concentrated

during the rainy season (July to September) and in winter. On the whole, the area may be classified into a semi-arid zone. The area around these springs, and adjacent to the Naurar, Gangas and the Ramganga rivers in the valley can be very well irrigated with the available sources of water. Generally these are all perennial sources of water. However, the amount of water available in these streams during the hot summer months is much less compared to rest of the period of the year. Water storage alters the pattern of water movement; it may reduce soil erosion and simultaneously creates a potential water supply for irrigation. Soil erosion is heavy in this area. The main carriers of this eroded soil are the small streams. It may be a worthwhile proposition to check this flow or eroded soil into the streams itself. At suitable places small dams may be constructed on the streams. These may be constructed in a series, if necessary. The dam structures may stop the sediment transport, to a great extent. The small reservoirs which would be created may be utilised for irrigation. The quick siltation of the small reservoirs may be checked by putting vegetative barriers and check dams on streamlets feeding the streams, at the same time keep improving the condition of the terraces.

It has been observed that the temporal variation in the concentration of sediment is quite large, especially in small streams. Most sediment in small streams is carried during a few large storms. This means that for a large part of the year, streams may remain clear, during which, water in the stream is supplied by base flow and discharge may nearly be constant. During a storm event the sediment concentration increases with increase in discharge. Therefore, sampling the storm events may be more useful than a regular periodic sampling of these streams. (Very little research has been conducted on sediment transport in the mountain streams of UP). It may be interesting to find out the causes for the increase in sediment concentration with increase in discharge. The answer can probably be found in the complexity of the sediment transport process in small, turbulent streams.

For the success of an effective sediment sampling programme, a rigidly standardised scheme for sample collection should be used, so that changes imposed by man's activities can be separated from those imposed by nature. Sampling may be confined to storm events, and concentrated during the rising and peak stages.

Economics and Social Impact : The benefits from such a soil conservation-cum-irrigation project are likely to be substantial. It may result in direct benefit to the farmers near the streams, and indirectly to the siltation problem down stream.

The farmer may have two-fold benefits. The first is the stoppage of erosion of his top soil and the nutrient from his farm land. Secondly, he gets irrigation water. Both combined together may have tremendous effect on his economic and social status. The community in the area may gain in terms of more income. The benefitting farmers may like to invest more in conservation measures.

The government has a large amount of funds allocated for soil conservation and for minor and major irrigation works to be spent either on a subsidy basis or as a full government project. As a matter of fact, the present system has not clicked much, and a rethinking is warranted. □

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Measurement of Capital Productivity

D.K. Kotia*

Though every action initiated by a company is not aimed at maximising profits, irrespective of social consequences, yet profit is essential. The company is in business to make a profit. Profit is the final output.

If an executive is asked to state the two most important criteria for assessing company profitability it is almost certcin that he would quote, Profit : Sales, and Profit : Capital Employed. It may be pointed out that :

$$\frac{\text{Profit}}{\text{Capital Employed}} = \frac{\text{Profit}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Capital Employed}}$$

There is wide acceptance of Profit : Capital Employed as the measure of profitability. However, the serious disadvantage of this ratio is that it is of little use for measuring company performance other than over a period of years.

To achieve long-term stability and growth, it is essential that a firm maintains and, if possible, increases its stock of capital. Indeed without such an increase it is unlikely that it will be able to improve labour productivity, which is so necessary for the control of unit wage costs. How then does a firm increase its stock of capital ? The answer is, 'by ploughing back retained profits', or 'by raising money through a share issue or other similar floatation'. Both of these methods are only feasible if the company earns consistently good profit on its capital employed. Return on capital is important for defining the absolute profit required from a given level of assets. However, when considering the month-by-month operations of a company, endeavour should be to relate the capital emloyed not to profit, but to company output, that is, to Added Value. In other words, the attempt should be to measure productivity of capital.

The great difficulty in any discussion concerning capital is to define how one values it ? Whether fixed capital at book value ? At orignal value? At replacement value? And then there is the matter of stocks. Do these

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consist of raw materials, work in progress, or finished goods?

Accountants can argue for hours about the subtler distinctions between fixed assets and current assets, and how they should be valued. For the purpose of inter-firm comparisons these distinctions do matter. Within a given firm, however, they do not really affect the situation, provided that the assets are valued on a consistent basis, and that fluctuating rates of depreciation are not applied. As with all matters relating to the measurement of performance, consistency over time is the essential feature.

Industry has two primary resources, labour and capital. The productivity of labour determines the standard of living of the nation, but the productivity of capital determines whether it will be able to attract the investment which sooner or later will be required if economic growth is to be maintained.

In spite of its limitations as a short-term criterion of performance, the ratio Profit : Capital Employed is the ultimate measure of managerial effectiveness. Its principal value lies in its ability to focus attention on the total operation, thus allowing management to evaluate the effects of existing policies on the firm's objectives.

When comparing the performance of a number of companies, be it for investment, takeover or general appraisal purposes, the return on capital is a useful yardstick. The proviso is that trends must be examined over several years. In the shorter term, we can obtain a much more helpful assessment of the effective use of capital by looking at the relationship between different types of assets and the output resulting from these; in other words, by examining the relationship between Assets and Added Value.

The starting point for assessing capital productivity is the ratio Profit : Capital Employed. This ratio is the product of Profit : Sales and Sales : Capital Employed. Since Sales Value does not represent the net output, and is not a measure of the work done in the production of goods or services, it is preferable to express the profitability of capital as follows :

$$\frac{\text{Profit}}{\text{Capital Employed}} = \frac{\text{Profit}}{\text{Added Value}} \times \frac{\text{Added Value}}{\text{Capital Employed}}$$

The importance of the two terms on the right hand side of the equation cannot be over-emphasised; both must be maximised in order to maximise Profit : Capital Employed.

The first charge on the income of a company is the payment of the employees. Thus a company must constantly examine the percentage of its Added Value paid out in wages and salaries. Having paid the employees, it then must allocate a further percentage of Added Value to the remaining fixed expenses of the company. Finally, whatever it has left will be available for profit—hence the significance of the ratio Profit : Added Value. The ratio Added Value : Capital Employed represents the productivity of capital.

The capital employed by a company can be subdivided into Fixed Assets and Working Capital. In turn these can be broken down further, as follows :

Fixed Assets :

Land + Buildings + Machinery

Working Capital :

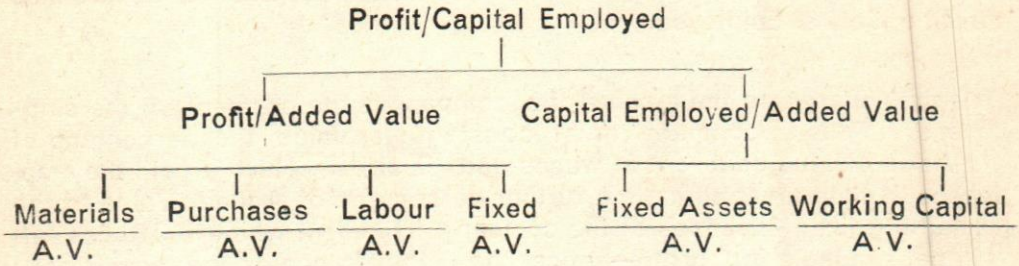
Current Assets—Current Liabilities = (Stock + Debtors + Cash)—
(Creditors × Other Liabilities)

If we now invert the term Added Value/Capital Employed, we can equate it to its two main constituents as follows :

$$\frac{\text{Capital Employed}}{\text{Added Value}} = \frac{\text{Fixed Assets}}{\text{Added Value}} \times \frac{\text{Working Capital}}{\text{Added Value}}$$

From this equation we can develop a comprehensive ratio chart, itemised down to the last nut and bolt if necessary. A chart might appear rather like a family tree with all the branches leading to the ultimate objective of Profit/Capital Employed.

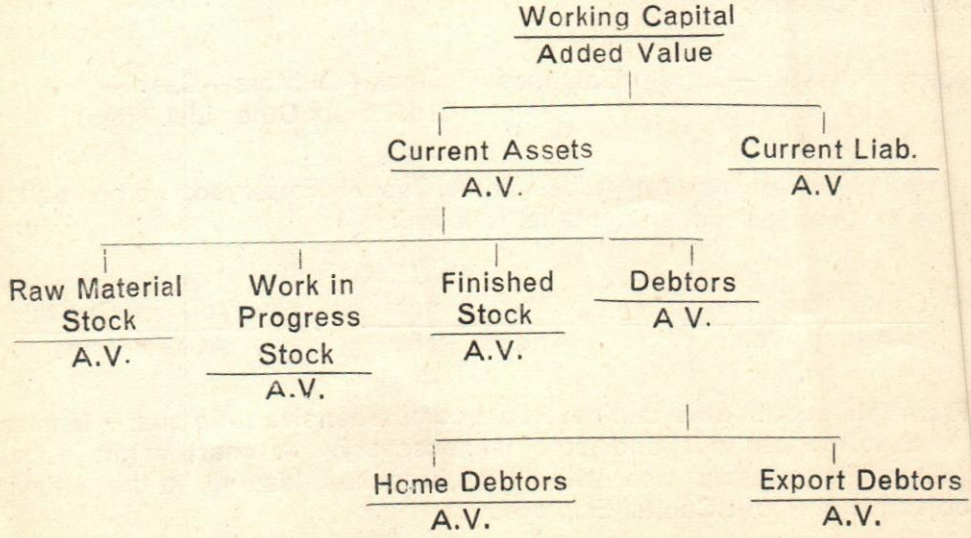
Fig. 1 : GENERAL RATIOS



The senior management of a company rarely needs to study a more-detailed breakdown than that shown. Most people would agree that too much information is as unhelpful as too little. The brain quickly becomes confused when confronted with mass of information. and every successful manager knows that the hallmarks of an effective information system are brevity and objectivity.

There are circumstances where it can be advantageous to subdivide the chart further than shown above—for example,when comparing performance between different companies within a large group. On the capital side, a further breakdown could be undertaken as shown in fig 2.

Fig. 2 : CAPITAL PRODUCTIVITY RATIOS

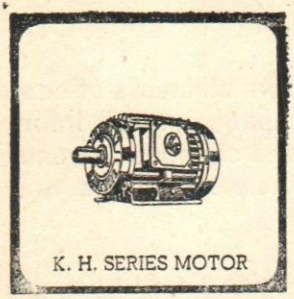


With a little imagination one could go on breaking down elements of cost until several aspects are covered. In field of company control, information, to be effective, must readily indicate trends and changes in trend. It must enable those in authority to locate areas of incipient trouble and to take action where action is required.

Figs. 1 and 2 show how a given objective, in this case Profit : Capital Employed, can be divided and subdivided into a number of ratios, each ratio expressing a resource input in terms of output (i.e., Added Value). By an examination of trends over time, those inputs which are resulting in a greater or less output can be readily identified.

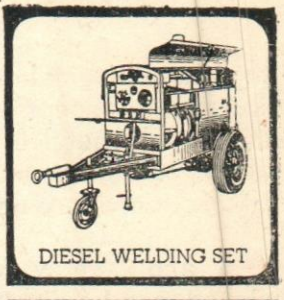
The efficiency with which a company utilises its resources is a matter of fundamental importance not only to the company and its employees, but also to society at large. It is undoubtedly true that the more efficient the management, is the greater will be the Added Value produced by individual firms in the economy and the higher would be the Gross Domestic Product.

The ratio Profit : Capital Emloyed and its subdivision helps in measuring overall efficiency of the business enterprise and identifies spots requiring attention of the management for keeping appropriate control on various aspects of the business activity.

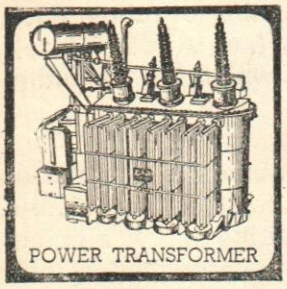


K. H. SERIES MOTOR

Kirloskar



DIESEL WELDING SET



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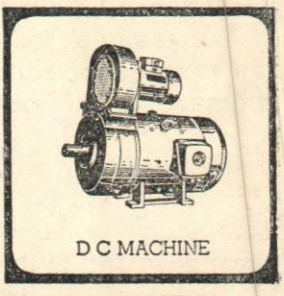
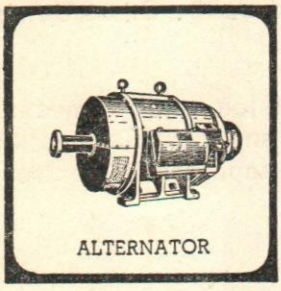
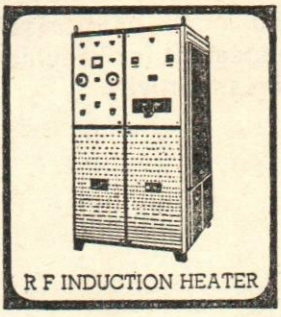


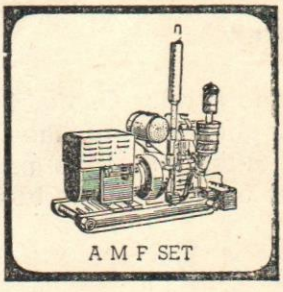
D C MACHINE



ALTERNATOR



R F INDUCTION HEATER



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Industrial Relations Machinery: A Case

M. L. Monga*

The enigma of industrial conflict is intrinsic is an industrial society and It must find answer for it. The resolution dedends upon the historical development of industrialisation, cultural and national characteristics of the society and, therefore, every society must find its own solution. India in its efforts to offer some solution to industrial strife passed the Industrial Disputes Act, 1947 for creating infra-structure to resolve the industrial unrest. The Industrial Relations machinery under the Act comprises preventive and curative steps. The machinery for the prevention of industrial disputes includes broadly all those methods which, directly or indirectly, contribute towards improvement in industrial relations whereas curative machinery comes to play its role when measures likely to prevent the emergence of indusirial disputes prove either inadequate or ineffective and a strike or lockout is apprehended or is actually declared. The mashinery for the purpose includes conciliation, arbitration and adjudication processes.

Since the authority to administer the industrial relations machinery rest with the respective State Governments, a modest effort is made here to pinpoint how the machinery has been functioning in a comparatively newly born State, viz., Haryana during 1970-76. With the above ends in view a case study has been undertaken for Haryana and the major findings are discussed hereunder.

Enforcement Staff

The Industrial Relations Machinery is headed by the Labour Commissioner in the State, assisted by a Joint Labour Commissioner, two Deputy Labour Commissioners, eight Labour-cum-conciliation Officers, one Indusiial Tribunal and one Labour Court. The Labour Commissioner has to look after 33 enactments in the State including this machinery.

Conciliation Machinery

As soon as an industrial dispute is apprehended, conciliation machinery

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sets itself into motion in order to avoid a confrontation between labour and management. It tries to resolve the dispute through persuasion and mediating between the parties. The number of cases handled by this machinery in the State is presented in table 1. The statistics suggests that the performance has steadily decreased during the period under study. In 1970, conciliation machinery settled 26.06 percent of the total cases handled, whereas in 1976, the percentage stood at 23.66 per cent. The total number of conciliation cases to be dealt with have considerably gone up in the State.

Table 1 : Statistics of Cases Handled by the Conciliation Machinery

Year	*Pending at the beginning of the year*	*Settled during the year*	*Total*	*Settlement by efforts of Conciliation Machinery*	*Withdrawn by the Workers/ Unions*	*Rejected/ Untenable under the law*	*Pending at the end of the year*	*Cases where Conciliation failed*
1970	321	1.292	1,613	420 (26.06)	239 (14.81)	354 (21.94)	321 (19.90)	279 (17.22)
1971	321	1,667	2,009	606 (30.16)	311 (15.48)	374 (18.60)	342 (17.05)	376 (18.71)
1972	342	1,482	1,824	414 (22.69)	292 (16 0)	404 (22.14)	385 (21.14)	329 (18.03)
1973	385	1,665	2,050	518 (25.26)	235 (11.46)	543 (26.48)	442 (21.56)	312 (15.24)
1974	442	2,370	2,712	520 (19.17)	374 (13.78)	606 (22.34)	880 (32.47)	332 (12.24)
1975	880	2,168	3,048	596 (19.55)	371 (12.17)	1,164 (38.18)	498 (16.36)	419 (13.74)
1976	498	1.898	2,396	567 (23.66)	374 (15 60)	668 (27.87)	415 (17.35)	372 (15.52)

Note: Figures in brackets indicate percentages to total.

Source: Annual Administration Report, the Industrial Disputes Act, 1947, for 1970 through 1976.

The data further reveal that a substantial number of cases were first filed, but later on, withdrawn by the workers or trade unions. This suggests that many petty issues might have been taken up for conciliа-

tion but subsequently withdrawn or not persued. This was an unnecessary strain on the machinery which could have been easily avoided had the plant level machinery been effective. Similarly, a significant number of cases were rendered untenable under the law and hence rejected. These cases seemed to be the result of misunderstanding of the legal provisions. The percentage rejection of such cases appears to be significantly high as 38.18 percent and 27.87 percent cases were rejected in 1975 and 1976 respectively. The number of cases in the State where conciliation machinery failed to arrive at a settlement was considerably high. Moreover, nearly 1/5th of cases out of the total have remained pending at the end of each year which testifies the ever growing workload on the machinery.

Arbitration and Adjudication Machinery

The status of this machinery is that of curative under the Act and it is utilised when conciliation fails to resolve the disputes. The powers to refer a dispute to this machinery lies with the appropriate Government. In Haryana, one Industrial Tribunal at Faridabad and one Labour Court

Table 2 : Statistics of Arbitration and Adjudication Cases

Year	*No. of cases referred to*			*No. of cases decided*		
	Arbitration	*Adjudication*	*Total*	*Arbitration**	*Adjudication*	*Total*
1970	—	279	279		144(51·60)	144
1971	12(3.27)	364(96·73)	366(100.0)		259(71.15)	259
1972	13(3.42)	367(96.58)	380(100.0)		327(89.10)	327
1973	4(1.29)	308(98.71)	312(100.0)		248(80.50)	248
1974	26(7.82)	306(92.18)	332(100.0)		232(75.80)	232
1975	17(4.05)	402(95.95)	419(100.0)		288(71.64)	288
1976	6(1.47)	402(98.53)	408(100.0)		402(100.0)	402

*Records for cases decided by arbitrators was not available.

Note : Figures in brackets are percentages to total.

Source : Annual Administration Reports for the respective years.

at Rohtak are functioning as adjudication agencies. The cases referred to this machinery and their outcome are shown in table 2. The data suggest that cases referred for arbitration have remained insignificant in the State and adjudication machinery has been loaded heavily. Nearly 96 to 99 percent of the cases have been referred for adjudication. Thus, pressure on the adjudication has remained constant and abitration has receded into the background. It emerges from the data that a tendency has firmly entrenched in the State in favour of adjudication, inspite of abritration receiving lot of lip-service. The ratio of cases decided to the total cases referred to has stood almost static except in 1976 when all the cases were decided.

Time taken by the machinery to give awards confirms the above fact that pressure has increased on this machinery (table 3). The data pin-

Table 3 : Time Taken by Industrial Tribunal and Labour Court in giving Awards

Year	Awards given		Total	Time taken in giving Awards				
	Under Section 10 of the Act	Under Section 33—A of the Act		Upto 3 Months	3—6 Months	6—12 Months	Over 12 Months	Total
1970	140	4	144	37 (25.69)	28 (19.44)	41 (26.40)	38 (26.40)	144
1971	210	40	259	35 (13.51)	114 (44.0)	59 (22.77)	51 (19.72)	259
1972	310	17	327	14 (4.28)	33 (10.09)	164 (50.15)	116 (35.48)	327
1973	226	22	248	48 (19.35)	35 (14.11)	51 (20.56)	114 (45.98)	248
1974	232	7	239	20 (8.36)	24 (10.04)	59 (24.68)	135 (59.92)	239
1975	278	10	288	27 (9·37)	36 (12.50)	68 (23.61)	157 (54.52)	288
1976	384	18	402	46 (11.44)	44 (10.94)	110 (27·36)	202 (50.26)	402

Note : Figures in brackets are percentages to total

Source : Annual Administration Report, The Industrial Disputes Act, 1947 for 1970 through 1976.

point that during 1970-76, the percentage of cases decided within three months has declined steadily and the same is true about caess decided within six months. The percentage of cases which took one year to be decided shows a variation but has definitely increased in 1976 when compared to 1972. The percentage of cases which took over one year for settlement has increased which exhibits a declining performance of the adjudication machinery particularly during the period 1973-76. This delay in decision making can also to a greater extent be ascribed to the presence of industrial strife.

Table 4 : Implementation of Awards

Year	No. of Awards		Total	No. of Awards		Total
	Not Requiring Implementation	Not requiring Implementation		Implemented on the date of enforcement	Not implemented on the date of enforcement	
1970	71	73	144	51 (69.86)	22 (30.14)	73 (100)
1971	166	93	259	54 (58.06)	39 (41.94)	93 (100)
1972	109	218	327	190 (87.15)	28 (12.85)	218 (100)
1973	189	59	248	38 (64.40)	21 (35.60)	59 (100)
1974	197	42	239	23 (54.76)	19 (45.24)	42 (100)
1975	214	74	288	54 (72.97)	20 (27.03)	74 (100)
1976	247	155	402	36 (23.22)	119 (76.78)	155 (100)

Note : Figures in Brackets are percentages to total

Source : Annual Administration Report, The Industrial Disputes Act, 1947, for 1970 through 1976.

Implementation of Awards

The status of implementation of awards (requiring implementation) on the date of enforcement (table 4) shows uneven trend. Every alternate year the implementation rate has changed during the period. The number of awards not implemented on the date of enforcement was highest in 1976 viz., nearly 77 percent awards remained unimplemented. Incomplete and abrupt implementation of awards create suspicions in the minds of workers and shake their faith in the machinery.

Conclusions

The following are the major findings ot the present study based on preceding discussions. The performance of industrial relations machinery was not encouraging at all. The conciliation machinery could resolve nearly 19 to 30 percent of the cases referred to it and gave a clearance chit to nearly 12 to 18 percent of the cases referred to it to go to adjudication. A substantial number of cases were rejected as untenable under the law indicating poor awareness of the legal provisions among workers in the State. Similarly, quite a good percentage of cases were first filed and subsequently withdrawn or not persued by the respective parties depicting absence of a machinery at the plant level to resolve petty issues. This unnecessarily burdened the concliation machinery. There is a growing tendency in the State in favour of adjudication and it reflects certain definite misgivings about arbitration process which needs further probing. The pressure on adjudication machinery during these years has increased substantially. The time taken in giving awards has accelarated. The implementation of awards has declined in the State. □

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Plant Layout Decision Models : A Review

Sadananda Sahu* and Kailash C. Sahu**

Introduction

This paper presents a review and appraisal of approaches and models for developing plant layouts, emphasising on more recent computerised heuristic algorithms which have greater potentialities as aids to better layout planning. A large number of papers, numbering over 500 have appeared in the area of layout design during the last three decades. Much of these have been reviewed by Lea [45] Elrayah & Hollier [15], Ritzman [77], Parker [67], Jackson & White [35], and Sahu [81]. The various layout decision models can be grouped into three categories : (i) Visual Aids, (ii) Optimal-Producing Procedures and (iii) Heuristic Procedures.

Visual Aids

Most of these techniques have appeared in literature since the early fifties to early sixties. These approaches do not employ rigorous rules ; instead, the various layout alternatives are evaluated depending mainly on judgement, intuition and experience of the analyst. The flow process chart and operation process chart are means of determining the sequence of operations for each product. These charts, along with the demand figures for the product(s), facilitate computation of the flow between department pairs [114,105]. These flow values can further be adjusted by taking into account the differences in mode and means of material handling, by means of the Magnitude Chart [75].

The Product-Quantity Chart is a plot wherein demand is shown on the y-axis and the product, arranged in decreasing order of demand, is shown

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on the x-axis (110). For products on the upper region of the plot, a product layout is suggested. Process layout for the products in the lower region and combination layouts for the central region are recommended. The main limitation of this chart is its inability to specify boundaries for each region. Deming has suggested that machines and capital utilisation are appropriate criteria for determining shift from process to product type layout [12].

The travel (cross) chart is used to show the flow between various departments in a matrix from [48,9]. Smith [87] suggested the use of flow distance rather than flow for the purpose of ranking. Although travel charting does not lead to an optimal solution, it provides a good basis for improving solutions in a logical way, as well as for evaluating layouts [49, 51, 82].

Sequence analysis, suggested by Buffa [6], uses travel chart as a guide. Alternative block diagrams are generated by trial and error in an attempt to reduce the sum of non-adjacent flows. The procedure starts with development of flow-between matrix. A schematic diagram, where the nodes represent work centres and straight arcs connecting the nodes represent flow between the centres, is developed. Nodes and arcs are manipulated by trial and error so that minimum number of arcs intersect. This gives the ideal schematic diagram from which a block diagram of work centres showing physical relationships is developed. For small problems this approach gives quite satisfactory solutions. This approach has stimulated research work in the application of graph theory to the plant layout problem. Graph theory has been applied for formalising the process of constructing the schematic diagram as mentioned above [85, 59,17,47].

The Relationship chart is similar to the cross chart except that the entries in the matrix represent closeness ratings instead of flows. Closeness ratings specified in five or six levels indicate the desirability of locating a pair of departments adjacently [63]. This chart has led to the development of two computerised algorithms, ALDEP [84] and CORELAP [46]. Systematic Layout Planning developed by Muther [110], considered to be an improvement over the other schematic and graphical techniques consists of a framework of phases, a pattern of procedures and a set of conventions.

A flow diagram is a scaled plan of a given layout with each department specified on it, and with flows between departments represented by arrows. In the string diagram the material flows are represented by unbroken strings connecting pins placed at the centroids of departments [79].

Optimal Producing Procedures

Although a number of quantitative methods have been developed, until the early sixties none of these were able to ensure an optimal solution. This led to the development of a number of mathematical models concerned with the problem of (a) locating new facility (or facilities) in existing layouts and (b) assigning facilities to locations (in new or existing layouts).

Locating New Facilities in Existing Layouts : Bindschedler and Moore [5] have presented the method of level curves to find the optimum location of a new machine in an existing layout, where the objective function is the minimisation of the flow-distance between the new machine and all the existing machines. The method consists of computing the total cost of locating the new machine at several points on the layout grid. All points having equal cost values are joined to form isocost (or level) curves. The machine is then assigned to a feasible location on the lowest possible isocost curve. Straight-movement and rectangular-movement cases are considered.

Francis [18] has extended the rectangular-movement case of Bindschedler and Moore to accommodate situations where the layout involved is one, two or three-dimensional. An extension of this model enables determination of the optimal location of two machines, with material flow between them.

Francis [19] has arrived at the optimal solution to a special case of the two-dimensional rectangular movement model when there are several new machines to be located in an existing layout.

Moore [57] has solved the problem of adding new machines in existing layouts applying the assignment method of linear programming. The measure of effectiveness is the flow-distance considering flow between the new machines and the existing machines only.

Vergin and Rogers [91] have suggested an algorithm for locating optimally a new facility with respect to existing facilities. The straight-movement case is shown to be computationally more involved than the rectangular-movement case.

Location Assignment by Cost of Handling (LACH) is a dynamic programming model developed by Willoughby [95], for assigning N new centres to k candidate areas in a layout having M fixed centres. Each of the new centres is introduced sequentially for analysis, with the centres having the highest $\sum_{k=1}^{M} f_{ik}$ values introduced first. The first centre ignores the interaction with the remaining (N—1) new centres, the second ignores the other (N—2) new centres and so on. After all the new centres are considered, the assignment having the minimum operating cost is selected while honouring the budget constraint on the purchase of material handling equipment. In addition, there are a number of physical analogies relating the problem of adding new facilities to an existing layout [53].

Assigning Facilities to Locations : The problem of assigning indivisible facilities to locations has attracted researchers from various disciplines and this has led to the development of a number of optimal procedures. The problem can be formulated as a quadratic assignment problem in the following general form :

Find $X_{11}, X_{12}, \ldots, X_{nn}$ to

$$\text{minimise} \sum_{i,j,k,l}^{n} C_{ijkl} \, X_{ij} \, X_{kl} \qquad (2.1)$$

Subject to the constraints :

$$\sum_{j=1}^{n} X_{ij} = 1, \qquad (j = 1,2 \ldots\ldots n) \qquad (2.2)$$

$$\sum_{i=1}^{n} X_{ij}=1, \qquad (i=1,2,\ldots\ldots\ n) \tag{2.3}$$

and $X_{ij}=0$ or 1 $(i, j=1, 2,\ldots\ldots\ldots\ldots n)$ (2.4)

C_{ijkl} may represent the cost of transportation from facility i at location j to facility k at location j. Equations 2.2 and 2.3 require that each facility be fully assigned to locations, and that each location be fully utilised by facilities. Equation 2.4 prohibits splitting of facilities, so that each is completely assigned to one location or another.

The quadratic assignment problem has many applications, including : (i) minimising total wire length in electronic and electrical assemblies [88], (ii) locating machines, departments or offices within a plant so as to minimise transportation cost [3], (iii) arranging the indicators and controls in a control room so as to minimise eye fatigue [106], and (iv) laying out departments or operation theatres in a hospital [16].

For solving the quadratic assignment problem, a number of procedures of both the optimal and sub-optimal type have been reported in the literature. Existing optimal procedures can be classified into three groups :

(i) Integer programming approach of Lawler [44],

(ii) Semi-enumerative procedures of Lawler [44] and Gilmor [24], and

(iii) Semi-enumerative procedures of Gavett and Plyter [23] and Land [43].

The integer programming approach is not feasible even for small problems because of huge computational efforts involved. Gilmore [24] states that his algoritnms are "probably not computationally feasible for problems of size larger than 15". Gavett and Plyter [23] report the computing times for problems of different sizes. The rate of increase in time with problem size is too high to select this method as a practical procedure.

Robert and Flores [78] have tried to use dynamic programming for solving such problems.

Layout Planning Using Graph Theory : The techniques using graph theory could as well be included under visual aids since the end result is a schematic diagram as in the case of sequence analysis mentioned above. Basic concepts of the mathematics of graph theory as relevant to layout planning are as follows :

A graph {V, E} consists of a non empty finite set V, whose members are called 'vertices' (or nodes), together with a set E of unordered pairs {a, b} of vertices ($a \neq b$). The members of E are known as "edges" (or arcs).

A planar graph is one which can be so mapped onto a plane that no two edges intersect.

A maximal planar graph is one such that if one more edge is added, the graph becomes non-planar.

Valency of a node is the number of edges incident to it. Important results of graph theory relevant to layout planning are as follows [85, 59, 17] :

(i) If {V, E} is a maximal planar graph with m vertices, then {V, E} has 3m-6 edges. This gives the upper limit to the number of adjacencies that can be satisfied.

(ii) A graph with less than nine edges is planar.

(iii) A graph which has neither six vertices of valency at least 3, nor five vertices of valency at least 4, is planar.

(iv) Vertices of valency 1 or 2 are irrelevant for the purpose of determining planarity.

The end result of an optimal searching technique using graph theory is a planar graph whose arcs represent relationships and nodes represent departments. Adjustments to cater for department areas and configuration have to be made manually. Foulds and Robinson [17] report that hand computations for a twelve department problem took about four hours. RUGR [42] is the only computerised algorithm developed which uses graph theory.

The various optimal procedures for solving the plant layout problem appear to be limited in their usage to very small problems. The huge amount of computational effort prohibits them as practical approaches. Nugent *et. al.* [66] have stated "One is forced to conclude that no computationally feasible optimal-producing procedure exists at present. Interest must therefore, focus on sub-optimal procedures".

Heuristic Procedures

The term "heuristic" has been defined as "a rule of thumb, strategy, trick, simplification or any other kind of device which drastically limits search for solution in large problem spaces" [103]. Heuristic programming involves algorithms capable of reducing the amount of search required to find an "acceptable" solution. Recent research since early sixties in plant layout and design has focussed on the development of computer programs to assist the layout planner in generating alternative layouts. In most cases, a block layout, rather than a detailed layout is produced. These programs can generate a large number of alternative layout plans and compare them on the basis of some selected criterion.

Vollman and Buffa [92] have classified the computerised programs for layout design as either construction type or improvement type. The construction algorithms build or construct a layout by building up a solution "from scratch" and successively adding blocks until all facility blocks are placed in the layout. The improvement algorithms require an initial layout to start with and successively improve upon it till no more improvement is possible. CORELAP[46] is the first construction algorithm whereas CRAFT[3] is the first improvement algorithm developed.

Apple and Deisenroth [2] have pointed out that the computerised algorithms make one or more of the following assumptions :

(i) All departments (activity centres) are square (symmetrical);

(ii) Material flows between the centres of the departments;

(iii) Material handling cost is directly proportional to distance;

(iv) All data on material flow is known, and is deterministic in nature;

(v) All travel is in two dimensions.

These assumptions might result in poor solutions.

Apple and Deisenroth further go on to say that if an attempt is made to obtain good data on most of the relevant factors, the results of a computerised layout algorithm can be useful in :

(i) exploring a myriad of potential relationships, not otherwise possible,

(ii) permitting the designer to "learn" from the data collection process,

(iii) providing an insight into the problem of watching the print out process;

(iv) defining the problem in a better way.

Moore [61] has presented an international survey of computerised layout algorithms.

A large number of computerised algorithms are available of which a few promising algorithms are outlined in the following paragraphs.

Hillier [32] has suggested a heuristic procedure based on the "move desirability table" which shows the saving in cost if each department is moved from its present location by one step. It makes pair-wise exchanges between the adjacent departments when the net saving involved is positive. A modification of the above technique made by Hillier and Connors [33] removes the restrictions against non-adjacent department exchanges.

CORELAP (Computerised Relationship Layout Planning) [46] constructs layouts in a crystal growth fashion : the facility with the largest amount of interactions is placed in a central location. Subsequently, facilities are selected and placed on the basis of their interactions with the growing layout plan. It can accommodate upto 45 departments. Interactive CORELAP developed by Moore [60] utilises a general purpose time-

shared system. This permits the best talents of both the man and the machine to be utilised.

RNA Comp I [62] develops a schematic pattern of relative locations first, then assigns the required spaces to facilities without regard to layout.

ALDEP (Automated Layout Design Program) [84] is basically a construction type program requiring information in the form of REL chart. It can handle upto 63 departments and can generate a multi-storeyed layout upto three floors. Layouts are generated initially by random selection and successive location of departments relative to one another as per the REL chart.

CRAFT (Computerised Relative Allocation of Facilities Technique) was presented by Armour and Buffa, [3] and Armour and Vollman [7]. In brief, the procedure can be described as follows :

> Given an initial assignment and a flow matrix, the algorithm executes successive exchanges of department locations which reduce the objective function. For each iteration, the exchange leading to the greatest reduction is selected. This process continues until no further reduction is possible. Only those departments having equal areas or departments of unequal area having common border are considered for exchange.

FRAT (Facilities Relative Allocation Technique) presented by Khalil [39] makes use of a combination of existing heuristics. It is an improvement type algorithm, accommodates facilities of equal area and can handle both the straight-movement as well as rectangular-movement case.

MAT (Modular Allocation Technique) by Edwards *et. al.* [14] is a construction algorithm which requires as input the flow and distance matrices. It can accommodate upto 40 departments and constructs continuously a plan, assuming identical spaces for all facilities. MAT output, when fed as input to improvement algorithms, produces better results.

PLANET (Plant Layout Analysis and Evaluation Technique) by Apple and Deisenroth [2] is a heuristic construction algorithm for establishing an area allocation diagram utilising information about material flow

patterns. It provides the layout designer with three alternative methods of selecting the sequence of activity centre placement into the layout so that heavy material flows are directed over shorter distances.

LSP (Layout Planning by Computer Simulation) developed by Zoller and Addendroff [98] is a construction approach using material flow data. It honours building outline constraints, and can accommodate multifloor layout problems. Computer simulation is employed to generate and evaluate layouts.

The linear placement algorithm of Neghabat [64] treats the problem of locating a given number of interrelated physical facilities in a single or multi-storeyed building as an optimisation model in order to minimise the weighted sum of the distance along orthogonal directions and later uses a heuristic placement algorithm.

TSP (Terminal Sampling Procedure) proposed by Hitchings and Cottam [34] is an amalgam of previous heuristic algorithms. It embraces a number of desired features which help in getting superior solutions.

COFAD (Computerised Facilities Design) developed by Tompkins and Reed [89] is used to design or assist in the design of a facility where the facility design includes the selection of material handling system and the placement of departments within the facility. The algorithm selects the facilities design for which the material handling system cost is minimum.

COSFAD (Computerised Safety and Facilities Design) [90] is an extension of COFAD and involves joint consideration of safety and facilities design. In this approach, an attempt has been made to quantify safety by a method of evaluating hazards presented by various situations.

Bazaraa [4] has formulated the layout design problem as a quadratic set covering problem and presented a computerised procedure. The formulation handles single or multi-storeyed buildings; objects with regular or irregular shapes; designing a layout 'from scratch'; or adding new facilities to an existing layout. A branch and bound optimisation procedure provides the final layout.

Elshafei [16] has presented an efficient heuristic procedure for solving the problem of locating hospital departments so as to minimise the total

distance travelled by patients. It consists of two parts : Part A builds the initial layout and Part B improves it.

Comments and Conclusions

The visual aids, though incapable of providing rigorous decision rules for solving the plant layout problem, are most commonly used [50]. They are very useful for small and uncomplicated problems. Optimal procedures are more of academic interest now; huge computational efforts prohibit their use to problems of interesting size. Heuristic procedures are compromises between solution quality and computational effort.

Scriabin and Vergin [83] have reported the results of a comparison of computer algorithms and visual based methods on a number of problems, involving departments of equal area. They conclude that human subjects, without the benefit of any prescriptive help from a computer, achieve layouts which are stochastically better than those produced by computer programs. Buffa [8] criticised the above claim on the ground that facilities of identical area rarely occur in practice and a trained analyst using visual aids such as Sequence Analysis [6] can get better solutions. Vollman and Buffa [92] have indicated that short-cut methods could be used for cases where the flow dominance is very high.

Solution to realistic plant layout problems becomes very difficult because of a number of obstacles such as multiple objectives, changes in system parameters over time, rapid increase in computational difficulty, as the problem size increases.

Computerised algorithms are definite steps in the search for near optimal solutions to the complex problem of plant layout. It must further be emphasised that they are only aids. For example, none of the existing programs honour the requirement of shape configuration for any activity, unless it is assigned to a fixed location. □

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15th AUGUST

Day of Rejoicing—Day of Rededication to Values and Ideals

On this Day We recall:

—The historic struggle for **freedom under** Mahatma Gandhi's leadership,

—The sacrifices and sufferings of **millions** of our countrymen,

—The consolidation of freedom, integration of the country and laying of the foundations of economic development.

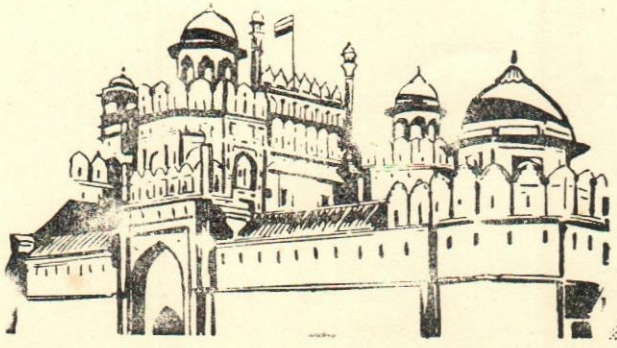
Today We resolve:

—To banish unemployment, sickness and illiteracy from our midst;

—To provide our people in the 5,76,000 villages with the minimum needs of drinking water, health, education and roads;

—To take the weaker sections of society along the path of socio-economic development as equal partners

On this 31st anniversary of Freedom let us resolve to build the India of Gandhiji's dreams. Let us strive to wipe every tear from every eye.



davp 78/211

Optimal Replacement of Weaving Machines : A Case

Prem Vrat* and M. S. Mudaliar**

The machine replacements are undertaken mainly for two reasons—first due to deterioration or degradation of the machines involving increasing rate of maintenance costs in course of time and second due to sudden or accidental failure of the machine. In the case of the first reason, newer machines offer improved, faster and cheaper service and it is always economical to replace the old machines with new ones at optimum time, i. e., at which the rate of increase in maintenance costs just balances the rate of decrease in capital depreciation costs. In the case of the second, sudden failure involves heavy costs which may be quite high when compared to the acquisition cost of the item concerned and it is always economical to replace the same in anticipation of failure before it actually takes place. The predictions of failure may be made from the past record. The replacement of weaving machines belong to the first category.

Review of Previous Work

The paper on equipment replacement by Clapham and Eilon [1] determined the optimal replacement age of any machine in a fleet by studying the average rate at which annual repairs tend to increase with age. Their analysis used linear regression techniques and consequently assumed that annual repairs are normally distributed with constant variance about a trend line. The method in the paper does not explicitly consider the random nature of individual repairs to the equipment. Drinkwater and Hastings [2] developed a method for determining the upper limit for any repair cost on a machine in a fleet of similar equipment The model consists of two random variables: the cost of any future repair and the number of repairs in a future period of use. The former is Exponentially distributed and the latter is Poisson, both having a mean that depends on the age of the machine. Records of past repairs to a fleet of army trucks support the assumed distribution and provide estimates for their parameters. Subse-

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quent work by Hastings [3] applied dynamic programming to the model to improve the method determining the repair limits. Although this method detects a machine having a very high cost for an individual repair, it does not necessarily detect a machine having consistentiy more frequent or higher repair costs than the average machine of its class. Such differences in quality are a well known phenomenon, and result from the vagaries of equipment construction and use.

It has been proved that an optimum policy involves replacement at equal intervals, when the new equipment is identical to the old equipment. It has also been proved mathematically, by Elton and Graber [4] that even in the case of replacement of old machines by the technologically-improved new machines, equal life policy leads to optimality. In their paper, Ghare and Torgersen [5] proposed a method for considering the effects of inflation and increased productivity in machine replacement analysis.

Problem

This article is mainly concerned with the case study undertaken to evaluate the Optimal Replacement period for the particular type of automatic weaving machines or auto-looms situated in a textile mill of

Table 1

Year	Av. Maintenance cost per loom/year in Rupees	Year	Av. Maintenance cost per loom/year in Rupees
1953	445.28	1965	850.92
1954	460.20	1966	861.12
1955	482.06	1967	883.20
1956	501.26	1968	1188.12
1957	524 16	1969	1415.04
1958	528.96	1970	1623.36
1959	559.80	1971	1766.40
1960	633.60	1972	1815.60
1961	651.12	1973	2177.28
1962	729.00	1974	2926.32
1963	734.04	1975	3054.24
1964	825.84		

Delhi, taking into consideration all the factors such as the acquisition cost of the new weaving machine, the salvage value of the old machines, the maintenance costs to keep the machine in reasonable working condition, the rate of inflation, the discounted cash flow, etc. At present there are 312 auto-looms which were installed in 1952. It has been found that the maintenance costs increase year by year (Table 1). This may be attributed to wear and tear and also to more breakdowns and partly to inflation. Now the problem is to find the most economical way of replacing these machines by new ones.

Model for Optimal Age of Replacement

The mathematical model given in Ackoff and Sasieni [6] was suitably modified by the authors to take into account the rate of inflation besides the discounted cash flow.

The prices of the machines or materials do not remain steady with respect to time. This is an age-old phenomenon. Here, we assume that the prices rise exponentially.

Let it be the rate of inflation, p_o the present price and p_n the price after n years. Then

$$p_o\,(1+1)^n = p_n$$

The price of the particular type of auto-loom installed in 1952 was Rs. 3850 and the present price of the similar type of auto-loom is Rs. 22,000. Taking these figures into account the annual rate of inflation works out to be nearly 8%.

The salvage value depends on the age of the machine. It is assumed to decrease exponentially which is more or less realistic. Let S_n be the salvage value in the nth year then,

$$S_n = Ke^{-an}$$

where K and a are constant. In our case the expression works out to be :

$$S_n = 3853\ e^{-0.062n}$$

If c is the acquisition cost of the machine at certain base year (say, 1952 in this case), then the present value of the new machine with respect to the same base year is $C(1+i)^n v^n$, where i is the rate of inflation and v is the discount factor which is equal to $1/(1+r)$, r being the rate of interest. Let R_n^1 be the running cost in year n, assumed to be payable at the start of the year. We shall assume that running costs R_n, occurred at mid-year and shall discount them to start of the year by multiplying them by $v^{\frac{1}{2}}$, i. e., $R_n^1 = v^{\frac{1}{2}} R_n$.

If we replace the machine at the end of K years, then the present value of all the costs is :

$$C(1+i)^k v^k - S_k v^k + \sum_{n=1}^{k} v^{n-\frac{1}{2}} R_n$$

A present value P is equivalent to payments of x at the start of each year for K years, where

$$P = x + vx + \ldots\ldots + v^{k-1}x$$

$$= \frac{(1-v^k)}{1-v}$$

$$\text{thus } x = \frac{P(1-v)}{1-v^k}$$

and the present value of all payments over the life of the machine is equivalent to fixed annual payments of :

$$x = \frac{\left[C(1+i)^k v^k - S_k v^k + \sum_{n=1}^{k} v^{n-\frac{1}{2}} R^n\right](1-v)}{1-v^k}$$

The optimal replacement period k will be such that the equivalent fixed cost x is minimum.

Analysis of Results

Using the above mentioned mathematical model and with the help of

computer, the optimal replacement periods were obtained for various combinations of parameters like the different rates of interest and the different rates of inflation, once with salvage value taken into consideration and then without taking into account any salvage value of the old machine. The tabulated statements of results are given in Tables 2, 3, 4 and 5. Generally, the textile mills borrow the capital at 15% rate of interest. We know that the rate of inflation is approximately 8%. The optimal replacement period for the weaving machines under consideration works out to be 17 years when salvage value is taken into account and 20 years when salvage value is not taken into account, in both cases the rate of interest and the rate of inflation being 15%

Table 2 : Optimal Replacement Period in Years (Without Salvage Value)

i/r→ ↓	0	6	8	10	12	12 1/2	14	15	16	16 1/2
0	15	15	15	15	15	16	16	16	16	16
1	15	15	15	15	16	16	16	16	16	16
2	15	15	15	15	16	16	16	19	16	17
3	14	15	15	16	16	16	16	17	17	18
4	12	15	15	16	16	16	17	17	17	18
5	11	15	15	16	16	16	17	18	18	20
6	11	15	15	16	16	17	17	18	20	20
7	11	15	15	16	16	17	18	20	20	20
8	10	15	15	16	16	17	18	20	21	21
9	9	13	15	15	16	17	20	20	21	21
10	—	—	—	—	—	—	18	20	21	21
11	—	—	—	—	—	—	17	20	21	21
12	—	—	—	—	—	—	17	20	21	21
13	—	—	—	—	—	—	16	17	21	21
14	—	—	—	—	—	—	15	17	20	21

i=Rate of inflation in percentage

r=Rate of interest in percentage

Tabie 3 : Optimal Replacement Period in Years (With Salvage Value)

i/r→ ↓	0	6	8	10	12	12 1/2	14	15	16	16 1/2
0	1	7	9	11	11	11	15	15	15	15
1	1	7	9	11	15	15	15	15	15	15
2	1	7	9	11	15	15	15	15	15	15
3	1	7	9	15	15	15	15	15	16	15
4	1	7	9	15	16	16	15	15	16	16
5	1	7	9	15	15	15	15	15	16	16
6	1	7	9	15	15	15	16	16	16	17
7	1	1	7	15	15	15	16	16	17	17
8	1	1	7	11	15	16	16	17	18	20
9	1	1	1	9	15	15	16	17	20	20
10	—	—	—	—	—	—	17	17	21	21
11	—	—	—	—	—	—	15	17	20	21
12	—	—	—	—	—	—	15	16	21	21
13	—	—	—	—	—	—	15	15	17	21
14	—	—	—	—	—	—	9	15	16	—

i=Rate of inflation in percentage

r=Rate of interest in percentage

and 8% respectively. Figs. 1(a) and (b) indicate the graph of Total Annual Cost/Loom (Rupees) against Age (Years). It is obvious that the curve of total annual cost/loom (with salvage value) is almost flat in the range of 15 to 20 years. That means that there will be no heavy loss incurred if the replacement period is deviated by 2 to 3 years from the optimal point of time i. e. 17 years in this case. Therefore, the optimal replacement period for these weaving machines is within the range of 15 to 20 years.

Table 4 : Optimal Total Cost Per Loom/Yeay (Without Salvage Value)

i/r→ ↓	0	6	8	10	12	12 1/2	14	15	16	16 1/2
0	901.37	755 82	715.96	680,12	647.91	640.37	618.19	604.48	591.57	585.40
1	939.74	780.54	737.16	698.25	662.71	654.24	630.35	615 60	601.74	595.13
2	983.37	808.66	761.29	718.83	679.36	670.18	644.31	628.38	613.08	605.68
3	1031.52	840.61	788.67	741.75	698.66	688.46	660.33	642.37	639.95	618.14
4	1083.92	876.84	819.74	767.77	720.34	709.41	677.89	658.24	655.72	645.43
5	1138.28	917.91	854.94	797.55	745.37	733.37	698.07	767.58	565.72	645.43
6	1194.93	964.38	894.78	831.56	773.97	760.23	721.35	696.88	692.30	661.11
7	1256.64	1016.92	939.82	870.38	806.60	791.17	747.83	719.35	715.46	679.68
8	1321.16	1076.75	990.67	913.65	843.82	826.75	778.29	745.63	715.46	700.99
9	1384.29	1139.00	1048.03	963.87	886.17	867.65	813.49	776.67	642.40	726.26
10	—	—	—	—	—	—	854.51	813.28	774.93	756.36
11	—	—	—	—	—	—	901.76	856.40	812.58	792.12
12	—	—	—	—	—	—	955.15	907.12	857.80	834.56
13	—	—	—	—	—	—	1014.99	965.55	911.39	884.85
14	—	—	—	—	—	—	1081.10	1028.85	973.90	—

i=Rate of inflation in percentage

r=Rate of interest in percentage

Table 5 : Optimal Total Cost Per Loom/Year (With Salvage Value)

i/r→ ↓	0	6	8	10	12	12 1/2	14	15	16	16 1/2
0	677.59	660.44	644.76	627.93	608.72	604.10	588.80	578.17	568.05	563.18
1	677.59	688.66	670.97	649.66	627.10	620.56	601.92	590.27	579.19	673.87
2	677.59	718.31	697.69	673.43	644.66	632.63	616.85	604.02	591.86	587.03
3	"	749.45	727.01	699.92	664.60	656.58	633.81	619,65	606.65	599.84
4	"	782.14	758.39	725.47	687.22	678 31	653.05	637.37	622.06	614.64
5	"	816.43	791.96	755.55	722.86	702.94	674.85	656.84	639.63	631.49
6	"	852.40	827.85	789.60	741.88	730.85	699.19	678 78	659.70	650.18
7	"	869.58	864.96	828.08	774.68	762.31	726.31	703.83	681.84	671.26
8	"	860.58	902.15	868.70	811.72	797.89	757.16	732.26	707.27	693.89
9	"	869.68	928.76	909.88	853.50	838.01	793.28	764.47	734.91	719.85
10	—	—	—	--	—	—	833.33	801.42	767.42	750.13
11	—	—	—	—	—	—	879.50	843.28	805.71	785.90
12	—	—	—	—	—	—	930.14	891.40	850.73	828.34
13	—	—	—	—	—	—	787.07	945.10	902.89	878.63
14	—	—	—	—	—	—	1041.17	1003.90	962.43	—

i=Rate of inflation in percentage

r=Rate of interest in percentage

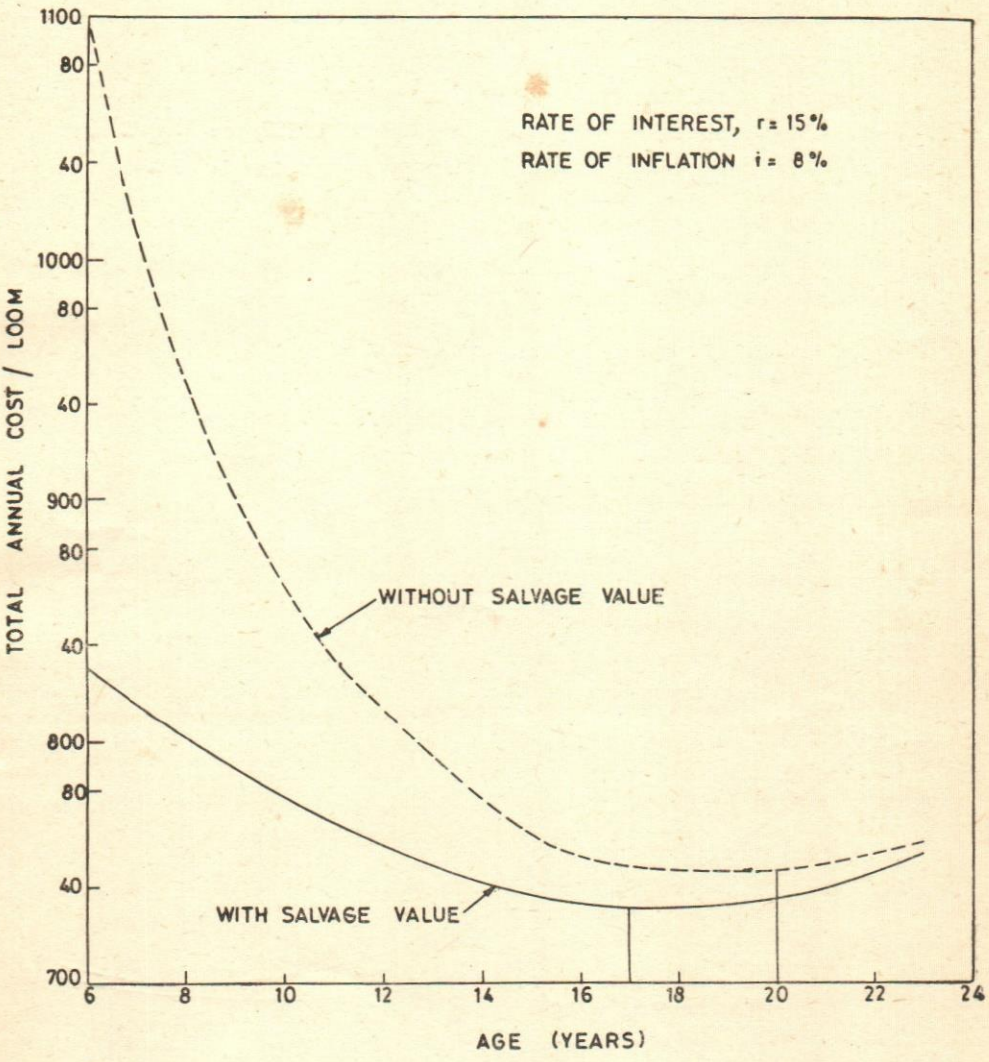

RATE OF INTEREST, r = 15%
RATE OF INFLATION i = 8%
WITHOUT SALVAGE VALUE
WITH SALVAGE VALUE
TOTAL ANNUAL COST / LOOM
AGE (YEARS)
1100
80
40
1000
80
40
900
80
40
800
80
40
700
6
8
10
12
14
16
18
20
22
24

Fig. 1 (b)

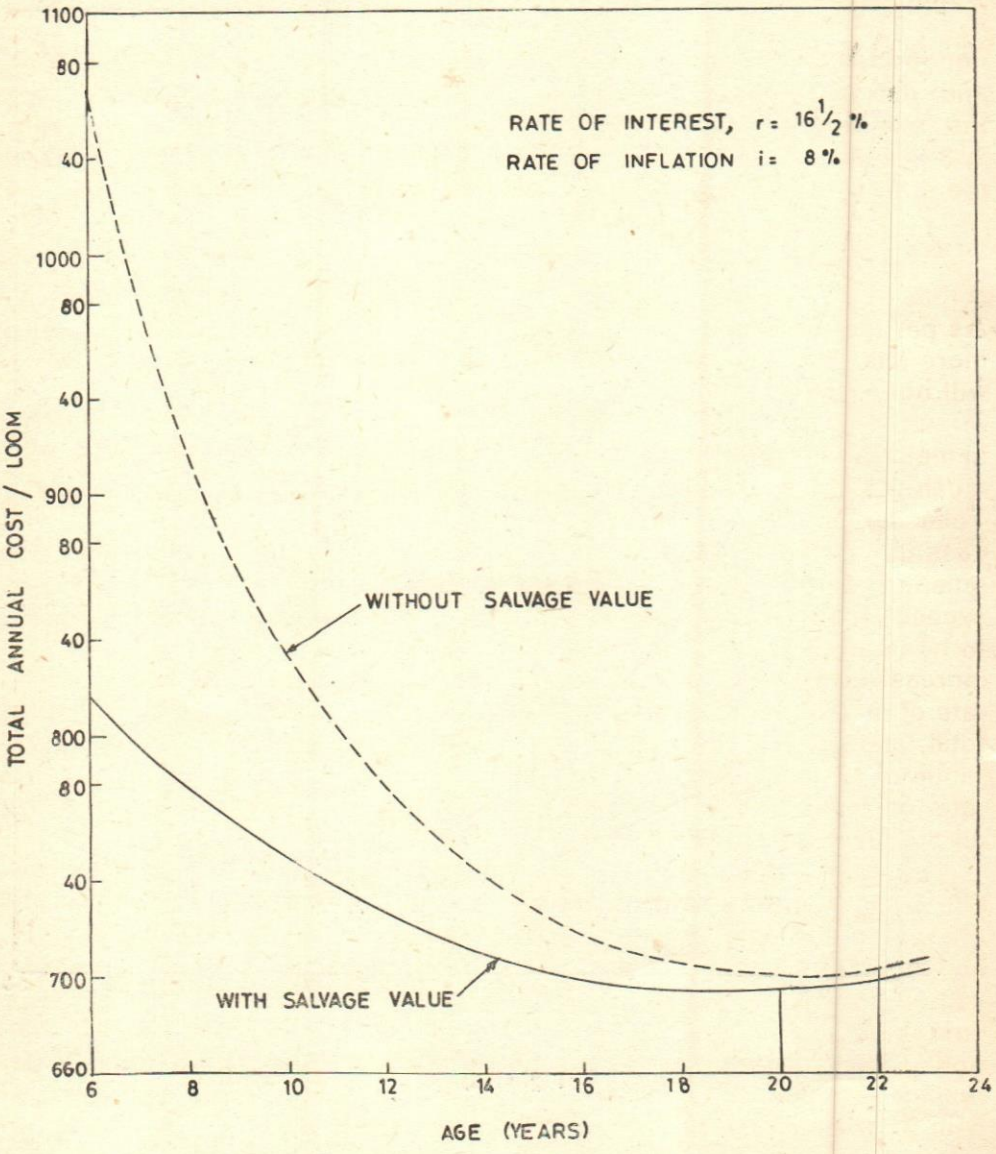

RATE OF INTEREST, r = 16 1/2 %
RATE OF INFLATION i = 8 %
WITHOUT SALVAGE VALUE
WITH SALVAGE VALUE
TOTAL ANNUAL COST / LOOM
AGE (YEARS)
1100
80
40
1000
80
40
900
80
40
800
80
40
700
660
6
8
10
12
14
16
18
20
22
24

Fig. 1 (a)

Sensitivity Analysis

For various combinations of parameters like different rates of interest and different rates of inflation, the optimal replacement periods and the annual total costs per loom were obtained, as shown in Tables 2, 3, 4 and 5. The following different rates of interest, r (percent) and the different rates of inflation, i (percent) were considered :

$$r = 0, 6, 8, 10, 12, 12\tfrac{1}{2}, 14, 15, 16, 16\tfrac{1}{2}.$$

$$i = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14.$$

As per the directive from the Reserve Bank of India, no bank can charge more than $16\frac{1}{2}\%$ as rate of interest. We hope that the rate of inflation will not exceed 14% for this kind of a situation.

In majority of cases change in the rate of inflation will not effect very much the optimal replacement policy as seen in Figs. 2 (a) and (b). Take for example the case when the rate of interest is 6%. In this case the optimal replacement period is 7 years for different rates of inflation from 0 to 6 percent. In all cases if the rate of inflation exceed that of interest, the optimal replacement period happens to be one year. In case of $16\frac{1}{2}\%$ rate of interest, there is a stepwise increase in optimal replacement period from 15 years to 21 years, as the rate of inflation changes from 0 to 14 percent. However, the curve of total annual cost/loom [Fig. 1 (b)] against age is almost flat within the range of 15 to 21 years. It may be concluded that the change in the rate of inflation has little effect on the optimal replacement policy for all practical purposes.

Fig. 3 shows the graph of the optimal replacement age against the rate of interest in percentage. Here it indicates that the optimal replacement age increases with increase in the rate of interest. The same conclusion can be drawn by observing Fig. 4. In Fig. 5, various curves of total annual cost/loom against age are plotted for various values of the rate of inflation. The curves are almost parallel indicating more or less the similar replacement period. However, the total cost per loom-year increases with increase in the rate of inflation.

By observing Figs. 6(a) and (b), it is obvious that the total annual cost (optimal) per loom decreases with increase in the rate of interest. On

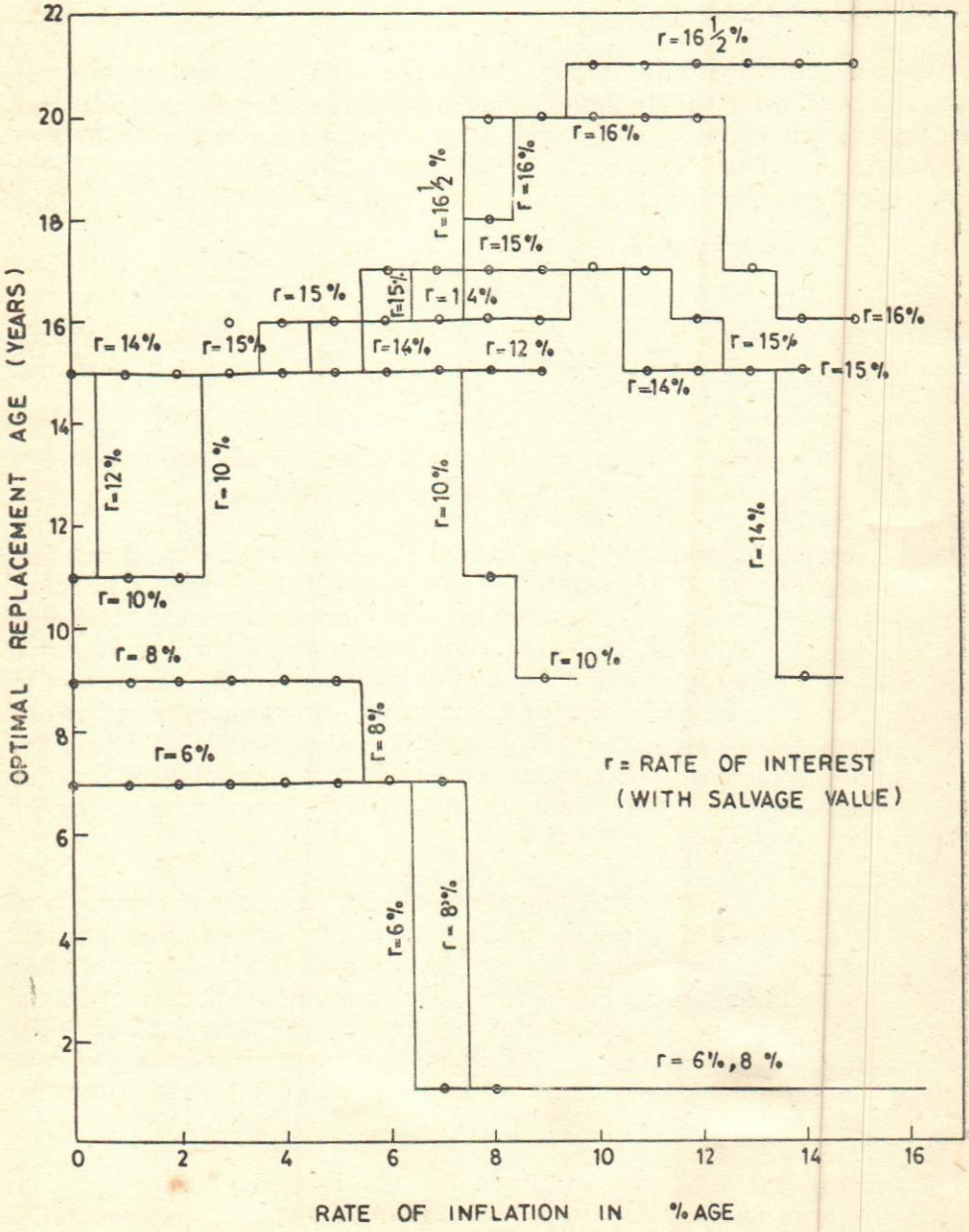
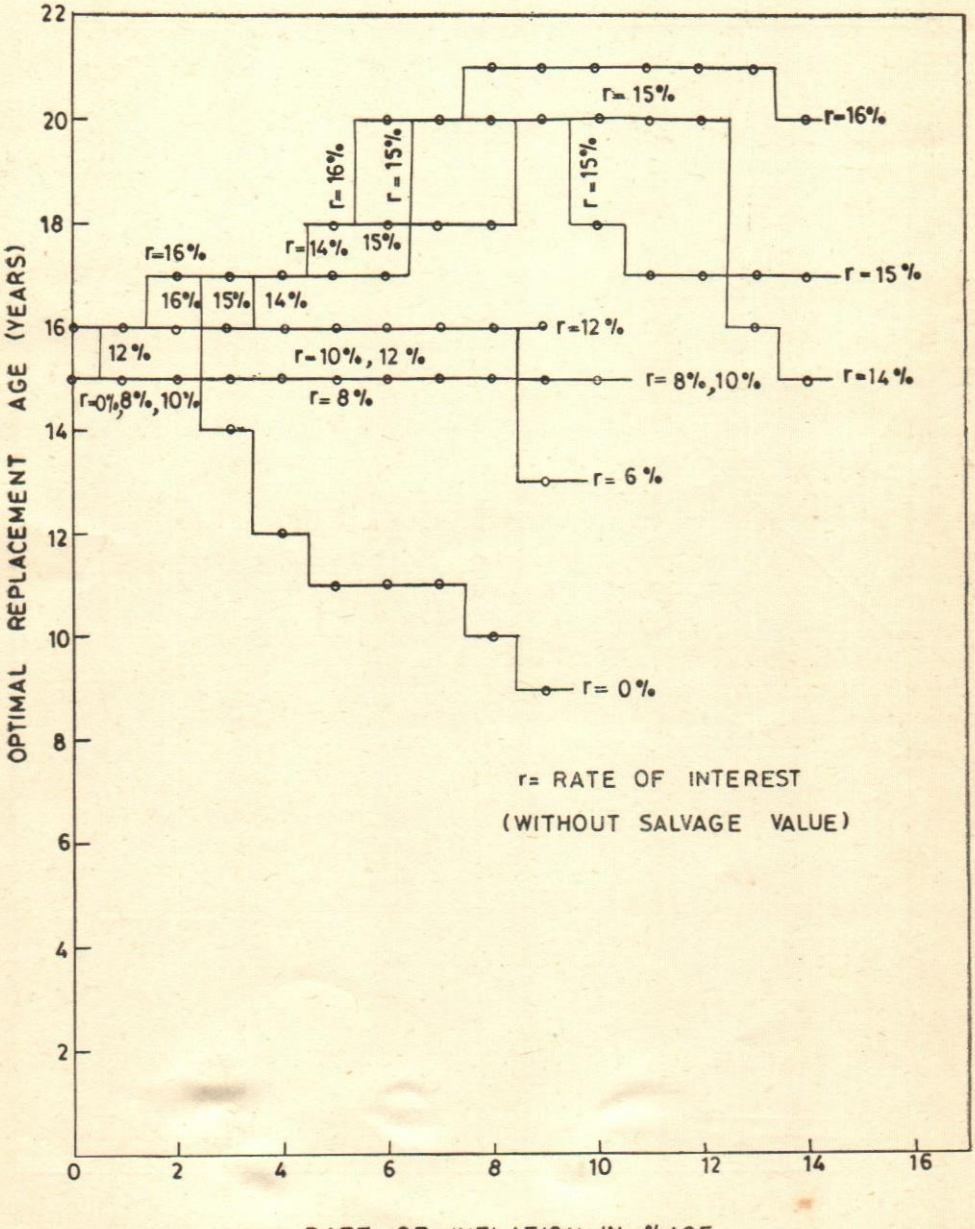

OPTIMAL REPLACEMENT AGE (YEARS)
RATE OF INFLATION IN %AGE
r = RATE OF INTEREST (WITH SALVAGE VALUE)
r = 16 1/2 %
r = 16 %
r = 15 %
r = 14 %
r = 12 %
r = 10 %
r = 8 %
r = 6 %
r = 6 %, 8 %

Fig. 2 (a)


OPTIMAL REPLACEMENT AGE (YEARS)
RATE OF INFLATION IN %AGE
r= RATE OF INTEREST
(WITHOUT SALVAGE VALUE)
r= 15%
r=16%
r= 16%
r= 15%
r=15%
r=16%
r=14% 15%
16% 15% 14%
r=12 %
12 %
r=10%, 12 %
r= 8%,10%
r=14 %
r=0%,8%,10%
r= 8 %
r= 6 %
r= 0 %
22
20
18
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6
8
10
12
14
16

Fig. 2 (b)

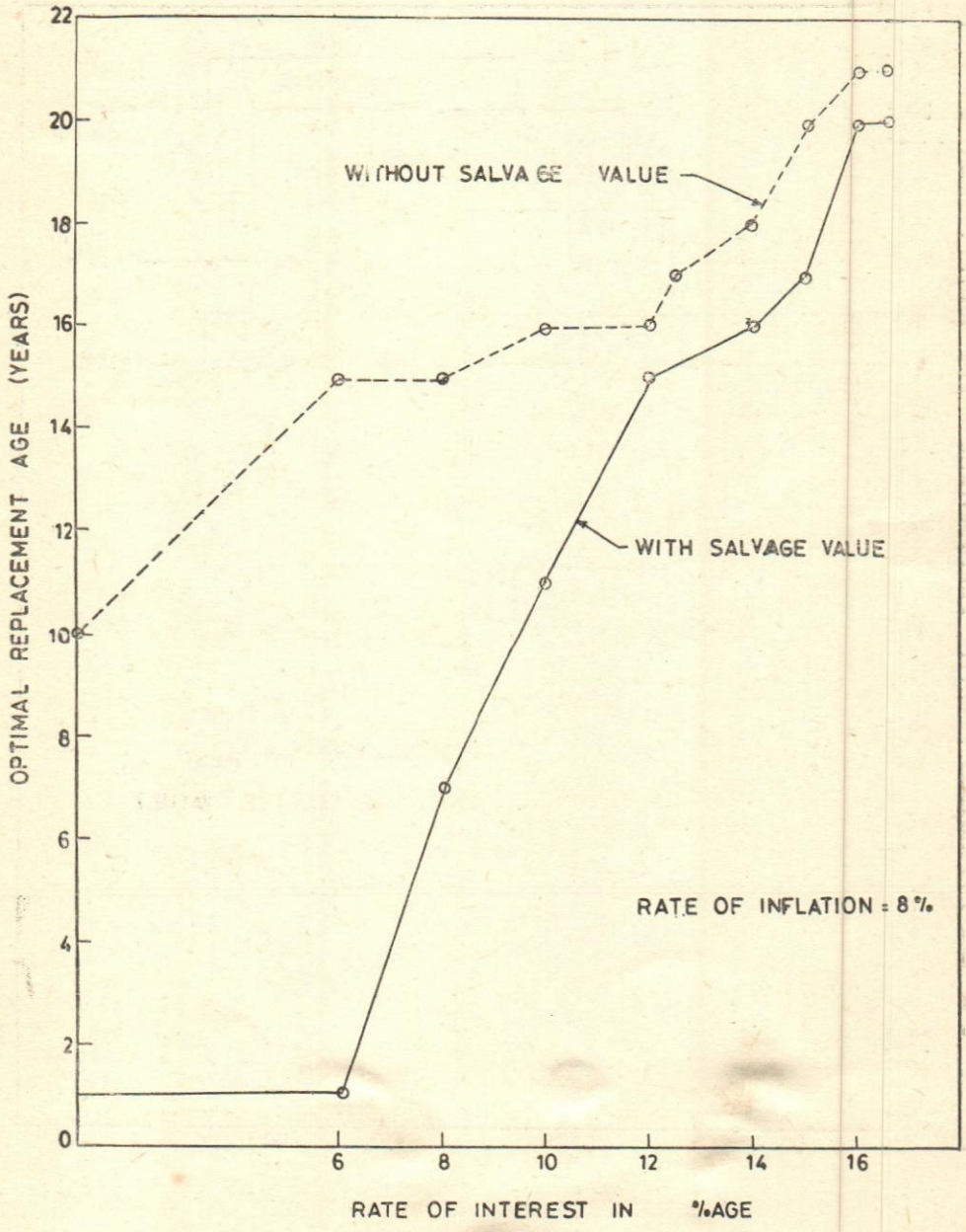
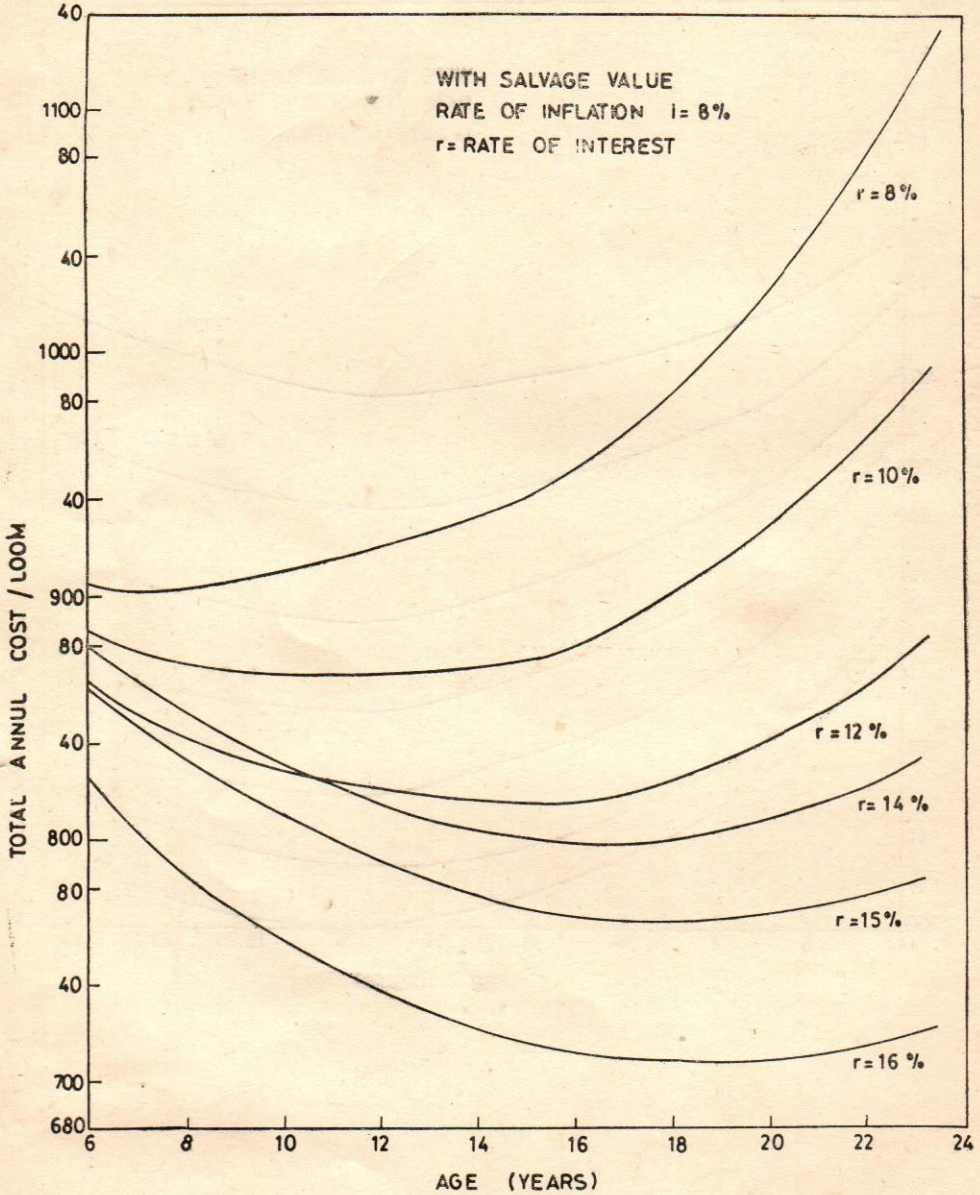
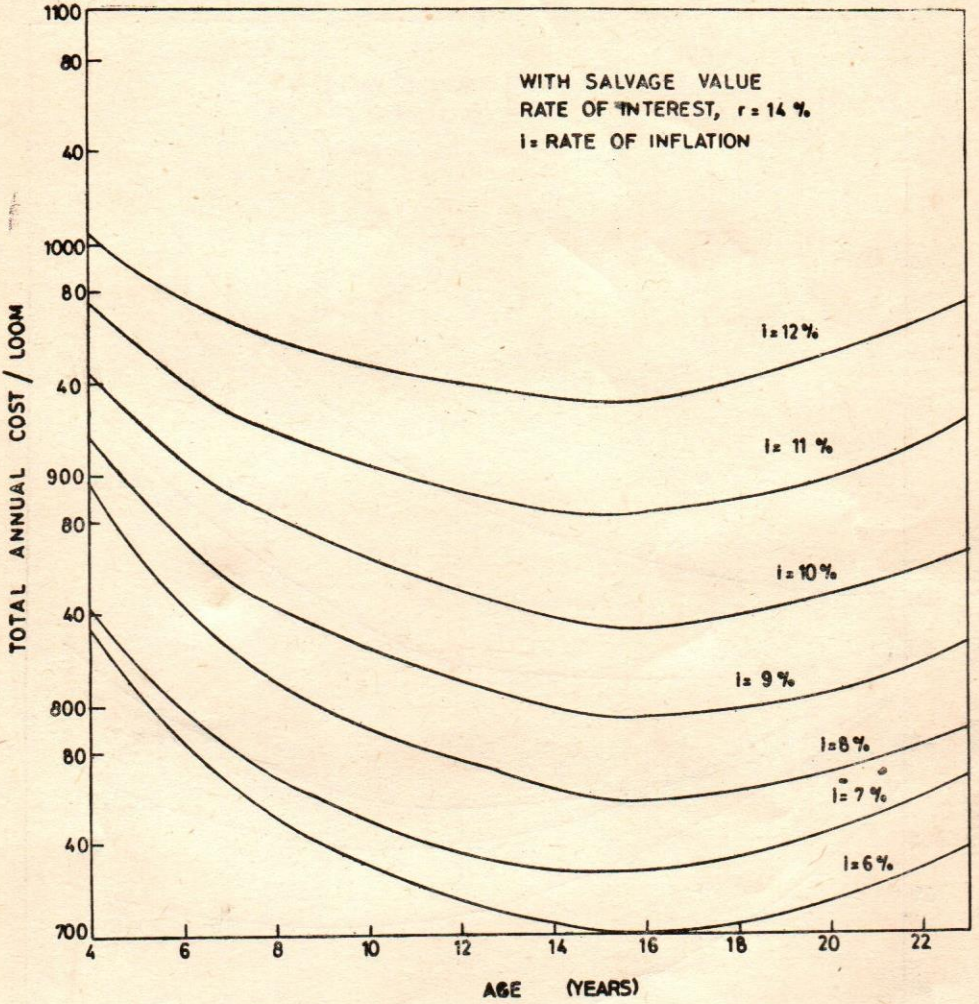

22
20
18
16
14
12
10
8
6
4
2
0
OPTIMAL REPLACEMENT AGE (YEARS)
WITHOUT SALVAGE VALUE
WITH SALVAGE VALUE
RATE OF INFLATION = 8 %
6
8
10
12
14
16
RATE OF INTEREST IN %AGE

Fig. 3


WITH SALVAGE VALUE
RATE OF INFLATION i = 8%
r = RATE OF INTEREST
r = 8%
r = 10%
r = 12 %
r = 14 %
r = 15%
r = 16 %
TOTAL ANNUL COST / LOOM
AGE (YEARS)
40
1100
80
40
1000
80
40
900
80
40
800
80
40
700
680
6
8
10
12
14
16
18
20
22
24


WITH SALVAGE VALUE
RATE OF INTEREST, r = 14 %
i = RATE OF INFLATION
i = 12 %
i = 11 %
i = 10 %
i = 9 %
i = 8 %
i = 7 %
i = 6 %
TOTAL ANNUAL COST / LOOM
AGE (YEARS)
1100
80
40
1000
80
40
900
80
40
800
80
40
700
4
6
8
10
12
14
16
18
20
22

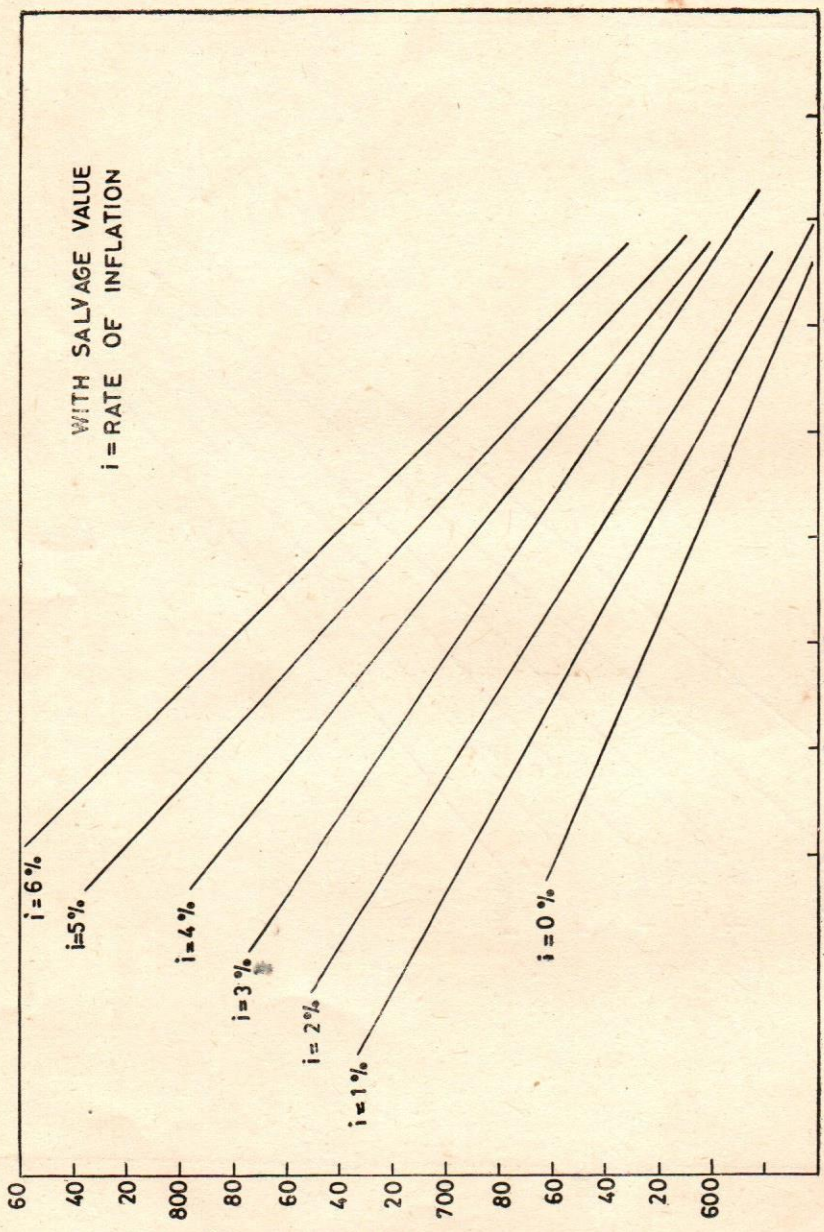
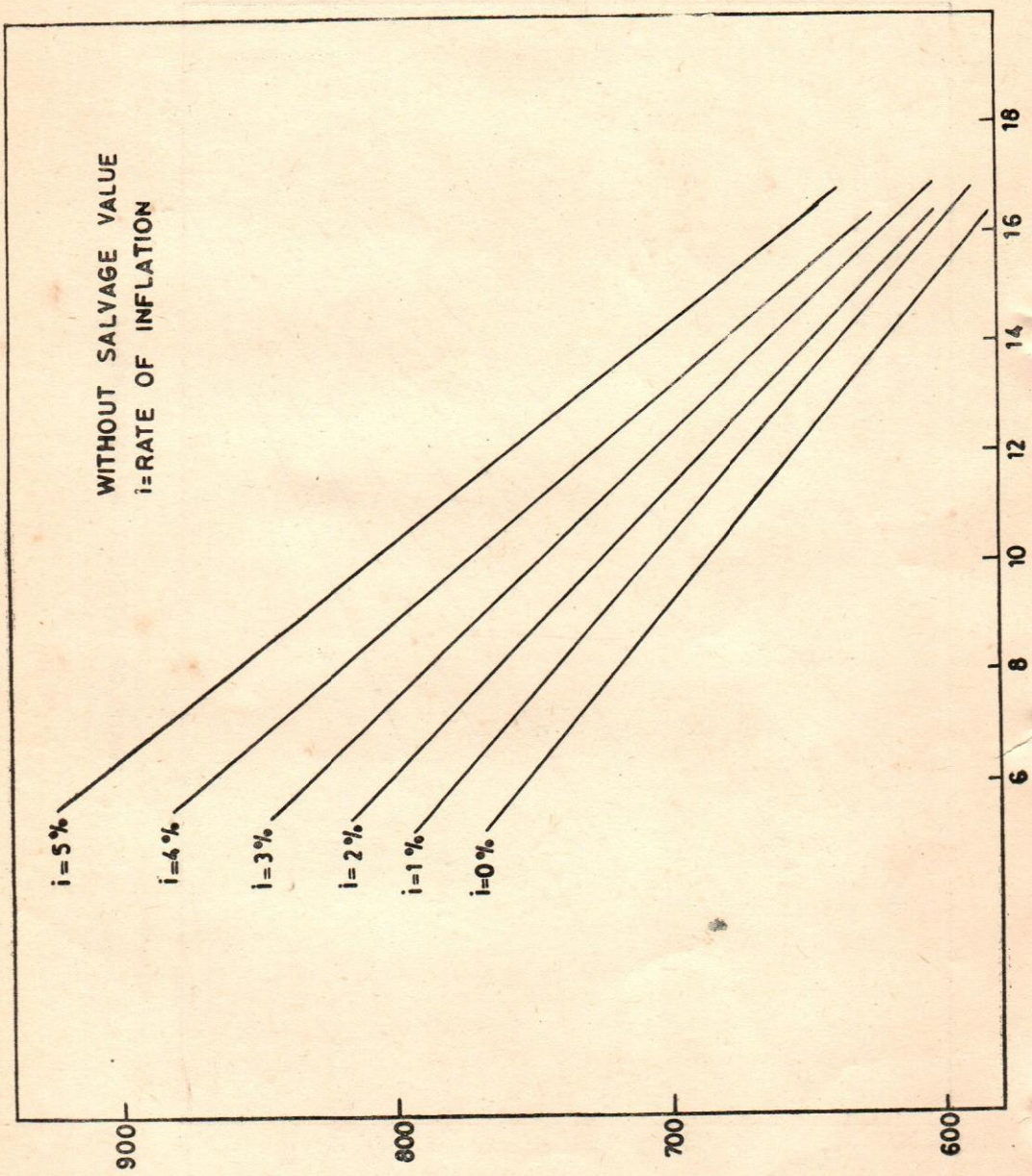

WITH SALVAGE VALUE
i = RATE OF INFLATION
i = 6 %
i=5%
i=4 %
i=3 %
i= 2%
i = 1 %
i = 0 %
RATE OF INTEREST IN PERCENTAGE
6
8
10
12
14
16
18
20
TOTAL ANNUAL COST (OPTIMAL) / LOOM
600
700
800
20
40
60
80

Fig. 6 (a)


WITHOUT SALVAGE VALUE
i=RATE OF INFLATION
i=5%
i=4%
i=3%
i=2%
i=1%
i=0%
TOTAL ANNUAL COST (OPTIMAL) / LOOM
900
800
700
600
6
8
10
12
14
16
18

F.g. 6 (L)

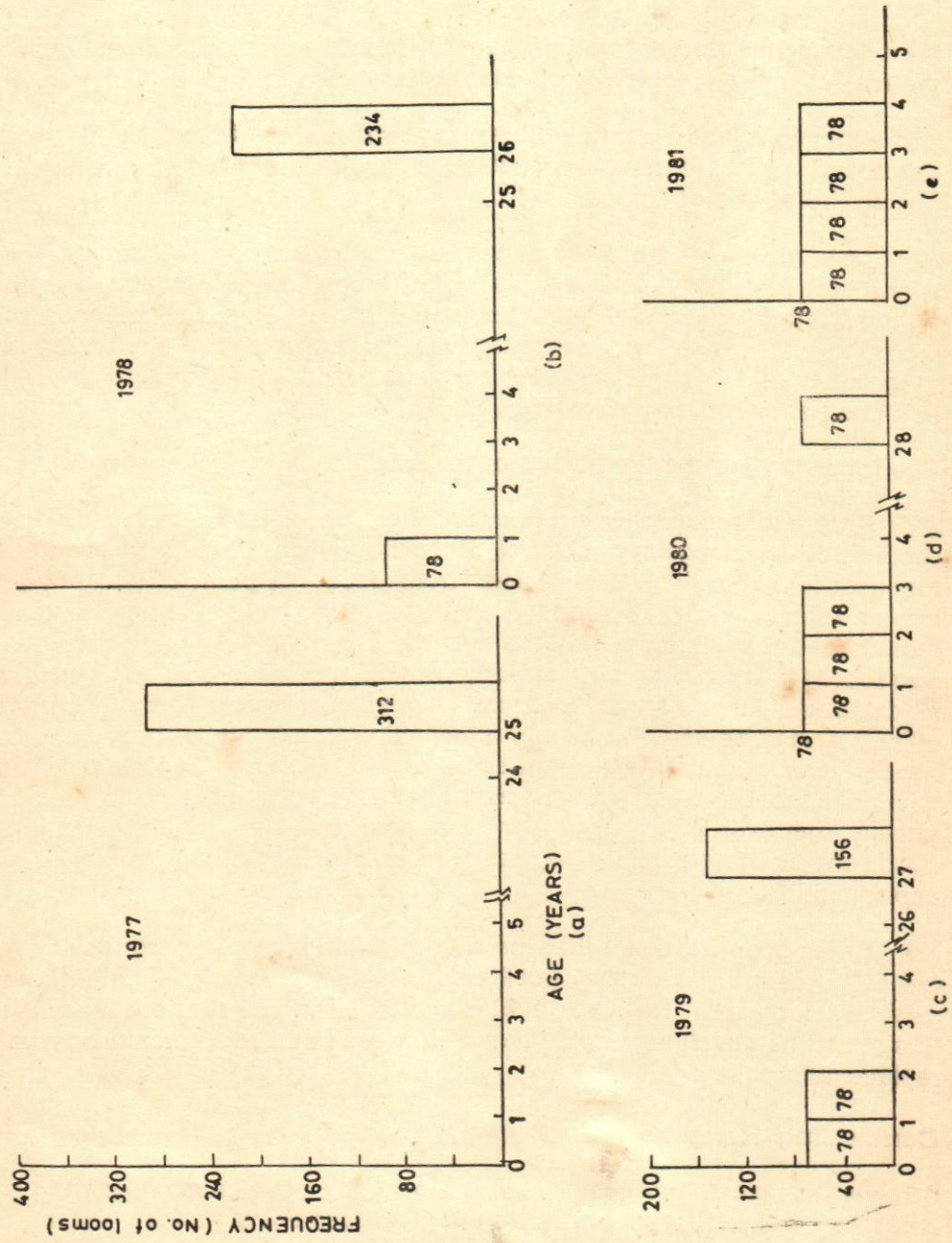

1977
1978
1979
1980
1981
(a)
(b)
(c)
(d)
(e)
AGE (YEARS)
FREQUENCY (No. of looms)
400
320
240
160
80
200
120
40
312
78
234
156
0 1 2 3 4 5 24 25
0 1 2 3 4 25 26
0 1 2 3 4 26 27
0 1 2 3 4 28
0 1 2 3 4 5

Fig. 7

the contrary the rate of inflation has a counter-effect as compared to the rate of interest, which is obvious as is shown in Fig. 5.

It is better to adopt a staggered replacement policy from the financial constraint point of view and also to avoid heavy loss in production during the period of errection.

Here, it is proposed that 25% of the existing machines may be replaced in the first year, than the same number of looms in the second year and so on within four years all the machines will be replaced. Henceforth, the policy of replacing the machines at the attainment of age within the range of 15 to 20 years may be adopted. The age-structure analysis has been shown in Figs. 7(a), (b), (c), (d) and (e).

The following are the limitations of the study :

(1) The maintenance cost figures have been taken from the past records of the Budgetory Control Reports, which are essentially meant for assessing profits and losses from accounts point of view. As a matter of fact maintenance cost have been found indirectly from these reports and they indicate only the average figures. At present there are no records for finding out directly the maintenance cost of individual machine and its performance. It may happen that some of the machines' efficiency may be very low within a few years entailing a heavy maintenance costs. Such loom ought to be replaced before the attainment of specified economic life. Some machines' efficiency may remain comparatively high even after they attain the economic life. Such machines need not be immediately replaced after the attainment of average economic life.

(2) It has been assumed that the rate of inflation remains constant over the entire period. This may not be so in actual practice. The inflation rate may fluctuate. However, this may not be a very big-draw-back of this study, as the change in inflation rate does not affect much the optimal replacement policy.

Concluding Remarks

Broadly speaking, no textile mill follows any set pattern regarding replacement of machines. Now and then replacement of textile machines are carried out without taking into consideration the economic life of the

machines. According to the recent report of the National Productivity Council prepared by Goel and Nair [7], nearly 60% of the total installed textile machines are more than 30 years old, and most of them are inefficient and outdated. As a result there is a tremendous loss which is not very much apparent.

In this study an attempt was made to find the economic life of the particular type of weaving machines. In case this replacement policy is followed, much loss can be prevented. □

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Book Reviews

Financial Accounting–An Introduction

Paul H. Walgenbach, Norman E. Diettrich & Ernest I. Hanson

Harcourt Brace Jovanovich, New York, 1977, pp. 654

Principles of Accounting

Paul H. Walgenbach, Norman E. Diettrich & Ernest I. Hanson

Harcourt Brace Javanovich, New York, 1976, pp. 934

Reviewed by N.L. Dhameja*

Accounting—recording and evaluation of business transactions—is an information system of the business organisation. The understanding of accounting is necessary for every manager or would-be manager so that he can understand the financial impact of his decisions on business. There are number of books on accounting and these are addressed to a different segment of readers like college students or students of various management institutes or practising managers. The books under review are addressed to college students who want to have a fresh course of accounting with the objective of planning their career in accounting or to have general understanding of the subject.

Accounting as the process of recording, classifying, according to the authors, is a relatively minor part of the total responsibility of accountants. It also covers reporting and interpretation of the meaningful implication of the data and is an information system for the business.

The first book, Financial Accounting—An Introduction, provides general framework of financial accounting, while the second book—Principles of Accounting—is an extension of the first one and gives a balanced treatment of concepts, procedures and principles of financial and managerial accounting.

The first four chapters of Financial Accounting—An introduction, give a lucid exposition of accounting cycle in six steps starting from analysing transactions from source document, recording in journal to preparing financial statements, by citing examples of firms providing service.

*Deputy Director (Financial Management), National Productivity Council, New Delhi.

Chapter five discusses accounting in a merchandising firm, procuring and selling goods. The various control accounts and mechanical and electronic equipments used in processing of voluminous transactions are discussed in chapter six.

Next nine chapters discuss the areas of balance sheet like assets measurement, liability accounting, corporate owner's equity accounting. Accounting concepts and principles, inflation accounting and analysis and interpretation of financial statements are given in next two chapters. Last two chapters deal with manufacturing operations and managerial accounting. The chapter on managerial accounting reveals management's uses of accounting data for planning and decision-making to encourage further uses of accounting.

The second book—Principles of Accounting—besides covering the financial accounting in the above framework, discusses in detail the specialised accounting topics like partnership accounting, accounting for price level changes, and accounting problems of business enterprises composed of subdivisions and branches and their reporting system to analyse their performance. The last five chapters deal with various aspects of cost and managerial accounting and capital budgeting.

In short, both the books present the accounting concepts and techniques in a simple and logical fashion by furnishing exhibits, keyed diagrams and other illustrations. The accounting is generally found to be a dull and dry subject but the authors have tried to do away with the drudgery of studying accounts by including 'key points to remember' and various humourous anecdotes in each chapter. The material in the books has been supported by the recommendations of Accounting Principles Board and Financial Accounting Standards Boards. In fact, the books can be a good guide for the beginners in accounting. However, to make the book useful to the practising managers or those following up various professional courses who do not want to master mechanics of accounting and to do 'figure pushing' but want to learn it so as to understand the impact of their decisions in the business, there is a need to include more unstructured problems or cases in each chapter. □

Management : Concepts and Analysis

Navin Chandra Joshi

Vivek Publishing Company, Delhi., pp. 254, Rs. 48.00

Reviewed by Kewal Soeny*

Joshi's book reminds of EFL Brech's 'The Principles and Practice of Management' which became an authoritative text book for the serious study of management and gained equal acceptance aboard. Starting with Management Principles, Brech's book dealt in Part I with Marketing (which included market research, advertising, public relations, sales management, channels of distribution), in Part II with the whole gamut of Production, followed by Personnel, Control (Finance), and Management in practice—all in a matter of 1066 pages. Brech's style was followed by Indian authors who wrote books on management for B.Com., M.Com. students and for professional examinations. The book under review follows the same course, with the difference that it attempts to do all that in 254 pages and in a more general way. With a lesser student-oriented approach, it will have appeal for the general reader as well. In the author's own words "the book is designed for those who are interested in the practical aspects of the dynamic approach to managements opposed to those interested in highly theoretical and complex excursions in the discipline. In fine, the book provides the basic material for a formal course at graduate and post-graduate levels".

After an introduction which discusses management thought and development, professionalism in management and managerial responsibility, the book goes over to managerial functions in which it explains concepts like organisation, span of control, decision-making, communication, team spirit, entrepreneurship, control system, corporate planning, leadership in managers and managerial effectiveness—all in 32 pages. This is followed by chapters on production, financial concepts, Personnel and Mathematical Apparatus (Decisions and Uncertainty, PERT and CPM, Monte Carlo Simulation).

*Education Officer, All India Management Association, New Delhi.

In part II on Analysis, the author talks about Managerial Performance : Structuring an Organisation; Analyses through Budgeting; Appraising Manager's Objectives; Management by Objectives; Executive Tensions; Case Study Method; Developing Entrepreneurship, Project Evaluation, Financial Measurement (Measuring Corporate Health, Cost of Capital, Current Ratio); Production Planning (Manpower Productivity; Linear Programming for Optimisation, Creating new products; Inventory Management; Material Management for Corporate Growth; Utilising Production Capacity), Distribution System and Manpower Management. Four appendices discuss government-business relationship, scientific management in banks, obligations of business to society and management education in India.

It may be worthwhile giving a glimpse of the author's style. "Corporate planning is a management process, not a science. Its forms and contents may vary from company to company. And so also its timing for preparation. For example, some organisations let events happen to them. Others make things happen, master their own worlds and compete aggressively to survive. Nevertheless each company plan requires a careful searching study of the environment, present and prospective so as to identify the potential threats to the business on the one hand and potential opportunities on the other".

"A corporate plan needs to establish an identity with national policies and national properties that are of direct relevance. As such, it has to build the specific profits of resources, skills and tasks that it has and it wants to create or develop. This will call for a timely appraisal of strengths and weaknesses within the company so as to measure the company's ability to take advantage of the potential opportunities or to withstand the potential threats.

The epitome of a rational approach is the scientific method in plan formulation. It involves mobilising resources and applying resources with maximum thrust as optimum moments".

It is clear that this book does not reach anywhere near Brech's authoritative exposition. Joshi has attempted to do too much in the span of 254 pages, but it would still be a good material for those with knowledge of the subject and who seek to know more. □

Getting Along Better with People : 128 Proven Ways

M. K. Rustomji (Illustrated by Roma Chakravarty)

India Book House Pvt. Ltd., Bombay. pp. 134

Reviewed by Dr. B.R. Seth*

A supervisor occupies a very strategic position in modern management. Being an important link in the chain of administration and management, he has been accepted in industrially-advanced countries as an essential and integrated part of the management, and success of an enterprise depends considerably on his effective functioning. His main job is to translate the plans and policies of management into action. He is to give results, turn out production, maintain quality, hold down costs and keep his employees under a set of technical conditions. For this he has to function as a manager, cost accountant, an engineer, a lawyer, a teacher, an inspector, a disciplinarian, a counsellor, a friend and above all an example setter. For playing all these roles he requires a number of skills, of which the most important is how to get along better with his superiors, colleagues, and subordinates or workers under his control. It is this skill which is the main theme of the book under review.

This little book is extremely interesting as it explains and illustrates pictorially 128 different ways of getting along better with people at all levels. Episodes in this book are drawn from everyday real business and industrial life, and the lessons and instructions which it imparts, are delivered in delightful simple language which even a low educated front line supervisor should be able to understand and follow easily. Even if half the simple and profound truths contained in the book are acted upon, it can help in building up an effective leadership.

This impressive book deals with human problems, and is so very relevant to the problems of human relations. The Do's and Dont's mentioned in the book really set the pattern of relations between persons occupying different positions, and therefore, it should be a useful guide book which

*Consultant on Labour Laws, New Delhi.

every supervisor and manager must study and act upon.

Although some of the pictorial illustrations may not be exactly relevant to the morals drawn, this does not detract from the value of the book, as the morals are not only right and suitable but simple home truths which everyone should know. More and more such supervisory and managerial guides are published the better, and if they are studied and acted upon, they may improve human relations not only in industry and business, but also in domestic and social fields.

Operations Research

Kanti Swarup, P.K. Gupta & Man Mohan

Sultan Chand & Sons, New Delhi, 1977, p. 728+16 (Supp.), Rs. 22.50 (Student Edition)

Reviewed by Dr. J.P. Saksena*

The book entitled 'Operations Research' by Kanti Swarup, *et.al.* is a welcome addition to the OR literature from Indian authors and publishers. The only other text book available on the above subject from the Indian group is "*Elements of Operational Research*", by A.G. Ghosal publised by Hindustan Publishing Corporation, 1969.

The authors have taken pains to present all OR techniques to make the present text an exhaustive one. The reviewer is of the view that it will be a good text book for students preparing for their Master's Degree examination in Operations Research or as special papers in OR included in Engineering Courses. The case study portion of the book is, however, not very adequate, the reason being that Indian Industry is not yet willing to experiment with these techniques. It will be a further effort to project more work from application point of view. The book otherwise fulfils all needs as a standard text in Operations Research.

*Deputy Director (Research), National Productivity Council, New Delhi.

Essentials of Store-keeping And Purchasing

Dr. M.M. Verma

Sultan Chand & Sons, New Delhi, Revised Edition, 1978, pp.190 (Students' Edition) Rs. 10.00, Library Edition Rs. 20.00.

Reviewed by P.G. Menon*

Books on the theory and practice of management concepts in India are welcome in principle, because of their paucity; and Dr. Verma has apparently packed a lot of material in a short book. Yet, students should beware because :

1. Indian practices differ substantially from those of the US Being an academician, Dr. Verma should have read what Indian practitioners have written, but of the 96 authors listed in the Bibliography, only 2 are Indians, and only 2 of them were competent practitioners. Dr. Verma has ignored Bhattasali, Kapoor, Menon, Palit Verman, and the Stores Manuals of certain Indian Units, and the better theses produced in our Universities and IIMs; only one Indian Journal is referred to, despite excellent Indian case-experiences and conceptual developments having frequently been published in several others, including "Productivity".

2. The auther has not adequately understood several important aspects of even what he has read. The section on Value Analysis is not well-designed. The section on ABC Analysis glasses over vital differences between ABC for Purchasing and ABC for Inventory Control.

A revised 1978 Edition should not give the inventory-carrying-cost as 15 to 15 and, as these figures were operative only when the interest-rate was 2 to 1978. The Stores-Layout given on page 223 would be rejected by Firemen.....

3. Anore important than these short comings is the lacks of conceptual Dr. Verma claims that the "book covers almost all aspects of materials

*Editor, The Materials—Management Journal of India, New Delhi.

management without designating it as such" (p.2). Yet spares are ignored, as is the EOQ formula and its basis, although the safety-stock for- is given. Only stores personnel are considered as material managers (p.6), and the "purchase function should invariably be separated from the materials organisation" (p.6). although he holds the storekeeper responsible for suggesting possible names of supliers, and the quantity to be purchased. Another drawback of the book is the absence of an Index.

Management Trainee Scheme

B. R. Virmani

Sultan Chand & Sons, New Delhi, 1978, pp. 60, Rs. 20.00

Reviewed by S. K. Kalra*

The emergence of professional management concepts in the Indian Industrial scene is of recent origin. It is only during the last decade and a half that the Indian industries have felt the need of trained professional managers who can take higher managerial responsibilities. With this in view, quite a few large and medium size industries in the country introduced Management Trainee Schemes in their organisations so as to fill up their managerial positions by developing managerial skill through such schemes.

The book "Management Trainee Schemes" by Prof. B.R. Virmani is basically a research study to survey various practices regarding recruitment, selection, training and career planning of the management trainees and to analyse the effectiveness of the management trainee schemes in the country. The author has discussed the selection and training procedures of the Management Trainee Schemes in the 24 organisations which responded to his questionnaire. The selection procedures in most of these companies are similar and confined to written tests, psychological and I.Q. tests, group discussions and personal interviews. The mode of training differs from organisation to organisation. In Chapter 2, the author has tried to highlight the perception gap between what the train-

* Manager (Training), Usha Telehoist Ltd., Faridabad, Haryana.

ees think about the training programme and the complacent feeling of the management about it. In majority of the organisations, the trainees were not happy with their training because they were not given jobs of meaningful responsibilities during the training period. According to the author, the scheme is more successful in the organisations where the trainees, after a brief period of induction, are straightway given specific responsibilities and separate training programmes are organised for them depending on individual's need after completion of one year on the job.

The book has also tried to highlight that a proper manpower planning and appraisal system, as well as career planning is lacking in many of the firms, thus resulting in dissatisfaction and high turnover amongst the trainees. The author has listed some of the reasons for this high turnover, while quite a lot more reasons could be added to this list. The author discusses at length the organisational problems of management graduates *vis-a-vis* their training and placement in the industries. The author suggests that the management training institutes should establish closer links with the industrial world and conduct a thorough scrutiny of their own curriculum and the jobs which the management graduates take after leaving the institutes.

Through this book the author has been successful in highlighting the need for having a relook at the Trainee Schemes to find solution to some of the inherent problems so that the training schemes become meaningful to both the organisations and the trainees. However, some of the analysis and solutions suggested in the book lack depth and thoroughness. Drawing conclusions on the basis of survey of only 24 industries in the industrial scene of our country does not give a representative picture. It is apparent that most of the industries included in the survey are large industries while quite a large number of medium size industries are also operating "Management Trainee Schemes" and their experiences are quite different. Looking at the contents and coverage in the 58 pages of the book, it is rather priced high. □

Books Received

1. Some Aspects of Textile Policy

Papers presented at the round-table meeting on current textile policy at Bombay on June 25, 1976; Indian Institute of Management, Ahmedabad, 1977, pp. 71.

2. A Study of Industrial Law

By Dr. G. M. Kothari, 3rd Edition, Published by N. M. Tripathi Pvt. Ltd., Bombay, 1978, Rs. 60.00, p. 375 + xxviii.

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New Books : Annotated List*

Making Experience Work : The Grid Approach to Critique

Blake, Robert R. and Mouton, Jane Srygley,

New York, McGraw Hill, 1978, pp. 117 $ 9.95

Years of research and experience with Grid concepts lead to the conclusion that there are three concepts inherent in good management. One is the notion of participation. The second involves setting goals. The third is the use of critique to learn from work experience.

This book is about how to learn from work experience, and critique is the technical word for it. The term is often confused with criticism, but critique is the application of study and diagnosis to any situation in order to analyze that situation, how to change it, and how to generalize that is learnt so that similar situations arising in the future can be dealt with in a similar, more efficient and more effective way.

Successful Personnel Recruiting and Selection

Starton, Erwins

New York, AMACOM, 1977, pp. 214 $ 17.95.

This book describes a tried, proven, and practical system to recruit, interview and select personnel successfully. These people should then be able to make a useful and worthwhile contribution to the organization that has employed them. This book introduces the sequential selection system, a step-by-step system designed to optimize the time of the personnel specialist or manager so that he or she can more quickly and effectively select qualified applicants without spending a lot of unnecessary time in fruitless, nonproductive activity.

*Prepared by S.N. Vig, Documentation and Information Officer, National Productivity Council, New Delhi

Integrated Materials Management : A Functional Approach

Daita, AK

New Delhi, S. Chand, 1876, pp. 284 Rs. 5.00

This book provides a comprehensive study of Materials Management. It also shows how the concept of Total Materials Control and Management (TMCM) can be brought to life within an integrated system in the context of Indian industries and lucidly explains how to apply the techniques of Modern Materials Management for cost reduction and improving profitability. This book is primarily for scholars preparing for a deeper study of the field. It will also be useful for those who are interested in the prosperity of their firms and professions—from top management to professional managers and—are responsible for managing materials.

Physical Distribution Management : An Analytical Approach to Cutting Costs

Willis, Roger

New Jersey, Noyes Data Corporation, 1977, pp 239 $18.00

This book defines physical distribution management as the broad range of activities concerned with the efficient movement of finished products from the end of the production line to the consumers. These activities include freight, transportation, warehousing materials handling, protective packaging, inventory control, plant and warehouse site selection, order processing, market forecasting and customer service. The author shows how analytical techniques can be applied in all these sectors to maximize efficiency and service and to minimize costs. This book will be valuable to working managers and to students of management.

Handbook of Personnel Management Practice

Armstrong, Michael

London, Kogan Page, 1977, pp. 408 £ 12.00

This hand book provides a comprehensive survey of the basic techniques and principles of personnel management, which apply the world over. It looks in depth at every aspect of the personnel manager's role and is likely to become the definitive text on this subject. It presents an integrated picture of personnel management as a vital function in any enterprise, one which concerns all management. In the first part of the book personnel objectives and activities are discussed and the role of the personnel function examined, while personnel management itself is analysed into five main areas.

Worker Participation in Europe

Carby-Hall, Joseph Roger

London, Croom Helm, 1977, pp. 271 £ 9.95

This book is a comparative study of worker participation in France, Belgium, Luxembourg and Britain. The first part of the book treats employee participation in general terms and examines its meaning and scope. The second part examines the major terms of representative establishment councils and employee representation through an analysis of the relevant statutes and common law of the countries concerned and by exposing the legal and other problems which have arisen in each. It also examines how these laws are applied in practice and the opinions of those concerned.

Social Psychology of Bargaining

Morley, Ian E and Stephenson, Geoffrey M

London, George Allen, 1977, pp. 317 £ 11.50

This book deals with the social psychological factors which influence the process of bargaining. It examines the structure behind the process, by which it can be analysed and better understood. Particular attention is paid to the character of negotiations in which agreements are obtained. Part one of the book provides the systematic review of social psychological approaches to the study of bargaining. Part two presents the results of the programmes of the research.

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Problems of Management Consultancy Development in Developing Countries : An Overview

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Introduction

Problems of management consultancy work and running of consultancy organisation are varied and diversified. Therefore, it is hard to generalise these problems irrespective of different backgrounds, conditions and environments. However, as given in the survey report, predominant problems of management consultancy services in APO member countries can be summarised into the following areas :

(a) What are the suitable policies and directions in developing consultancy activities in a country under a given condition of economic and industrial development, and the prevailing problems of business enterprises and consulting organisations?

The question has direct connection with the presumption that there would be certain groups of consulting patterns best suited for different countries having different stages of economic/industrial development. It is quite likely that problems of business enterprises as well as consultancy organisations are highly interrelated with different development stages.

(b) How to secure consulting assignments?

This is one of the most crucial problems faced by most of the consulting organisations in developing countries. Problems can be classified into the following :

(i) How to let businessmen aware of the existence of consulting facilities and availability of consultancy services.

(ii) How to let businessmen understand the usefulness of consultancy services.

(iii) How to obtain sufficient amount of consulting assignments needed for maintaining existing consulting staff.

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(c) How to manage management consulting organisation?

Perhaps managing the management consulting organisation is one of the toughest jobs among other business ventures. Major problems would be as follows :

1. How to decrease relatively high rate of personnel turnover.
2. How to promote prestige and social standing of consultants.
3. How to eliminate unethical consultants without violating human rights and freedom of profession.
4. What would be the suitable remuneration system for consultants.
5. How to control activities and work assignments of consultants.
6. How to evaluate performance and achievement of consultants.

(d) What are the best ways in recruitment, training and development of consultants?

Aptitude of consultant is still not clearly defined. It is still a controversial issue whether consultants be recruited from college graduates or from experienced specialists. Method of on-the-job training is not developed fully and there is no generally-accepted concept and approach. Most of the training programmes are nothing but management development/training programmes without containing curricula for professional practices and skills.

Scope and Contents of Consultancy Services

(a) The job of a consultant can be summarised as follows :

Consultancy Services
- Diagnosis
  - (1) To clarify the business problems
  - (2) To design effective course of actions for solving problems
- Assistance in Implementation
  - (3) Orientation and training of people for successful implementation
  - (4) Practical guidance and assistance in implementation as well as follow-up

(b) In reality, scope of activities carried out by different types of consultants is varied.

	Defining problems	Designing systems for solving problems	Orientation and training	Guidance in implementation
Diagnostician	A	B	C	C
General Consultant	A	A	B	B
Specialised Consultant	B	A	B	A
Trainers/ Instructors	C	C	A	C

A = Major area; B = Mostly being covered; C = Usually neglected or ignored

In public sector, where consultancy services are carried out in connection with small business/industries development programme the scope of activities is, by and large, limited to diagnostic work. Such a service is normally extended "free of charge" in conjunction with several assistant schemes.

Complete consultancy services covering all the areas mentioned above are usually carried out by professional, private consultants on a "cost plus basis".

Ironically enough, it is observed that, irrespective of the stage of industrial development of a country, requests from clients call for an emphasis on practical guidance on implementation without due regard to the diagnostic process. Small businesses in developing countries are somewhat reluctant to disclose business secrets to the outsider including consultant for one reason or another. And yet, they seek outside help for solving specific problems. According to their understanding, consultants are contracted specialists who would undertake specific problems which they could not handle themselves.

There are various institutions undertaking management training and development programmes. Officers assigned to these institutions as instructors or trainers often take advantage of being called as management consultants even though they rarely undertake diagnosis and/or implementation as vices.

(c) Areas where consultancy services are rendered can be classified in accordance with the scale of business.

Large enterprises are usually covered by private, professional consultants including foreign firms and this area is usually omitted in discussion of consultancy services in developing countries.

Small and medium industries are the target of consultancy services in developing countries. Considerable difference exists among them with regard to policies and guidelines leading to the selection of clients.

(d) There are also different views as to whether consultancy (or more strictly diagnostic) services should cover individual assignments, group work or mass media instructions.

While individual method aims at extending consultancy service to each

Type→ Approach ↓	Consulting	Training
Individual	Diagnosis, advisory, and/or consultancy services to individual or model plant	Demonstration (pilot or model plant) services for in-plant training
Group	Diagnostic, advisory and/or consultancy service as Trader-wide, District-wide, Shopping centre, Commercial block, Industrial estate, etc.	Group Training, Itinerant team, Marketing clinic, Training course, Seminars, Discussion groups
Mass	Meetings	Exhibition, Meetings, Radios, Televisions, Publications

individual client separately, group method applies consultancy services to a group of business enterprises of the same trade, industry or those located at a certain area such as an industrial estate, industrial park, industrial apartment, etc.

There is a need for selecting proper scope and content of consultancy services in different countries from a strategic viewpoint while giving due regard to different prevailing conditions.

Problems on Promotional Activities

It is a common problem of almost all the consulting organisations that businessmen usually are not aware of the existence or availability of consultancy services. Even if the availability is known, they are rather skeptical about the usefulness of such consultancy services.

Reasons for employing consultancy services often illustrated by management consultants are as follows :

(a) *Expertise :*

Clients can best utilise knowledge, skills and experience of consultants which would not otherwise be available to these business enterprises.

(b) *Financial :*

Clients can utilise the services for a limited duration, thereby avoiding constant financial and administrative burden in maintaining extra specialists.

(c) *Psychological :*

Clients can take advantage of a relatively favourable reaction on the part of employees in responding to outside advice than to orders/ instructions from within the organisation.

All the same, many potential clients are reluctant to employ external consultants for one reason or another, as given further :

(a) If the service is not free of charge, small businessmen often make excuse that they cannot afford to pay the fee.

(b) If the service is free of charge then they are apt to say that they are not sure of the benefit of the service. Further, they often say that 'free' means 'useless' as both parties do not take responsibility for the outcome.

(c) Apart from the expenses involved, many businessmen are concerned about the utility of such external advice.

Thus, in spite of the efforts by the consultants in advocating the usefulness of their services, businessmen remain cautious and skeptical. Perhaps the most important aspect of promotional activities is to sell the benefit of consultancy service to the future client by adopting the following measures :

(i) *Publicity :*

The concerned organisation should make available the name of consulting firms and particulars of the consultants working with them as well as the procedure for acquiring their services. The accent on publicity may be through case presentations mainly for demonstration purposes.

(ii) *Model Shops :*

Concentrated consultancy service is made to a selected business enterprise so that the achievement could be made public as a successful case. In reality such successful cases are unfortunately very few and far between. However, most of the small businessmen, especially in the earlier stage of industrial and management consultancy development, often seek one or several of the following benefits as by-products of the consultancy service.

(a) *Linkage with Financial Assistance :*

To seek financial assistance, especially of long-term cheaper loans, after having received diagnosis from consultant of an authoritative body

whose report definitely becomes an evidence to justify the extension of financial assistance.

(b) *Linkage with Technical Assistance :*

To seek technical assistance, including financial assistance, necessary for purchasing or renting new machinery or equipment in line with the recommendation made by consultant. They expect that the consultant will prepare a report to justify the new investment, thereby being able to have an access to financial resources with supporting documents.

(c) *Linkage with Sales/Marketing Assistance :*

In expectation that the institution which has rendered consultancy service might extend help in providing or exploring sales and marketing opportunities.

Even in the case of medium/large scale industries they often find indirect merit in the acquisition of better financial resources or marketing opportunities after receiving consultancy service. They believe that the employment of consultancy services could be an endorsement of a healthy business management leading to better image and standing in the business community.

Irrespective of the political system prevailing in a country, invariably there is an obligation on the part of the government, to enforce administrative guidance upon small business management in relation to industrial/small business development programme. While the business enterprises have to comply with the guidance laid down by the government, they, in return, enjoy some privileges or benefits such as financial/technical assistances, tax holidays, etc., accordingly :

(a) Consultancy services for small businesses, which sometimes call for diagnostic service, extension service, management guidance, and the like, may advantageously be linked with financial, technical and/or marketing assistance schemes at the earliest stage of consultancy development, though this is not an absolute necessity.

(b) Consultancy service for small enterprises is usually carried out by governmental or public institutions connected with regional or industrial

development programme. In this aspect, these services consequently, whether it is so intended or not, tend to relate with administrative guidance or control by the government. This draws obligations on the part of businessmen to receive consultancy services provided they could anticipate accrual of commensurate benefit from this relationship.

Another problem is promotional activities in the interaction among professional ethics and business affairs. Since a management consultant is considered to be a professional one, establishment and enforcement of professional ethics is considered to be a vital issue. Their activities are greatly restricted by being forced to comply with the code of ethics and/or ethical standards generally accepted by the profession.

General practice in this profession within the scope of professional activities is :

(a) Do not advertise oneself in a *self-glorifying* and *exaggerated* manager.

(b) Also the profession, because of its objectivity, sincereity and integrity, calls for a basic attitude among consultants not to promise any substantial results (benefits) prior to the initiation of the service. It is based on the belief that the authority and responsibility of managing a business are on the shoulders of managers and not on the consultants.

Such an understanding will also influence the design of promotional campaign by consultants utilising appropriate publications. To what extent they can sell themselves about the real benefit of consultancy service by demonstrating real cases and by presenting actual figures is a matter of balance between business promotion and ethics.

Though, from strict ethical considerations, the consultancy organisations should not use advertisement as a media for direct promotional activities, they may still advertise for recruitment of consultants for their own organisation, thereby providing an indirect but effective promotional measure. Moreover, the consultants themselves may use other indirect means and media such as books, articles in journals and newspapers to propagate their activity. They may also use the radio and T.V. media to conduct seminars and lectures or give speeches. The basic approach

should be to make the public aware of the availability of such capable, highly-experienced consultancy organisations.

Stage of Development in Promotional Campaign

Render consultancy service with either legal enforcement or by providing financial/technical or marketing assistance → To extend special efforts in arriving at substantial result at a selected company

——model plant —→ To publicise the usefulness by illustrating the case of model plant

Gradually to switch the promotional activities by consultants.

Administrative Problems

Perhaps the most critical issue with regard to personnel management in consulting organisation is the relatively-high ratio of personnel turn-over, perhaps caused by inadequate compensation system and improper treatment of consultant within the organisation including opportunity for promotion.

Another aspect is the administrative control of the performance of consultants by regulating the number of working days and providing a basis for the consultancy fee and evaluating the consultants in relation to the prevailing wage scale.

It is generally observed that the main reason for consultants not staying long enough in any organisation is that the salary offered by outside firms is more attractive.

Further they do not believe that their status within the organisation, as specialised staff, is necessarily as high as they had expected or in comparison to other administrative staff. It is a general practice in governmental organisations that a generalist has a better access to higher ranks than a specialist.

Compensation (remuneration) system is another controversial issue. While in other positions, salaries are determined by indirect, potential values such as educational background, years of service and age, the consultants prefer to receive remuneration commensurate with their achievement rather than their background. This dichotomy often leads to problems in wage administration.

Organisations often face with the problem of part-time jobs including lecturing, advisory service, writing, broadcasting etc. by consultants. Hence, it is imperative to set up detailed rules and regulations applicable to them.

Policies in this regard do vary from one organisation to another. Some organisations are very strict by treating almost all these part-time jobs as official ones and insist that income so accrued belong to the organisation while others are more lenient. The latter view such services as a form of incentive for consultants for self-development.

Workload assignment is another difficult task for the consultancy organisation. Further, since consultants are engaged in outside activities, control of their activities is as difficult as in the case of salesman or service engineer. If this includes performance control, the task becomes even more complex. Management consultancy, being a profession, requires that more control of hours or days spent, or comparison of actual and predetermined schedule, would not be sufficient. Perhaps the best way to arrive at a performance control would be to get information on reactions from the clients. How to formalise this system is another controversial issue.

It is a perennial problem on a nation-wide basis to eliminate unethical consultants. Some believe in establishing authorised titles for consultants which are given only after a strict examination to the experienced consultants. Others are of the opinion that it is only a client and not the government authorities or even senior consultants who can evaluate whether a consultant is a capable one or not.

Training and Development of Consultants

There are basic areas to be discussed before getting into technical aspects of training and development of consultants.

(i) *Determination of the aptitude of a potential consultant* : This will influence the recruitment policy as well as the screening criteria for applicants. It is still a controversial issue whether preference should be given to a college graduate or to those who have some amount of professional experience.

There is really no consensus as to whether a consultant should be a generalist or a specialist.

(ii) *Requirements for consultant* : Unfortunately, this aspect has not so far received sufficient attention to enable formulation of a proper curriculum and syllabus. More often than not, they receive a cursory treatment within the broad framework of management training and development. The basic deficiency is due to the fact that more knowledge and know-how of management is not sufficient for management consultants to carry out their business. They need special professional skills such as interviewing, recording, report preparation and presentation, training, overcoming resistance etc. Furthermore, consultant's job is to sell his idea and persuade company personnel to implement the recommendation by their own initiative. This requires special talents and persuasive capacity on the part of the consultant.

(iii) *Effective method of training and development* : It is generally believed that consultants cannot be trained in class-rooms and can be developed only by on-the-job training method requiring individual tutoring. While this ideal situation would improve the quality of consultants, the need for developing a large number of consultants, in tune with the demand for such professional service, requires a systematic approach to training involving group instructions as in other professional training activities.

Personal Observations for the Selected Issues

(a) Scope of consultancy services should be properly selected and the contents should be carefully designed in accordance with the prevailing conditions, needs and requirements of the industries and business enterprises of a country. Classification about sorting out of suitable scope of consultancy services could possibly be developed in relation

to the different stages of industrial/economic development. Intensive study for indentifying suitable scope of consulting activities in relation to different stage of industrial development would be very useful for the benefit of APO (Asian Productivity Organisation) member countries and NPOs (National Productivity Organisations).

(b) Well-prepared publications would be useful for disseminating information as to the usefulness of consultancy services. Model plant system is also effective for demonstration purposes. While ample opportunities should be provided for consultants for their promotional activities by each NPO without violating professional ethics, it is recommended that APO should extend effective assistances to NPOs in various ways.

(c) Positive actions are strongly recommended for promoting prestige and social standing of consultants by NPO and other related organisations. Their activities and achievements should frequently be made public and ample opportunities be given for them to appear in public to demonstrate their successful cases. Remuneration system should be reviewed and a proper consideration should be given to better treatment and working conditions in order to reduce the high ratio of turn-over of consultants. Possibly different salary systems be tactfully applied for consultants and other staff in consulting organisation. Control of consultants' workload assignments and activities as well as evaluating their performance should be carefully designed and applied since consultants are engaged in highly professional jobs and they are different from other administrative or clerical staff. It would be useful if a clearing house be organised for exchanging useful information and experiences among NPOs for the benefit of better administration and management of consulting organisation. To organise an international association of consultants in Asian region might be an effective means for promoting social and public recognition of this profession. Careful screening system is recommended for eliminating unethical and incapable consultants in order to maintain and promote prestige and dignity of consultants.

(d) Whether to recruit a college graduate or an experienced specialist as a junior consultant, depends on different policies and beliefs of different persons and organisations. In any event, a concrete manpower development programme should be established by each consulting

organisation. Since most of the so-called consultant training courses are nothing more than slightly modified management development/training courses and do not contain intensive and practical guidance on professional know-how and means to improve professional skills, a special survey and study should be made for the development of suitable curricula in this line. Intensive, yet organised, on-the-job training at consulting firms in advanced countries would be most effective, if it is applicable. □

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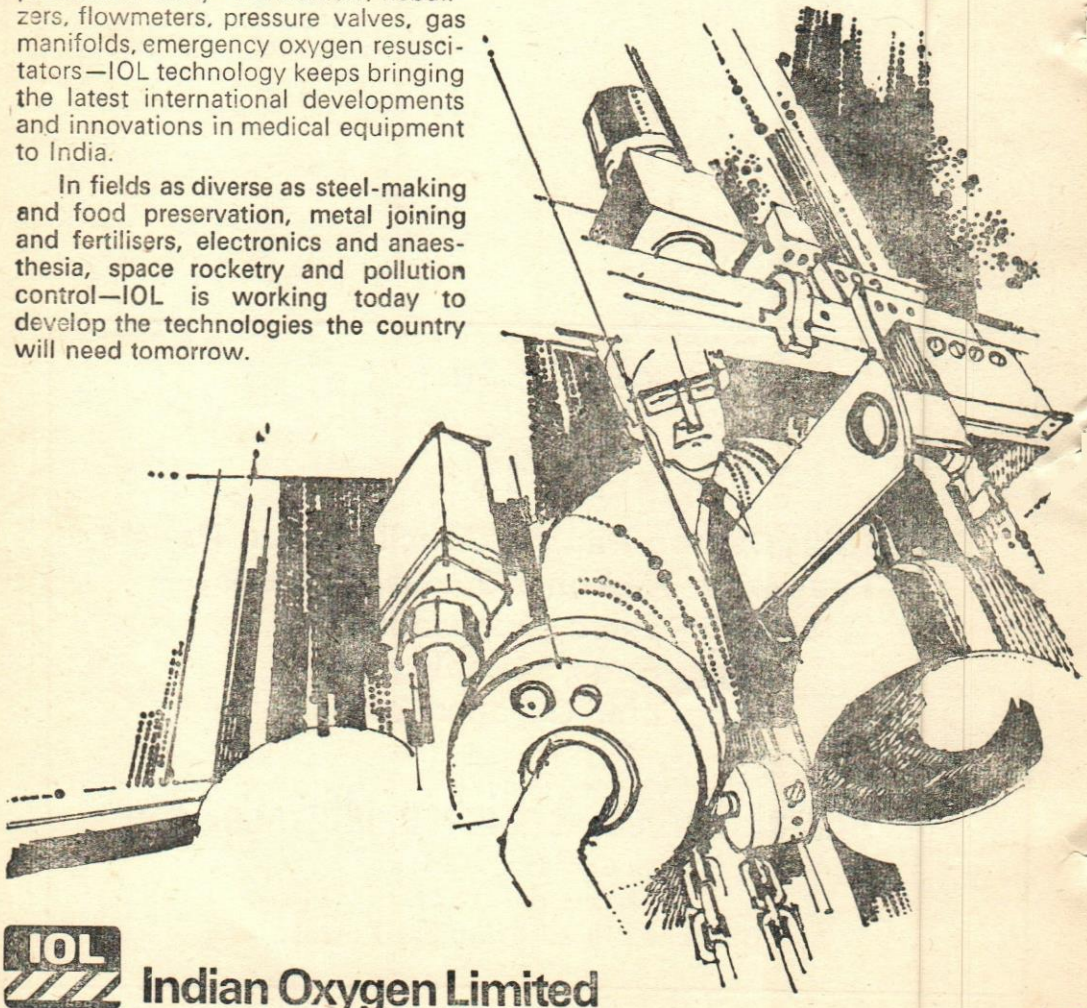

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Electric Discharge Machining : Alternative to Precision and Quality

Joseph Stanislao*

Introduction

Electric Discharge Machining (EDM) is a process in which metal is removed by the controlled thermal action of electric current on conducting materials. In recent years, more progress has been made on this technique than on any other metal-removal process. EDM is a very useful method for machining the new "super-tough" materials and "space-alloys", as well as for the manufacture of tools, dies, and other intricate parts. With technological advances in equipment and applications and a better understanding of its advantages and limitations, the EDM process is being adopted by many metal working firms as an important means of achieving greater design flexibility, reduced costs, and improved products.

In the EDM process (Figures 1A, 1B and 2), metal removal is caused by a series of electric sparks directed from the tool to the work-piece. The transient spark discharges occur at a rate of from 1 to 1500 kilocycles per second in the space between the positively charged workpiece and the negatively charged electrode (i.e., the tool). The sparks erode the workpiece in such a way that the erosion develops into a replica of the electrode.

During erosion, the workpiece and the working portion of the electrode are submerged in a dielectric fluid. This liquid bath serves to transfer the spark in a controlled direction, remove the eroded material, prevent fusion of the electrode with the workpiece and erosion particles, and cool the electrode. A spark discharge occurs when the electrical potential between the tool and the workpiece becomes sufficient to cause breakdown of the dielectric medium. The transient spark travels the shortest distance between electrode and workpiece, hence erosion of the workpiece exactly follows the configuration of the electrode.

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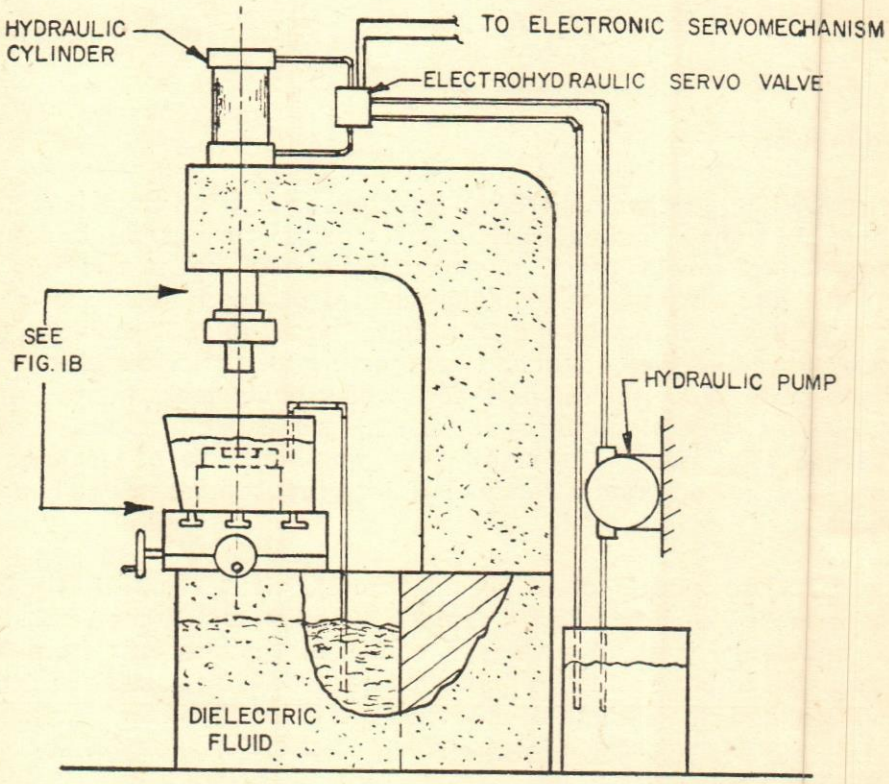

Fig. 1A—Electric Discharge Machine

The sparks erode the electrode as well as the workpiece, though usually at a different rate. When a spark strikes the workpiece (See Figure 2) microscopic metallic particles are vaporised, electrically energised, and finally released. These charged particles move rapidly through the electric field due to the attraction of the oppositely-charged electrode. Most of the particles are washed away by the fluid, but some strike and mechanically erode the electrode. Some wear is also produced as a result of the intense thermal effects generated at the electrode surface as a spark is generated and, as a result, a minute crater is formed at the point of spark origin. Basically, the EDM machine is composed of a solid bed-type machine with a tank (to retain dielectric fluid) attached to a work table. This assembly is positioned under the electrode by a

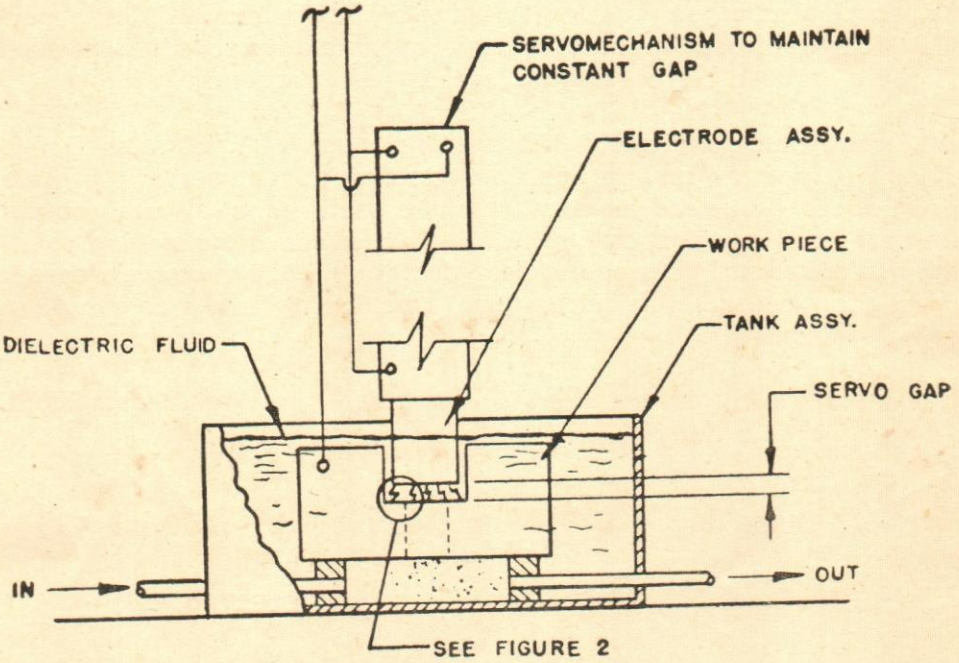

Fig. 1B– Diagram of EDM

precision X-Y co-ordinate lead screw system. As illustrated in Fig. 1A a ram with a specially designed chuck to position and hold the electrode travels perpendicularly to the work table face. Electrode feed rate is regulated by a low frequency electro-hydraulic servo-mechanism.

The spacing between the workpiece and electrode is critical, and repetitive accuracy and efficiency of machining can be achieved only when a constant and reliable gap-distance is maintained. For this reason the feed of the electrode is controlled by a servo-mechanism which advances or retracts the tool by sensing deviations in the gap-voltage.

In EDM, the removal rate of material is dependent on the size of the machining area, the shape and composition of the workpiece to be eroded, and such electrical parameters as current frequency, duration of discharge, and properties of the electrode material. As a rule, high-

amperage discharges produce a rapid rate of metal removal, but generally yield rough surface finishes. To achieve smooth surfaces, it is necessary to use a reduced current and increased spark frequency.

A recent study indicates that average metal removal rates from the workpiece are inversely proportional to the 1.25 power of the melting point of the workpiece material, whereas metal removal rates from the tool are inversely proportional to the 2.25 power of the melting point of the tool material. The proportionality factors in each case are dependent upon tool material, dielectric fluid, machine tool, power supply, and servo system.

It is important to emphasise at the outset that the direct costs of EDM

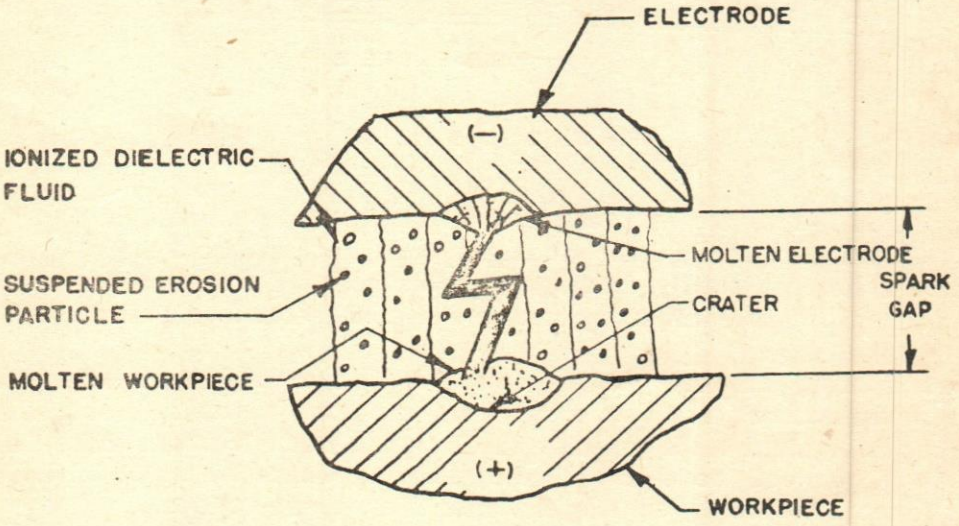

Fig. 2 –Spark Erosion

and conventional metal removal methods should not be compared. EDM should generally be considered as complementary to conventional methods, advantageous in selected situations.

Basic Elements of EDM

The EDM process consists essentially of the following basic elements :

1. Electrode
2. Power Supply System
3. Dielectric Fluid
4. Machine Tool

1. *Electrode*

In the EDM process, the electrode is the cutting tool and its configuration is reproduced in the workpiece when power is applied to the system. Though any electrically-conductive material can be used as an electrode, selection is based mainly on machinability, wear ratio, and cost. Common electrode materials are aluminium, brass, carbide, copper, carbon, etc.

Machinability in the electric discharge process is a measure of how much and how well the pulses that are delivered to the electrode by the power supply system are converted into sparks that do the eroding work. Not every pulse, however, is converted into a spark. Some electrode materials will actually transmit less than one percent of the possible sparks and the intensity of such a discharge may be uneven. Compared with other electrode materials, graphite has the best machinability rating. Wear of an electrode results in a gradual change in its dimensions; if the wear becomes excessive, the electrode must be removed and replaced.

Thus, tools exhibiting high wear rate will be costly in the long run because of the necessity of frequent replacement and long machine downtime. Since the wear of the EDM tool is inversely proportional to the melting point of the tool material, graphite appears superior to most materials as an EDM tool because of its high (6300°F) melting point; however, there are some disadvantages in its use. Despite the advantages of graphite electrodes, there are the following drawbacks : (1) When the electrode is machined, the work atmosphere becomes saturated with

fine graphite dust, a source of contamination to personnel and nearby equipment. (2) Being fragile, graphite tools require very careful handling and storage to avoid chipping or breaking the finished electrodes. (3) Graphite is susceptible to thermal shock. (4) Graphite contaminates dielectric fluid making it essential to change filters very often.

There are two techniques of electrode design that merit special note. For the introduction of holes of various shapes, an electrode may be used which is comprised of several stages. Each stage would be designed so that the most efficient metal removal rate would be achieved. In this way, a small cross-section of the tool would be used to begin a pilot hole and successively larger cross-sections to produce shapes closer to the final configuration of the hole. To produce a die, the working end of the mating punch can be coated or "tipped"* with an electrode material and the punch itself can thus be used to finish machine the die cavity.

In conclusion, it must be noted that the ultimate selection of an electrode material is often based on the ease with which it can be fabricated rather than on its EDM capabilities. To facilitate solving the fabrication problems, many manufacturers are concentrating on providing improved electrode materials which are less expensive and easier to machine.

2. *Power Supply System*

Several basic types of circuits used for providing pulsating D.C. Current to EDM machines are illustrated in Figure 3. No one particular type is best for all machining conditions. The most suitable circuit depends on the type of dielectric fluid, the nature of tools used, and the type of finish required.

One type of power supply unit, widely used in European EDM practice, is a resistance capacitance (RC) or relaxation circuit which utilises a high-energy discharge at low frequency. This self-oscillating circuit operates at approximately 70 to 180 volts with an open-circuit voltage of up to 300 volts. A voltage from a constant source is used through a resistance to charge the capacitor; the capacitor is charged to a level sufficient to break down the dielectric at the gap between tool and work-piece. Since the voltage across the capacitor in an RC circuit is the

*A tip of electrode material can be cemented to the punch with a conductive epoxy adhesive.

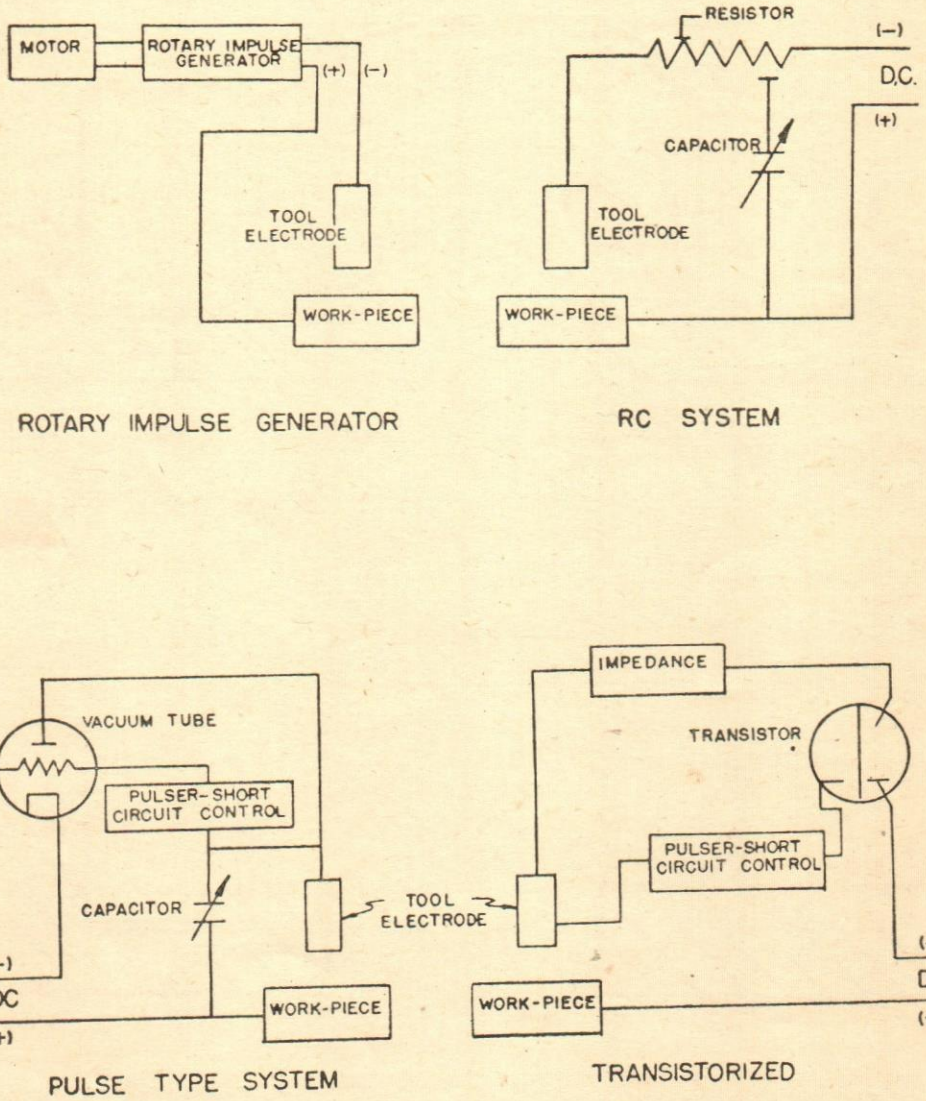

Fig. 3—D.C. Circuits For Pulsating EDM

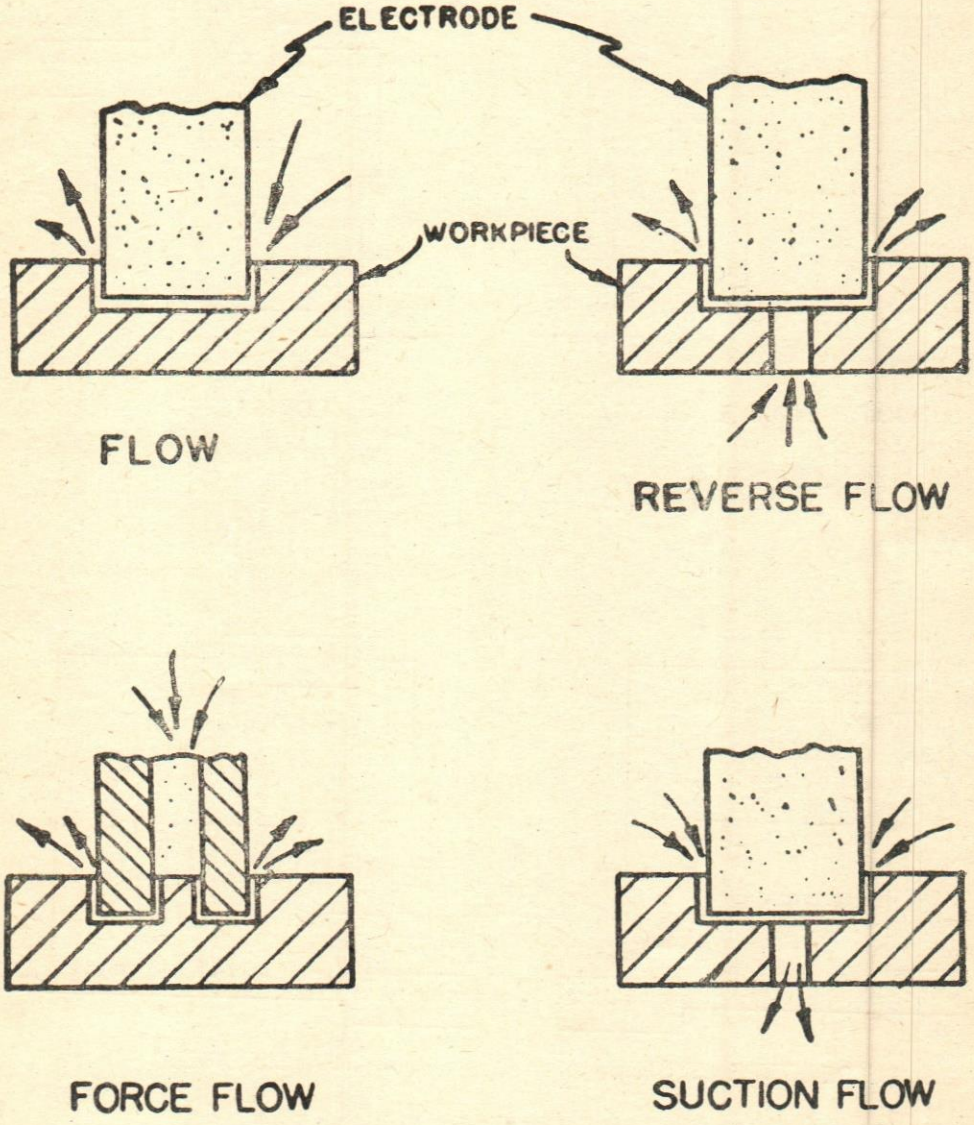

Fig. 4—Methods to Flush Eroded Particles from Machining Area

same as that across the arc gap, a charging resistance must be so chosen that the capacitor is not again charged to the arc voltage before the dielectric fluid in the gap has had time to become deionised. If this is not done, a continuous arc is formed from tool to workpiece and no machining occurs. The need for charging resistance in an RC circuit creates "dead" time and thus reduces the number of discharges possible per unit of time. While such circuits are simple, reliable, and relatively low in cost, it is necessary to use low machining rates to achieve smooth surface finishes.

The pulse type circuit incorporates vacuum tubes or transistors (in place of resistance elements) to provide minimum resistance during charging of the capacitors and maximum resistance during discharge. In this way, switching is accomplished at frequencies approximately 10 times greater than those used in RC circuits. The pulse type circuits provide a high frequency low energy discharge operating at about 20 to 60 volts with an open circuit voltage of 70. While such circuits are more complex, they permit greater flexibility and control, and are capable of producing finer surface finishes at relatively-high metal removal rates.

Transistorised pulse-type power supply units are not available having a wide range of frequency adjustment and variable current control for either relatively high or low material removal rates depending on the surface finish required. Fixed frequency, rotary impulse generators (using rotating motor generator sets) can be obtained for high material removal rates with a correspondingly rough surface finish. While power output can be reduced to improve the surface finishes, these units are usually used for rough machining of forging dies while the finish machining is performed with higher frequency power supply units.

Static impulse generators employ a high frequency, vacuum tube (oscillator and amplifier) power source, coupled to a series capacitor and a shunt silicon diode. The capacitor is charged through the diode during half of each cycle; during the other half of the cycle, the sum of the output voltage and the charged capacitor voltage is applied to the machining gap. Since there is zero potential difference across the machining gap while the capacitor is charged, deionisation of the dielectric can take place while the capacitor is being charged.

3. *Dielectric Fluid*

The dielectric fluids used for EDM serve several important functions : (1) The fluids constitute an integral part of the discharge between the tool and the workpiece. Ions and uncharged molecules of the fluid are largely responsible for initiation of the discharge and for providing the conductive path of the discharge. The bulk of the fluid serves to confine the spark path to a restricted zone. Thus both the amount of energy transferred and the size of the crater produced are influenced by the properties of the dielectric.

(2) To flush the eroded particles out of the machining area, the fluid is either forced through hollow tools, through holes in the workpiece, between the tool and the work, or by oscillating the tool (Fig. 4). It may be noted that filtration of the fluid is essential to prevent electrical short circuiting between the work and tool. The filter removes particles having diameters greater than a small fraction of the working gap distance and is essential for finishing operations. This action also minimises energy losses attributable to "remachining" of the debris.

(3) The dielectric acts as a coolant for both the workpiece and the tool. Dielectric fluids commonly used for EDM include different types of oils : kerosene, transformer oils, lubricating oils, various other petroleum distillate fractions, and expensive silicon-base oils. Distilled or deionised water, carbon tetrachloride, and some compressed gases have been used in certain instances. However, low-cost petroleum fractions have been used most often and perform quite well, especially when used with graphite tools.

Recently, the use of a dielectric solution consisting essentially of triethylene glycol, water, and monoethyl ether or ethylene glycol has given results with metallic electrodes which are superior to those obtained with conventional hydrocarbons.

4. *Machine Tool*

Productive efficiencies obtainable with EDM depend upon the interaction of all related elements : the machines, their servo-feed controls and power supply units, the workpiece materials, and the tooling and dielectric.

Machine tools used for EDM have undergone considerable changes. Originally, only limited results were realised from machine tools which were converted for EDM use. Currently, EDM machines are available in a wide range of sizes and types. Desirable machine features include negligible lateral deflection when subjected to flow of dielectric, precise movements of the ram of the order of 0.002 to 0.0004 inch with a minimum of friction, and the minimum amount of vibration transmission to the tool. Since EDM transmits little or no mechanical forces, massive tool members and heavy construction to support the ram or spindle are not required.

The important component of any EDM machine tool is the servo-feed control mechanism. The functions of these elements are to maintain automatically the required gap between the tool and the work, to advance the tool into the work as the operation progresses, and to sense and correct any short circuiting between tool and the work by first withdrawing and then returning to the tool. Precise control is essential because if the arc gap is too large, ionisation of dielectric and electrical discharge machining cannot take place; if the gap is too small, tool and work might bond together. This control is achieved by comparing the average gap voltage to a predetermined voltage. The difference between these two voltages is used to locate the tool by means of a servo-mechanism system. Electro-mechanical types of servo-feed control mechanisms formerly used are now being replaced by electro-hydraulic systems that offer faster response rates.

Advantages

Though in its infancy, EDM has proved to be a very important machining process in the metal working industry, it is currently being applied successfully and profitably in many industrial problems. Some of the major benefits of EDM are :

1. Any electrically conductive material, regardless of the physical properties, can be machined by EDM. This has two important implications :

(a) EDM can be performed as a final operation after hardening, thus eliminating distortions, strains, and mechanical fractures in the workpiece resulting from heat treatment.

(b) In many instances, die materials can be improved and productivity increased to a great extent. For example, carbide dies can be made by EDM at approximately the same cost as conventionally-made steel dies.

2. There are no cutting forces involved in EDM since there is no contact between the tool and the workpiece. Thus, very fragile and complex parts can be machined.

3. The ability of this process to produce intricate parts of various shapes and sizes have been very advantageous in eliminating costly split sectioning required in other methods.

4. The EDM process offers great potential in maintenance and repair of tools and dies. It is ideally suited as a means of correcting completely heat treated and finished tooling and out-of-tolerance cavity work requiring minor repair. Substantial savings have been realised in the resinking of forging, injection-moulding, die-casting, cold-heading, and stamping dies.

5. The non-directional finish produced by EDM forms a natural reservoir to sustain lubricants. Many studies have indicated that this factor might be responsible for extending the life of EDM-produced dies.

6. The EDM cratering types of surface is considerably easier and more economical to polish. Normally, grinding roughness is characterised by linear surface irregularities that are composed of a high and low variety of wavy surfaces, which require additional polishing or lapping effect for reduction or removal.

7. Since the erosion action is completely free of mechanical forces, deflection of the electrode is not encountered and set-up errors are much smaller in magnitude than in conventional machining.

8. EDM can reduce the cost of certain operations such as heat treating, straightening, annealing, deburring, fitting, keying, stoning, and finishing.

Disadvantages

Though EDM has many advantages, it has its own limitations. To begin with, it is not a mass-production process because metal removal rates

are very slow, varying from as little as 0.001 cubic inches per hour for precision machining with smooth surface finishes to 15 cubic inches per hour for rough machining with poor surface finishes. Usually large volumes of material are removed by conventional methods and EDM is used for finishing.

Another possible limitation of the EDM process is that the material to be machined must be electrically conductive. Also, under normal operation, the holes produced are tapered. However, this tapered effect can be controlled within usable tolerances for most applications to as little as 0.001″ in 1/4 inch with low currents and fine finishes. However, this further reduces the metal removal rate. Rapid tool wear can sometimes be a factor in deciding whether or not to use EDM. Discharge machining produces a highly stressed hard surface layer on heat treatable steels and occasionally tools made by EDM fail. This effect, however, may be minimised by reducing the depth of the hardened layer or by using lapping or grinding to remove the hardened zone.

Accuracy and Surface Finishes Obtainable with EDM

The accuracy that can be obtained with EDM depends on the machine tool, the set up, the tool and tool-wear rate, and the amount of overcutting. Overcutting is a function of the open circuit voltage and the amount of charge transferred in the spark when the tool and workpiece materials are kept constant.

To maintain close tolerances, the amount of clearance that will be produced by EDM must be predictable. Most manufacturers can provide overcut charts to show the amount of clearance produced as a function of currents. With such charts, it is possible to accurately predetermine the electrode sizes that will machine openings within 0.0001 inch of the amounts of overcut shown on the charts for pulse type power supply units. This accuracy can be affected by the size and quantity of eroded particles in the arc gap. For a specified frequency selector setting, the current alone is the determining factor as to the clearance produced between the electrode and machined surface.

Surface finishes obtainable with EDM are dependent upon metal removal rates. With very low metal removal rates such as 0.001 cubic inches

per hour, surface finishes of 2 to 4 micro-inches can be produced. Conversely, with very high metal removal rates, such as 15 cubic inches per hour, extremely rough surface finishes of the order of 1000 micro-inches can be realised.

The surface finishes can be controlled by varying the amount of charge transferred in each spark between the tool and work. This may be achieved in a variety of ways, depending on the type of the power supply used. With a pulse type power supply unit, the charging part of the cycle and the interval between charging pulses can be predetermined. Then, the charging cycle and the interval between the charging pulses should be chosen so that the maximum metal removal rate can be realised. The degree of surface finish produced is also affected by the tool material, work material and the dielectric fluid used.

Applications

EDM is being widely used by both small and large industries, primarily for the manufacturing of dies and moulds. Applications often permit the production of better parts and dies at less cost and greater design flexibility. However, the use of discharge machining generally depends on the quantity and complexity of the components. It is often economically efficient to use a combination of conventional machining and EDM. With current models of EDM units, one power supply can operate two EDM machines and one operator can supervise a multiple unit installation.

The final machining of cavities in dies for forging, injection moulding, die casting, cold heading, extrusion etc., is generally an excellent application for EDM. However, again this depends on the quantity required and the complexity of the workpiece.

For sinking work or washed-out dies EDM can sometimes be used profitably. By minimising or eliminating the need for hand finishing of forging dies, the number of man-hours required has been reduced significantly.

Additional savings often result from the reduction or elimination of secondary operations required on parts that are cast or moulded in

dies made by EDM. The process permits one-piece design, since intricately shaped contours can be cut in solid blocks, thus reducing the cost below that of sectionalised design.

The production of cutting-edge dies, including progressive dies, compound dies, and four-side dies for blanking, piercing, notching, trimming, lancing and similar operations, is an important and rapidly growing field of application for EDM. In general, the more complex the part required, the more advantages offered by EDM. Punches can be used to make their own mating die openings in hardened steel or other materials. Therefore, within the capabilities of the power supply units the die openings can be duplicates of the punch shapes and can serve as a clearance between the punch and die within uniform and controllable limits. Thin sections and irregularly shaped openings can be cut from the solid without the costly time-consuming job of making and fitting together inserts. With EDM the die material has practically no effect on the cost of making the dies; with the punches and dies hardened prior to EDM, no further heat treatment is required.

Potential of EDM

Many research and development programmes are currently being conducted to improve electrode materials and electrode fabricating systems, to create better electronic circuits that will yield finer surface textures, to design efficient dielectric filtering units, to make use of ultrasonics in order to reduce electrode wear, and to utilise the concept of Numerical Control on EDM machines. The solidarity of EDM is presently being formulated on local and international levels. There is much discussion on the suggestions for the world standardisation of the EDM technological language and the proposal of a system for EDM surface texture measurements.

Based on its present-day applications, the development and new applications in sight, and the emphasis on research and development by many manufacturers and universities, electric discharge machining will be a necessity for tomorrow. □

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□

Unused Inventories in Petroleum Enterprises of Central Government

Ram Prakash*

Introduction

On 31st March, 1977 there were 11 Central Government enterprises engaged in exploration of oil and gas, refining of crude oil, blending of additives and marketing of petroleum products. In these enterprises Rs. 649 crores** were invested as equity and loan. Out of every 13 rupees invested in all the manufacturing enterprises, roughly Re. one is in petroleum industry. These enterprises account for nearly 36 percent of total gross profit of about Rs. 581 crores earned in 1976-77 by all the enterprises, producing goods.

In 1966-67, there were only two undertakings, viz., Indian Oil Corporation Limited (IOC) and Oil and Natural Gas Commission (ONGC) with total employed capital of about Rs. 279 crores. The turnover of these two enterprises in that year was Rs. 367 crores. Over the period the number of undertakings increased to eleven and capital employed to Rs. 801 crores, i.e., by 187 percent. The turnover grew to Rs. 4622 crores, i.e., nearly by 13 times the sales in 1966-67. ONGC is the biggest undertaking of this group with paid-up capital of Rs. 241 crores as on 31.3.77 out of the total of Rs. 401 crores for the entire group. IOC is the second biggest company of this group with paid-up capital of Rs. 82 crores. The other enterprises with their year of incorporation (in bracket) are Cochin Refineries Limited (1963), Madras Refineries Limited (1965), Hydro Carbon India Limited (1965), Lubrizol India Limited (1966), Indo-Burma Petroleum Corporation Ltd. (1972), Hindustan Petroleum Corporation Ltd. (1974), Indian Oil Blending Ltd. (1974), Bharat Petroleum Corporation Ltd. (1976) and Caltex Oil Refining (India) Ltd. (1976).

Level of Inventories

The average value of inventories held by this group of enterprises during 1976-77 was Rs. 443 crores as compared to Rs. 62 crores in

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** One crore = 10 million

1966-67 The inventories as a percentage of total produce fell from 18 in 1966-67 to about 10 in 1976-77. The cost of sales has grown from Rs. 343 crores (1966-67) to Rs. 4413 crores (1976-77). The data on inventories, cost of sales and their associated relationships for the available last eleven years are summarised in Table 1. The changing pattern of inventories in relation to cost of sales have been graphically presented in Figures 1 and 2.

Table 1

Year	Rs in crores		Inventories as percentage of cost of sales	Inventories in terms of months of cost of sales	Inventories turnover rate 2÷3
	Cost of Sales	Value of average inventories			
1966-67	343.45	62.11	18.1	2.17	5.53
1967-68	460.35	70.39	15.3	1.84	6.54
1968-69	558.64	76.53	13.7	1.64	7.30
1969-70	700.17	89.56	12.8	1.53	7.82
1970-71	821.32	99.83	12.2	1.46	8.23
1971-72	979.90	108.09	11.0	1.32	9.07
1972-73	1124.27	113.76	10.1	1.21	9.88
1973-74	1485.25	171.72	11.6	1.39	8.65
1974-75	2786.10	300.20	10.8	1.29	9.28
1975-76	3530.16	384.31	10.9	1.31	9.18
1976-77	4413.42	443.09	10.0	1.20	9.96

A quick guide to efficient management of inventories is stocks turnover ratio. It reflects the "mileage" obtained from the money tied up in stocks and is calculated after dividing the annual usage or cost of sales by average inventories. Over the eleven years under study, gradual improvement in the inventory turnover ratio is seen from 5.53 to 9.96. In the first seven years larger volume of sales were covered by the same amount of inventories. Fig. 1 in this period shows some tendency of concave formation of inventories and cost of sales relationship curve. In 1973-74 after international oil crisis, inventories increased considerably and the turnover ratio fell from 9.88 in 1972-73 to 8.65. The stocks appear to have again become active in 1974-75 and 1975-76 as seen from higher inventories turnover ratios of 9.28 and 9.18 respectively. In 1976-77, the ratio reached at the highest level ever achieved. This

trend of overall improvement is further corroborated by the fact that gap between cost of sales and average inventories as seen from Fig. 2 markedly increased over the eleven years. The inventory holdings in terms of months of cost of sales were equal to 1.2 in the eleventh year as compared to 2.17 in the first year of the period. On the whole, lesser

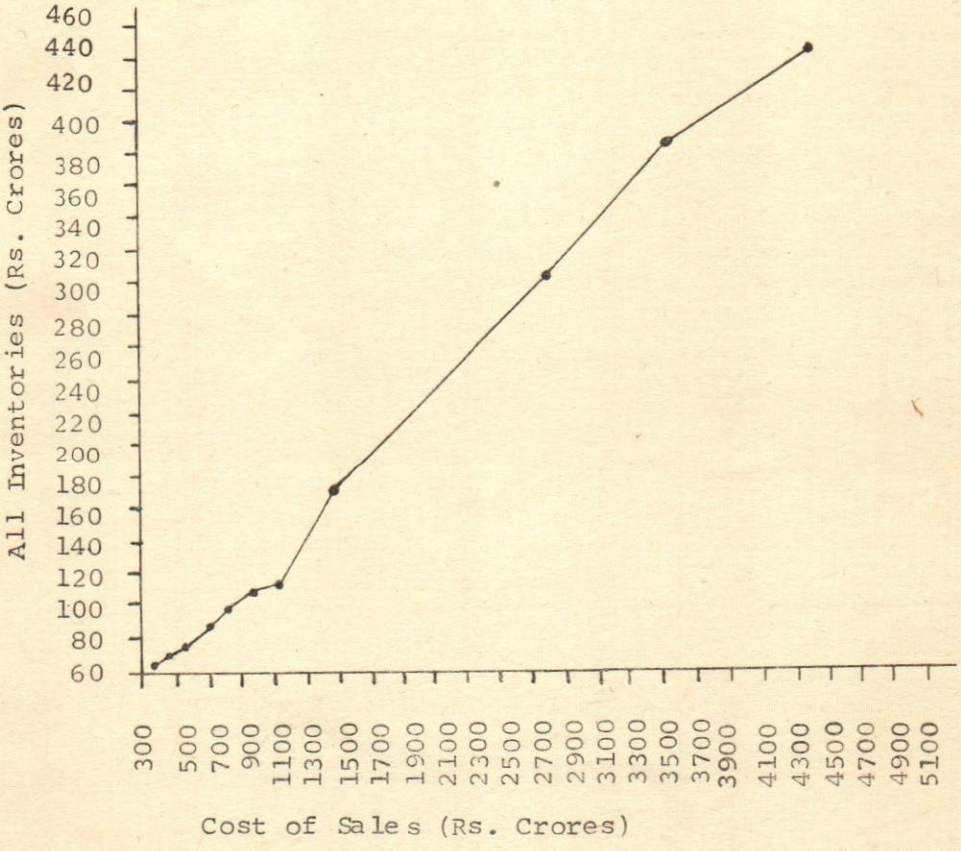

Fig. 1 : All Inventories and Cost of Sales Relationship - Petroleum

levels of inventories covered larger volume of produce. If judged from the turns ratio alone, the inventory performance in this group of

enterprises is quite good as compared to the companies in USA. In America, the ratio of net sales to inventory for 37 petroleum integrated

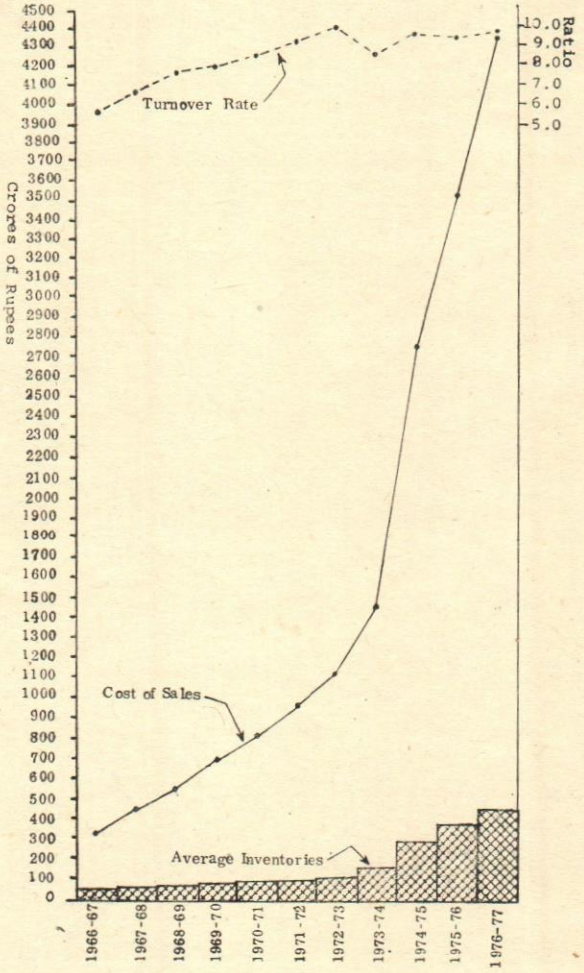

Fig. 2 : Inventory Chartwatch—Petroleum

corporations shows a range of 11.7 to 3.7 upper and lower quartile, the medium being 6.3. (*Encyclopaedia of Management,* edited by Carl Hayel; pp. 228-29: Ratio compiled by Dun and Bradstreet Inc.).

Inventory Components

The behaviour pattern of different components of inventories can be studied from the data on the three inventory components and other associated aspects as summarised in Table 2. The graphical presentations of data are made in Figs. 3, 4 and 5.

Raw Materials : The turnover ratio of crude materials and spares in relation to their consumption has greatly improved during the first nine

Table 2

Year	Cost of sales	Rs. in crores				Turnover Ratios	
		Value of materials & spares consumed	Av. inventories of			Materials & spares to their consumption 3÷4	Finished goods to cost of sales 2÷6
			Raw materials & spares	Work-in-process	Finished goods		
1	2	3	4	5	6	7	8
1966-67	343.45	172.07	35.43 (2.47)	1.34 (0.05)	25.34 (0.89)	4.86	13.55
1967-68	460.35	230.63	38.70 (2.10)	1.12 (0.03)	30.57 (0.80)	5.96	15.06
1968-69	558.64	283.73	45.96 (1.94)	1.29 (0.03)	29.28 (0.63)	6.17	19.08
1969-70	700.17	355.05	57.27 (1.94)	2.17 (0.04)	30.12 (0.52)	6.20	23.25
1970-71	821.32	415.56	62.36 (1.80)	2.29 (0.03)	35.18 (0.51)	6.66	23.35
1971-72	979.90	487.41	64.64 (1.59)	2.28 (0.03)	41.17 (0.50)	7.54	23.80
1972-73	1124.27	577.06	67.98 (1.41)	2.44 (0.03)	43.34 (0.46)	8.49	25.94
1973-74	1485 25	915.86	85.09 (1.11)	6.74 (0.05)	79.89 (0.65)	10.76	18.59
1974-75	2786.10	1874.20	134.72 (0.86)	13.12 (0.06)	152.36 (0.66)	13.91	18.29
1975-76	3580.16	2389.75	192.13 (0.96)	13.20 (0.04)	178.98 (0.61)	12.44	19.72
1976-77	4413.42	2836.20	237.60 (1.01)	15.42 (0.04)	190.07 (0.52)	11.94	23.22

Figures in parentheses relate to inventories in terms of months of consumption of materials and spares for crude materials, and of cost of sales for work-in-procress and finished goods.

years of the period. The said turns ratio, in the first year was 4.86 and in ninth year, it was 13.91. In the eighth (1973-74) and ninth (1974-75) years improvement was at an accelerated rate probably due to greater emphasis on optimum use of crude inventories, in the post-oil crisis period. During the last two years the stocks of crude materials increased disproportionately to the increase in their consumption and, as a result, the turnover ratio fell from 13.91 in 1974-75 to 11.94 in 1976-77, but was still higher than the highest of the first eight years. Fig. 3 shows sharp increase in stocks as compared to their consumption in the last two years. This indicates the importance of constant watch over inventories.

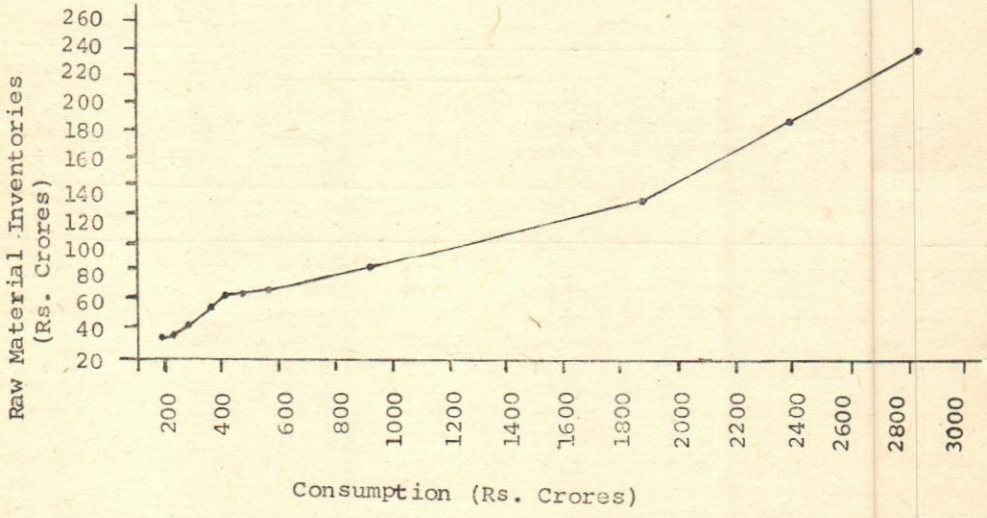

Fig. 3 : Inventories of Raw Materials & Spares and their Consumption Relationship—Petroleum

Work-in-Process : The inventories of WIP during the period of eleven years had never exceeded 1.8 days of the cost of sales and mode was 0.9 days. The trend in WIP inventories and cost of sales over the eleven years has been shown in Fig. 4. Keeping in view the fact that the quantum of work-in-process is mainly dependent on factors like production cycle, sequence of operation, pattern of sales orders and type of raw materials, the holding of inventories in this category appears to be satisfactory.

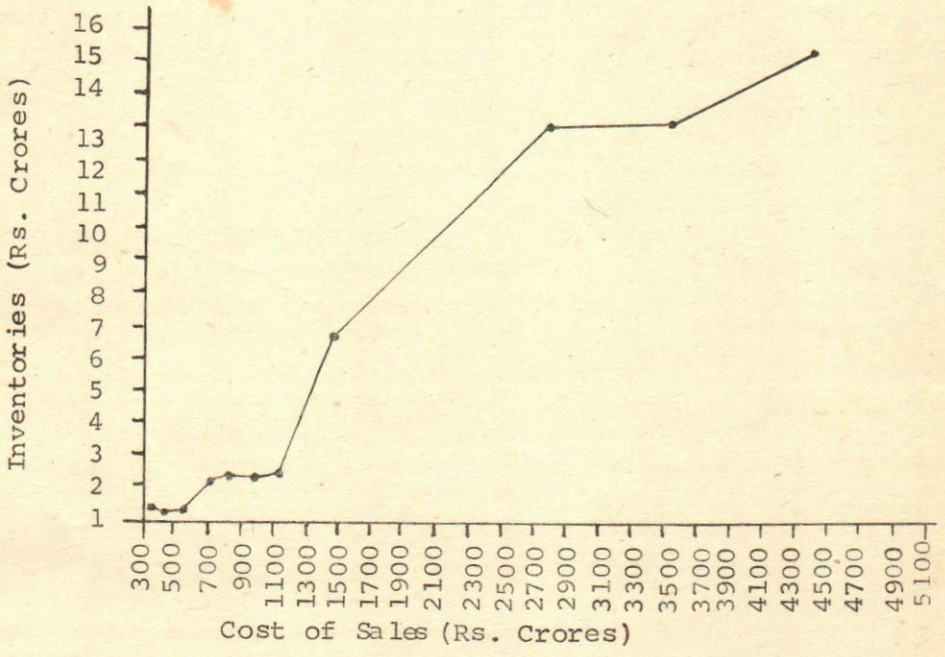

Fig. 4 : Inventories of Work-in-Process & Cost of Sales Relationship—Petroleum

Finished Goods : In this category of stocks the holding had varied between 27 to 14 days of sales. In the first seven years, the inventory turnover ratio has shown progressive improvement from 13.55 to 25.94. Thereafter it fell to 18.59 in 1973-74 and to 18.29 in 1974-75. In the last two years it improved first to 19.72 and then to 23.22, but did not reach the level of 1972-73. In finished goods stocks two important developments seem to have taken place. Firstly, due to excessive stocks in the initial year of the study it was possible to reduce the stocks to a level of 13.8 days under conditions of stable supply. Subsequently, we had world-over fuel crisis which sharply increased the prices of petroleum products and created insecurity of supply conditions. This had the chain reaction of reduction in demand. These resulted in second development of increase in stocks of finished goods in 1973-76. The inventories and sales curve in Fig. 5 also show a concave formation in first seven years and thereafter the stocks of finished goods increased

sharply. In the last year of the period under study, however, some tendency of reduction in the relative position of stocks *vis-a-vis* sales is seen in Fig. 5.

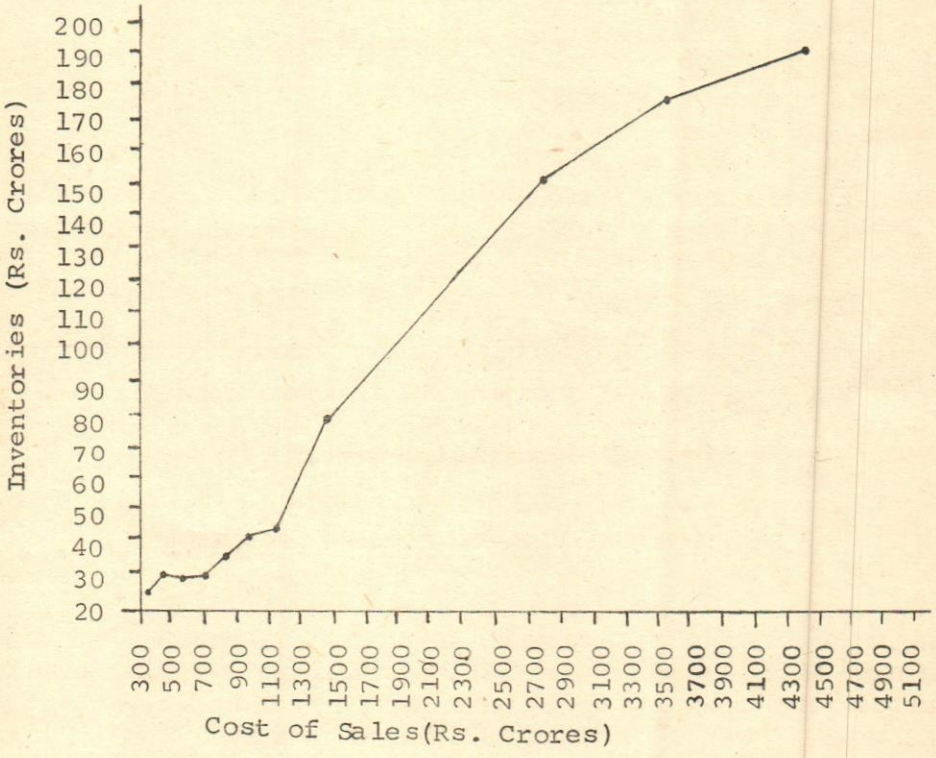

Fig. 5: Inventories of Finished Goods & Cost of Sales Relationship—Petroleum

Behaviour Pattern : Scientific management of inventories suggests that with increasing consumption of sales relatively lesser volume of inventories are needed, and under effective management, inventories should move in square root relationship with sales/usage. The extent to which this law of economies of scale operates can be ascertained by fitting the time series data of inventories and usage through Regression

Analysis to the general form of equation $I = a + bS^{\beta}$ model. Here I stands for inventories, a—safety stocks, b—policy variable and S for sales/usage. The value of β thus arrived at will indicate the degree of economies of scale in the holding of inventories. Unfortunately, there are statistical difficulties in estimating by linear regressions an equation of the form $I = a + bS^{\beta}$, and as such a general form model cannot be applied. Under these circumstances it would be legitimate to think of alternative models to indentify the extent of economies made by the management in holding of inventories over the eleven years under study. Experience has given some idea of approximate limits, within which, inventories *vis-a-vis* the derived demand would move. This approximate limit suggests three possibilities. One, inventories may move in constant ratio with their usage. Second, according to established belief under ideal conditions of effective management, inventories should move in square-root relationship with their usage. The third alternative is that inventories increase in between the two extremes. These trends in time series data can be captured through three models :

i) $I = a + bS$

ii) $I = a + bS^{1/2}$

iii) $I = S$ with $\frac{1}{2} < \beta < 1.0$

In the model (i), inventories form a constant ratio with usage. In (ii), stooks are in square-root relationship to derived demand. The model (iii) holds the assumption that economies of scale exist, but are not as great as those indicated by the square-root. The application of three models will give sufficient insight into the inventory behaviour, and assess the extent to which there had been economies of scale in inventory holding.

Application of Model I : The inventories of raw materials and spares were correlated with their usage and those of work-in-process and finished goods with cost of sales according to the linear model $I = a + bS$ through regression analysis, for five groups of years 1 to 7, 1 to 8, 1 to 9, 1 to 10 and all the eleven years. Since the holding of stocks under WIP category is nominal as discussed earlier, its further examination is not considered necessary. The important results in respect of other categories are summarised in Table 3.

In the inventories of crude materials there is strong evidence of economies of scale. In all the above three groups the intercept 'a' is five and is significantly different from zero at 95% confidence. The R^2 value is also more than .9. The analysis for the decade and first nine years also reveals similar trend.

In stocks of finished goods over the first seven years there is definite evidence of economies of scale. The intercept 'a' is +ive and significantly different from zero at 95% confidence level, thus showing that ratio of average inventory to cost of sales is more than their ratio of marginal rates of changes. But analysis relating to 1 to 8, 1 to 9,

Table 3 : Simple Regression of Inventories to Usage : I = a + bS

Parameters for Analysis	*1966-67 to 1976-77*		*1966-67 to 1973-74*		*1966-67 to 1972-73*	
	Materials & Spares	*Finished goods*	*Materials & Spares*	*Finished goods*	*Materials & Spares*	*Finished goods*
No. of observations	11	11	8	8	7	7
a - coefficient	26.22	3.39	28.39	5.30	21.55	17.53
standard error	4.23	5.55	3.82	6.94	4.04	2.27
t - value	6.20	.61	7.43	0.76	5.33	7.71
b - coefficient	.0696	.0464	.0670	.0421	.0878	.0225
stanard error	.0032	.0027	.0079	.0079	.0105	.0030
t - value	21.72	17.10	8.48	5.35	8.35	7.52
R^2	.991	.985	.923	.827	.933	.919
F - Variance Ratio	471.57	292.50	71.96	28.65	69.77	56.50

1 to 10 and all the eleven years shows that the coefficient 'a' is not significantly different from zero. The R^2 in the last three groups of years is more than .9 and when analysis is confined to only 8 years R^2 is .827. This indicates that stocks of finished goods have moved over the period as a whole in constant ratio with the sales, despite the fact that in the first seven years there is evidence of economies of scale.

The results of regression, according to this model $I = a + bS$ in respect of all the inventories, were also examined and these have shown consistent evidence of economies of scale for inventories as a whole in this group. The intercept 'a' is found +ive and is significantly different from zero at 95% confidence in all the five groups of years. The R^2 is greater than .95. It means economies of scale in the holding of raw material inventories have offset the effect of higher holding of stocks in finished goods inventories during the last four years of the period under study.

Model II : The alternative theory to that of the linear model I is that inventories are a square-root function of sales/usage(i.e. $I = a + bS^{\frac{1}{2}}$). Regressions were run again for each of the two kinds of inventories in the same correlation as in the Model I and results are set out in Table 4.

Table 4 : Regression of Inventories to Usage : $I = a + bS^{\cdot 5}$

Parameters for Analysis	*1966-67 to 1976-77*		*1966-67 to 1973-74*		*1966-67 to 1972-73*	
	Materials & Spares	*Finished goods*	*Materials & Spares*	*Finished goods*	*Materials & Spares*	*Finished goods*
No. of observations	11	11	8	8	7	7
a - coefficient	−34.80	−67.83	−2.91	−24.14	−8.63	3.11
standard error	10.86	10.77	4.56	15.37	5.92	4.83
t - value	−3.21	−6.30	−0 64	1.57	−1.46	0.64
b - coefficient	4.5880	3.9487	2.9905	2.2871	3.3166	1.1614
standard error	.3508	.2723	.2199	0.5405	.3120	.1811
t - value	13.08	14.50	13.60	4.23	10.63	6.41
R^2	.975	.979	.969	.749	.958	.892
F - Variance Ratio	171.08	210.23	185.07	17.91	113.01	41.14

The value of intercept 'a' is found either −ive or not significantly different from zero at 95% confidence. The R^2 is quite high except in

the analysis of finished goods inventories for 8 years. The coefficient 'b' is +ive and is significantly different from zero. When mean value of 'S' was compared with the model value of $\frac{4a^2}{b^2}$, it was found that though the model responded to data, yet it failed to reflect the reality of life in the period as a whole. In the first seven and eight years the intercept 'a' for inventories of raw materials and finished goods is approaching zero. This fact together with reasonably high R^2 value, show that Model II in these periods is both valid and reflecting reality. The negative intercept 'a' and 'S' greater than $\frac{4a^2}{b^2}$ suggest that for the period as a whole the power of the exponent 'S' is more than .5 in both the categories of inventories. This calls for the need to examine the data according to the equation $I = \alpha S^{\beta}$

Model III : The Model $I = \alpha S^{\beta}$ indicates economies of scale, but these economies are not as great as those indicated by the square-root formula. Here it is expected that the exponent β would take value anywhere more than .5 and less than 1. Linear regressions for this model in five different groups of years were calculated in the logarithmic form $\text{Log } I = \text{Log}\alpha + \beta \text{ Log } S$. The results of regression for each of the two kind of inventories in the same correlation as in the previous two models are indicated in Table 5.

Table 5 : Regression of Inventories to Usage : Log I = Log α + β Log S

Parameters for Analysis	*1966-67 to 1976-77*		*1966-67 to 1973-74*		*1966-67 to 1972-73*	
	Materials & Spares	*Finished Goods*	*Materials & Spares*	*Finished Goods*	*Materials & Spares*	*Finished Goods*
No. of observations	11	11	8	8	7	7
β	.6453	.9029	.5528	.6594	.6002	.4289
standard error	.0323	.0737	.0423	.1397	.0537	0.0719
t - value	20.01	12.26	13.07	4.72	11.18	5.97
Log α	.18	—2.31	0.73	—0.74	0.46	.71
standard error	4.43	3.95	1.25	3.55	1.21	1.04
t - value	0.04	—.59	.58	—0.21	0.38	0.68
R^2	.989	.971	.966	0.788	.962	.877
F - Variance Ratio	400.20	150.29	170.90	22.29	125.06	35.61

The β value for inventories of materials and spares in respect of five groups of years varied between .55 and .64. In this category of inventory R^2 for the fit is very good. These give a consistent evidence of economies of scale. The 6 values of β indicate the slope of the log-log line and it means that each unit one moves the usage/sales to the right, the inventory line rises by 0.6 unit. Apparently the relative economies indicated by the difference between .60 and .50 (slope in case of square-root relation) may not seem to be very significant, but the rupee value involved in the undertaking is very large. A small change in the β coefficient in Model III represents a large change in the value of inventories in relation to sales. For the entire period of eleven years β value is .645 and is significantly different from both zero and .5 because table 't' value at 95 percent confidence is more than the actual 't' value. This shows that over the period as a whole there had been economies of scale, but not to the extent of square-root relationship. The results of the application of this model in respect of inventory component of crude materials and spares reinforces the conclusion drawn from Model I.

In finished goods the β value for the total period under study is .9029 and is significantly different from zero at 95% confidence. The application of further test shows that it is not significantly different from one. In the other group of years of 1 to 9 and 1 to 8 the β values respectively are .857 and .659 and are significantly different from zero at 95% confidence. In these two cases values of R^2 are low at .880 and .788. In the case of first seven years the β value is .4289 and significantly different from zero but not different from .5 at 95% confidence. R^2 is .877. These facts (when taken into account alongwith the results of other analysis) show that during first seven years there is strong evidence of economies of scale, but in the subsequent years the inventories of finished goods have increased substantially. This on the whole has made the finished goods inventories to move in constant ratio with sales despite the significant economies of scale in the first seven years. This conclusion is also supported by the results of the application of Model I.

Excess Holdings

The application of the models gives evidence of some rationalisation In the management of inventories of raw materials, but not to the extent

shown by square root relationship. The models, however, did not assist in assessing the excess inventories existing on any date. An approximate idea of the excess holdings can be formed through analysis of growth rates. The classical theory tells that the optimum value of order (the one that minimises the total procurement and stock holdings costs) is given by $I = K\ S^{\frac{1}{2}}$ where K is the policy variable taking care of the balance between frequent orders and high stocks. It means that *ceteris paribus*, if annual consumption or sales rise to a new constant level, say from 1000 to 2000, the economic order quantity will rise by 41%—strictly speaking by under-root of 2 which is nearly 1.4142. In a study of the eleven years if it is assumed that safety and policy variable stocks have not changed over time and also initial stocks were normal then inventories should under ideal conditions grow as square-root of sales/usage. In that case the unity growth rate of inventories, say 'g', will be obtained by $\left(\sqrt{1+g_s} - 1 \right)$ where g_s is the unity compound growth rate of sales or of usage, obtained through regression against time. With the help of ideal growth rate of inventories it is easy to ascertain the excess inventories in any terminal year. The excess percentage of inventories in the terminal year, say the eleventh year of the period, will be given by

$$\frac{I_{11} - \hat{I}_{11}}{I_{11}} \times 100 \qquad \ldots\ldots(1)$$

where I_{11} is the actual inventories of the terminal year; $\hat{I}_{11}$ stands for inventories under ideal conditions of square root relationship. It can be obtained by $I_o \times (1+g)^{11}$ where 'g' is the unity growth rate of inventories under ideal conditions of square root relation with sales/usage and I_o is the actual stocks in the initial year.

Substituting in (1) the value of $\hat{I}_{11}$, we get

$$\text{Percentage of Excess stocks in terminal year} = \frac{I_{11} - I_o\ (1+g)^{11}}{I_{11}} \times 100$$

$$\text{or} \quad \left\{ 1 - \frac{I_o (1+g)^{11}}{I_{11}} \right\} \times 100 \qquad \ldots\ldots(2)$$

If excess holdings in 10th year are to be calculated, then growth rate over the decade will be worked out and inventories of that year, i.e., I_{10} will be put. In that way excess stocks in any year can be estimated.

For the above calculations the inventories in the initial year are assumed to be normal. If stocks in the beginning of the period under study are found to be excessive to requirement, then the above formula (2) will give an under-estimate of excess inventories. The various case studies made by the Committees on Inventories Control of Bureau of Public Enterprises and Committees on Public Undertakings show that in the initial year for want of experience, most of the public undertakings were guided by the advice of foreign consultants on the purchase of stocks and spares. This, in a large number of cases, resulted in the piling of stocks which could not be used for many years. The stocks surplus to the needs of initial years should normally lead to relatively-less purchases in subsequent years and in these circumstances it should be easier to adhere to the square-root relationship. It is also assumed that during the period of eleven years safety and policy variables did not change. In fact with the economic and technological development during the period, the risk of uncertainity in availability of raw materials and spares has been relatively reduced in later years. On this account also, therefore, the undertakings should carry comparatively less stocks. As such in these circumstances by estimation of the excess inventories on the assumption of no change in safety and policy variables, there is no over-estimate. In any case the excess of inventories estimated through above methodology must be interpreted in proper perspective. It is calculated through a technical relationship and is not based on actual behaviour of inventories *vis-a-vis* usage/sales. The behaviour pattern can be studied more meaningfully through application of models. The models help in examination of the extent of economies of scale and not in assessing the level of excess stocks existing on any date. Though the growth rate in methodology is simple to apply and gives an approximate idea about savings the public undertakings can make in holding of inventories, yet its inherent difficulty of being static in nature must not be forgotten. Moreover, the above methodology of the estimation of growth rate of inventories under ideal conditions derived from rate of increase in sales, will not reveal the confidence level of the strength of association between two variables, as the models do. In view of these limitations the excess percentage of stocks in the terminal year generated by analysis of growth rates should not be viewed with arithmetic accuracy as the figures might seem to convey. It is only an approximate excess under laboratory conditions.

Analysis of Growth Rates : During the first seven years value of produce

and inventories grew at 21.5 and 11.06 percent respectively. If inventories in that period had moved in the square-root relationship of sales, the growth rate would have been 100 $\left(\sqrt{1.215} - 1\right)$, i.e., 10.2 percent. The actual growth rate of 11.06 is marginally different from the 10.2 percent rate. Over the eleven years, the value of produce grew at a compound rate of 28.46% per annum (obtained through regression) and the inventories increased at 22.3 percent. If the square-root relationship had been adhered to, the growth rate of inventories would have been 13.34% rather than 22.3%. It seems after oil crisis in 1973-74, inventories increased at a much faster rate as compared to that of the first seven years of the period under study. At the end of 11th year petroleum enterprises had excess stocks of 44.4 percent as compared to what it should have been under the optimum conditions determined by square-root relationship. Thus out of total holdings of Rs. 433 crores nearly Rs. 197 crores are excess to the working under optimal conditions.

If the inventories of crude materials and spares had moved in square-root relationship with their usage, the rate of growth would have been 11.1 over first eight years, and 13.7 over the first nine years as against the actual growth rates of 12.72 and 15.43 percent. This also indicates that in first eight years inventories moved quite closely to the square-root of consumption and thereafter some signs of deterioration are seen. If the entire period of eleven years is taken into account the inventories of crude materials and spares under square-root relationship should have grown at 15.26% whereas actual rate of growth was 19.97%. This shows the importance of perpetual control of inventories. Unless a constant watch over inventories is kept it is not possible to have optimum use of funds invested in stocks. The excess inventories of raw materials and spares in the terminal year of the period under study as compared to those required under ideal conditions of square-root relationship are 28.88 percent, i.e., Rs. 69 crores out of total holdings of Rs. 237.6 crores in 1976-77.

The stocks of finished goods in the first seven years of study increased at a compound growth rate of 8.9 percent whereas sales during the period grew at 21.5 percent. By any standard the rate of growth in finished goods inventories was extremely low and it was lower than even the rate of growth under conditions of square-root relationship which works out at 10.2%. In subsequent years the stocks of finished goods

increased at a much faster rate. During eight years, the value of produce increased marginally from 21.5 (in first seven years) to 21.79% and inventories of finished goods shot up to 13.93% as compared to 8.9% and crossing the growth rate under square-root relationship conditions. If the entire period of eleven years is studied together, then the growth rate under ideal conditions of management control should have been 13.34%, whereas it actually was 24.66%. On that basis excess holding of finished goods works out at 47.14% i.e., about Rs. 90 crores out of Rs. 190 crores stocks of finished goods.

In-depth Studies

The Committees on Inventory Control of Bureau of Public Enterprises enquired into the levels of inventories and methods of control in ONGC and Barauni Refinery. The Committee on Public Undertakings (Fifth Lok Sabha) reviewed the control system of ONGC in their Sixteenth Report. The Indian Oil Company is the other undertaking which was studied by the Committee on Public Undertakings (Fifth Lok Sabha—52nd Report). The inventory position is further reviewed every year by Bureau of Public Enterprises in their Annual Report of Central Government Undertakings. These studies give evidence of excess inventories of spares. In the initial years this group of enterprises purchased large stocks of spares on the advice of foreign collaborators and with a view to utilising credit facilities offered by various countries. As a result, despite disposal of surplus stores every year, the undertakings still had excessive inventories. On the basis of norms of stock holdings recommended by Committees on Inventory Control, ONGC and Barauni Refinery had between 30 to 33 percent excess inventories in different years of study.

Analysis of growth rates indicated an overall excess of 44 percent whereas two case studies revealed figures of 30 and 33 percent. The experience of other countries show that a reduction of stocks between 20 to 25 percent in manufacturing undertakings is within easy reach of management through modern inventory techniques. This will release nearly Rs. 100 crores of capital for active use, apart from saving 10 to 15 percent of carrying cost of stocks every year as revealed by case studies of Bureau of Public Enterprises.

Conclusions

To study the behaviour of inventories of 11 Central Government Petroleum Enterprises over 1966-67 to 1976-77 six tests were applied. These related to : (i) inventory turnover ratios; (ii) trends in investment of inventories—absolute and in terms of period of usage/sales; (iii) comparison of level of holding with similar undertakings under different management styles; (iv) regression analysis according to three preconceived models; (v) analysis of growth rates; and (vi) corroborative evidence from in-depth study at micro level. The results of investigations are consistent in respect of the following conclusions :

i) The evidence here indicates that the undertakings of petroleum group had taken advantage of economies of scale in holding inventories, but these are not as great as those indicated by the square root formula evolved by management scientists. As a result we hold stocks more than what are required for efficient production flow. Our estimate indicates scope of reduction of inventories of about 44 percent, i.e., of Rs. 197 crores out of total average stocks of Rs. 443 crores in last year of the period under study.

ii) The two case studies show that the undertakings had in the initial years purchased excess inventories of spares partly on the advice of foreign collaborators and partly with a view to utilising credit facilities offered by various countries. As a result, despite disposal of surplus stores every year, the undertaking had still carried some excessive inventories. According to one study the excess holdings were of the order of 30% of the stocks on 31st March 1969.

iii) Keeping in view the experience of other countries a reduction of stocks between 20 to 25 percent is within easy reach of management through modern inventory techniques. This will release about Rs. 100 crores of capital for active use apart from savings in carrying cost of stocks every year.

iv) If judged from the turns ratios alone, the inventory performance in this group of enterprises is quite good as compared to the companies in U.S.A. The sales to inventory turns ratio for 37 petroleum integrated corporations of America had a range of 11.7 to 3.7

upper and lower quartile, the medium being 6.3. This ratio in the petroleum group of Central Government public sector undertakings during the period under study varied between 6 and 10. The highest achieved rate was 9.96 in 1976-77, the mode being 9.

v) The turnover ratio of raw materials consumed and their average inventories has shown on the whole progressive improvement. Considerable economies of scale were exercised upto the first nine years of the period under study. In the last two years of the study there had been substantial increase in inventories. On the whole the excess inventories over actual holdings at the end of 11th year as compared to those required under ideal conditions of square-root relationship are in the neighbourhood of 29%, i.e., Rs. 69 crores out of Rs. 238 crores. In the first eight years this component of inventories grew at the rate of 12.72% whereas under ideal conditions of management scientist it should have increased at the rate of 11.1%.

vi) Keeping in view the fact that work-in-process inventories are dependent on production cycle and pattern of sales, the holding in this category appeared to be satisfactory. During the period under study it had never exceeded 1.8 days of cost of sales and mode was 0.9 day.

vii) The inventories of finished goods in the first seven years of the said period had grown at a rate less than even the growth rate under conditions of square-root relationship. It was possible to have a very low growth rate of finished goods inventories in the first seven years due to large holdings of stocks in the base years. Subsequently in the last four years after fuel crisis considerations of economies of scale in the holding of inventories were less important than those of demand shrinkage and chances of break in regular supply. As a result, inventories were increased substantially. On a broad basis the undertakings in the 11th year carried excess inventories around 47% (Rs. 90 crores) of the actual stocks (Rs. 190 crores) as compared to the requirements under ideal conditions.

viii) The application of models to inventories of raw materials and finished goods show that the time series data has responded to

the model of square-root relationship in the first seven and eight years of the period under study. The other evidence brings out that the movement of inventories in square-root relationship with their usage in earlier years had been possible due to heavy build-up of stocks in initial years. If all the eleven years are considered together, then raw materials have moved at a rate slightly higher than under-root of the usage and finished goods at constant ratio with sales.

ix) During the period under survey when Inventory models were given wide currency some rationalisation took place in inventory policy, and substantial advantages of economies of scale were taken. A constant vigilance on the levels of inventories is necessary to maintain them at an optimum level.

x) The evidence here on the whole does not refute but rather supports the generally held hypothesis that level of inventories is higher than what is required for efficient production and service flow. □

Assessment Centres

Narendra K. Sethi* & Philip Matarese**

Concept Definition

What is an assessment centre? What does it do? What are its functions? These are just several questions being asked today by more and more people in the business world. Simply put, an assessment centre is a "place where assessments are made ".[1] In a recent issue of their publication, *Training and Development Journal*, (March 1972) the American Society for Training and Development defined assessment centres in the following manner[2] :

> An Assessment Centre is a multiple assessment of several individuals performed simultaneously by a group of trained evaluators using a variety of group and individual exercises.

Walter S. Wilkstrom, writing in the *Conference Board Record*, also has considered and gives attention to this relatively-new technique and reports[3] :

> Assessments...are the pooled judgments of several specially trained managers who use a variety of criteria to evaluate a man's performance as he goes through several different test situations. Usually some paper-and-pencil tests are also used, and an intensive interview is a normal part of the assessment procedure. It is this matter of multiple judgments based upon observations of performance in several situations that is the crux of the assessment centre method.

Richard Steiner, in his article, "New Use for Assessment Centres—

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1. Walter S. Wilkstrom, "Assessing Managerial Talent", *The Conference Board Record*, March, 1967, p. 39.
2. *Training and Development Journal*, "An Assessment Centre Program for Multi-Organizational Use", American Society for Training and Development, March, 1972, p. 6.
3. Wilkstrom, *Op. Cit.*, p. 39.

Training Evaluation" evaluates and defines for us what he considers an assessment centre to be, and the role it can perform in the organisation. He writes[4] :

> As originally conceived, an assessment centre is a multi-functional mechanism.
>
> First, it can aid an organisation in the critical selection process by providing a mechanism for objectively identifying and determining immediate management potential.....
>
> Second, the centre serves as a means for identifying and developing individualised executive improvement strategies...
>
> Third, the assessment centre can be thought of as a training vehicle. Research indicates that participants view the assessment process as a learning experience...
>
> Fourth, the assessment centre can have a positive influence on morale, job expectations, and motivation. Candidates view the centre as a means for fairly and objectively evaluating their worth and ability to perform...
>
> Finally, the centre can be used as a highly accurate means for evaluating executive development, or other types of training programmes.

It has been our intent in this section not to deal with the specific procedures and tasks that make up the programme of an assessment centre. Such specifics will be dealt with later. For now, our goal in this introduction has been to acquaint the reader with a basic overview of the assessment technique regarding its nature, function, and purpose through concept definition. As one might expect, much confusion had arisen regarding this relatively-new methodology and the precise nature and organisation of a typical assessment centre. Even the name is somewhat misleading. For example, the assessment centre is not a particular place nor a particular location as might be implied

4. Richard Steiner, "New Use for Assessment Centres – Training Evaluation", *Personnel Journal*, April, 1975, pp. 236-37.

but rather, it is a technique for employee selection, development, evaluation and training, occuring possibly in many different locations.

Allen I. Kraut has clarified the concept in his article entitled, "New Frontiers for Assessment Centres" wherein he provides us with the comparisons as illustrated in Chart I.

CHART I

What an Assessment Centre Is ..

The Task Force on Development of Assessment Centre Standards has recommended that a programme be considered an assessment centre only if it meets the following minimum requirements :

1. Multiple assessment techniques must be used. At least one of these techniques must be a simulation *(A simulation* is an exercise or technique designed to elicit behaviours related to dimensions of performance on the job by requiring the participant to respond behaviourally to situational stimuli. The stimuli present in a simulation parallel or resemble stimuli in the work situation.)
2. Multiple assessors must be used. These assessors must receive training prior to participating in a centre.
3. Judgments resulting in an outcome (that is, recommendation for promotion, specific training, or development) must be based on pooling information from assessors and techniques.
4. An overall evaluation of behaviour must be made by assessors at a separate time from observation or behaviour.
5. Simulation exercises are used. These exercises are developed to tap a variety of predetermined behaviours and have been pretested prior to use to ensure that the techniques provide reliable, objective, and relevant behavioural information for the organisation in question.
6. The dimensions, attributes, characteristics or qualities evaluated by the assessment centre are determined by an analysis of relevant job behaviours.
7. The techniques used in the assessment centre are designed to provide information that is used in evaluating the dimensions, attributes, or qualities previously determined.

and Is Not

The following activities do not constitute an assessment centre :

1. Panel interviews or a series of sequential interviews as the sole technique.
2. Reliance on a specific technique (regardless of whether a simulation or not) as the eole basis for evaluation.
3. Using only a test battery composed of a number of pencil and paper measures, regardless of whether judgments are made by a statistical or judgmental pooling of scores.
4. Single assessor assessment (measurement by one individual using a variety of techniques such as pencil and paper tests, interviews, personality measures, or simulations).
5. Use of several simulations with more than one assessor where there is no pooling of data (that is, each assessor prepares a report on performance in an exercise, and individual, unintegrated reports are used as the final products of the centre).
6. A physical location labelled as an "assessment centre" does not conform to the requirements noted above.

Source : Allen I. Kraut, "New Frontiers for Assessment Centres". *Personnel*, July-August, 1976, pp. 32-33

Historical Development

> The assessment centre technique was pioneered by Dr. Douglas Bray and his associates at American Telephone and Telegraph Company in the mid 1950's.[5]

This statement by Allen I. Kraut, Personnel Research Manager at IBM, writing in *Personnel Journal*, is indicative of what many people believe to be the origin of the assessment centre methodology in use today. Careful examination of this technique reveals that its roots lie somewhat further into the past. As early as World War I, the Germans were supposedly using this concept for the selection of intelligence agents.[6] The Germans, however, were not alone. In the US, some individuals were aware and experimenting with the assessment centre approach. In a recent issue of *Public Personnel Management*, Donald S. Macrae provides us with the following[7] :

> Although the first reported application of assessment centres was by German Military Psychologists in selecting officers during World War I, the centre approach was probably first tried in the US private sector by Professor Henry Murray of Harvard University in his research on personality in the 1930's.

Using similar techniques on his students, Professor Murray's work and findings are contained and still available for observation in his book, *Explorations in Personality*.[8]

Renewed attention and concern was given to the assessment centres as the world approached and became involved with international conflict. The World War II saw increased use of the assessment centre for selection of officer candidates by both Germany and Great Britain. The United States Government also became interested in this evaluation and

5. Allen I, Kraut, "A Hard Look at Management Assessment Centres and Their Future," *Personnel Journal*, May, 1972, p. 317.
6. Dennis P. Slevin, "The Assessment Centre : Breakthrough in Management Appraisal and Development." *Personnel Journal*, April 1972, p. 256.
7. Donald S. Macrae, "..... An Academic Laboratory Report," *Public Personnel Management*, September-October, 1974, p. 367.
8. *Training and Development Journal, Op. Cit.*, p. 6.

selection tool. In *The Conference Board Record,* Wilkstrom reports[9] :

> In the United States, the World War II office of Strategic Services used assessments to pick men for clandestine assignments behind enemy lines.

The first industrial applications of the assessment centre occurred in the 1950's at AT&T, under the leadership of Dr. Douglas Bray.[10] In an article appearing in the *Journal of Applied Psychology,* Dr. Bray and Richard J. Campbell describe the beginnings of the programme at AT&T and what they had hoped to achieve. They write[11] :

> The assessment centre received its first industrial application when it was introduced into the Bell System in 1956 as a major research method of the Management Progress Study. Two years later, in 1958, an assessment centre was opened in the Michigan Bell Telephone Company for the appraisal of candidates for promotion to management from vocational occupations. The results of this first operational assessment centre were deemed so useful by line managers that the assessment-centre method spread widely through the Bell System until over 50 assessment centres were established in the Bell System Companies processing approximately 8,000 men and women each year who are candidates for management positions.

Due mainly to the success of the centres at AT&T and to the weaknesses and shortcomings of traditional testing and employee evaluations, the assessment centre idea has come to spread the use and acceptance in both the private and public sector of our country. The *Training and Development Journal* reports that in 1969, 13 organisations had developed and put into use an assessment programme.[12] Companies such as IBM, General Electric, J. C. Penney Co., Standard Oil and Sears, had become assessment practitioners.[13] By 1972, the

9. Wilkstrom, *Op. Cit.*, p. 39.
10. *Training and Development Journal, Op. Cit.*, p. 6.
11. Douglas W. Bray and Richard, J. Campbell, "Selection of Salesmen by Means of an Assessment Centre", *Journal of Applied Psychology*, 1968, Volume 52, No. I, p. 36.
12. *Training and Development Journal, Op. Cit.*, p. 6.
13. Slevin, *Op. Cit.*, p. 256.

number of assessment users had swelled to over 100. In his article, "... An Academic Laboratory Report" Macrae writes[14]:

> The Great Lakes Assessment Council (a consortium of States of Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin, and the cities of Chicago, Detroit, Milwaukee, Minneapolis and Toledo) funded by an Inter-governmental Personnel Act (IPA) grant, studied assessment centres and published a report in November 1972. The results of a year's research and study of assessment centres in the US indicated that over 100 different organisations, mostly private, had employed the assessment centre approach and had found it to be a most effective assessment technique.

We thus can see that the history of assessment centres is rather short, dating from approximately World War I. Its use in the private sector has been recognised only for the past 20 years. The impact it has made, and most assuredly will continue to make in the future, may prove it to be one of the most significant methods for evaluation, development, and training of employees ever devised.

Deficiencies of Traditional Methodologies : Comparison to Assessment Centres

Traditional methods of testing for employee appraisal, training or development has been part of the domain of the psychologist. With tools and techniques like psychological testing, interviews, ink blot intrepretations, human analysis and biographical sketches, he has been charged with the responsibility and duty to attempt evaluation and assessment of employee potential and possibie promotions. Until recently, his word and domain were sacrosanct. More and more, however, people have become aware of the limited effectiveness of these approaches to assessment. Dennis P. Slevin comments in his article "The Assessment Centre : Breakthrough in Management Appraisal and Development" on the effectiveness of the psychological testing[15] :

14. Macrae, *Op. Cit.*, p. 367.
15. Slevin, *Op. Cit.*, p. 255.

> "Thousands of psychological tests have been developed for the specific evaluation of personality traits and mental aptitudes, but they tend to be rifle shot approaches that evaluate some narrow aspect of executive potential."

Cabot L. Jaffee, Personnel Research Analyst at AT&T, has given considerable attention to the nature and use of psychological techniques. According to his findings published in *Personnel Journal*, he believes that there is a definite distinction and varying applicability between the business world and educational institutions. He writes[16] :

> It does appear that there are certain basic differences between industry and schools or clinics when one considers the role of the psychologist and the test. First, the information gathered about a man in industry is relative to selection for promotion, special assignment or some other special skill determination. In schools or clinics, the information answers-questions concerned with potential adjustment, intelligence and emotional problem areas . . . .
>
> A second major difference between testing in the two areas lie in the use to be made of the information. In schools and clinics, the information the tests provide is invariably used in a developmental way, that is the information is fed back to people interested in modifying the individual's behaviour for the better. In industry, on the other hand, the tests are used, for the most part, to accept or reject a man for a particular assignment, many times for some very tenuous reasons.

What is objectionable to Mr. Jaffee and other researchers is that the same psychological testing techniques are used by the psychologists in a wide and varying range of situations and environments to examine and evaluate individuals, for diverse reasons, uses, goals and purposes. Such practices and procedures are both highly questionable and thus unacceptable to Jaffee. He continues[17] :

16. Cabot L. Jaffee, "Managerial Assessment : Professional or Managerial Prerogative ?" *Personnel Journal*, 1966, Volume 45, p. 162.
17. *Ibid.*, p. 162.

> .....There may be basic difference between testing in industry and testing in other traditional psychological domains. They have, however, apparently been equated on an almost one to one basis in many people's minds—what the psychologist can do in the clinic he can do in the factory. In regard to this point, the psychologist has, in many cases, been remiss in his duties by being all too willing to use the same technique in both types of setting.

What are some of the other traditional problems that make the assessment centre technique so appealing today? In a recent article in *Personnel*, William C. Byham and Regina Penetecost compare the assessment centre approach to traditional schemes and tell us some of their findings[18] :

> Studies made of thousands of employees assessed during the last few years indicate that the assessment centre method is much more accurate than traditional appraisal procedures.

Their rejection of traditional means is summarised in the following remarks[19] :

> Appraisals are often distorted by supervisors who try to achieve short-range salary advantages for subordinates, and by the differences in supervisors' own values and abilities. In the assessment centre method, accurancy is assured because standardised exercises provide an opportunity for assessors to evaluate candidates under constant conditions, which make possible comparative judgments.

Walter S. Wilkstrom in the *Conference Board Record* views the assessment centre technique particularly useful for two common problems that traditional analysis has had limited success[20] :

> For one thing, the work of a craftsman is quite different from

18. William C. Byham and Regina Penetecost, "The Assessment Centre : Identifying Tomorrow's Managers," *Personnel*, September-October, 1970, p. 17.
19. Ibid , pp. 17-8.
20. Wilkstrom, *Op. Cit.*, pp. 39-40.

> that of a manager. Yet, a manager trying to select a future foreman has to go by job performance as a craftsman . . . . Another problem is that the manager probably can consider only a very few of the men who should be under consideration. Thus he may have only a limited idea of the range of talent that is available. An assessment centre, on the other hand, can assess all the men who seem to have management potential . . . .

The ineffectiveness of traditional methods to determine employee potential is an area discussed in *Business Week*. In an article entitled, "Where they make believe they're the boss," *Business Week* quotes Douglas Bray of AT&T[21] :

> With assesment, you can also find talent you might otherwise miss, says Bray, and an example from a pilot programme at the Autolite-Ford Div. of Ford Motor Co. tends to bear him out. One of the 12 middle-manager candidates, recalls James Anderson, the personnel-planning coordinator, was a man with no college training who had never worked in an office. "He had a time clock in his head and out-analysed most of the guys," says Anderson. "He'll probably get a promotion he would not have gotten if he hadn't gone through the exercises."

Another problem facing traditional means of evaluation has been legal in nature. Recent court rulings and legislation such as the Anti-Discrimination law, EEOC, and Affirmative action, etc., have worked to ban and eliminate many established testing techniques as discriminatory and thus illegal. If a procedure is not closely related to the job function, its validity and viability may be in question. Assessment centre methodology has been and continues to be accepted by legislative and governmental bodies as a legitmate selection technique. Donald S. Macrae comments[22] :

> Assessment labs offer a process which appears to be in compliance with the US Equal Opportunity Commission

21. *Business Week*, "Where they make believe they're the boss," August 28, 1971, p. 34.
22. Macrae, *Op. Cit.*, pp. 367-68.

> regulations. Lab designs are behaviour-based and provide simulations of job-related tasks. Content validity is easily demonstrated, provided the behaviours selected for observation are shown to be those required for job success. Reported experience with assessment labs in both industry and government feel that behavioural approaches to selection are fair and impartial.

The problem of accurately evaluating women employees is particularly acute. Douglas Bray discusses this problem and the use of assessment centre techniques as a solution[23]:

> It is very hard to convince managers who might take a woman on a transfer basis into a job usually thought of as "male" that she has the requisite ability. Even her own boss may be skeptical about advancing her, since the undemanding nature of many entry jobs for women does not allow a real demonstration of ability.

How does one determine and evaluate the management potential present in the group of female employees under these circumstances? How does one select and promote to be consistent with and satisfy affirmative action for example? According to Bray[24]:

> A thorough evaluation of potential is needed not only as a persuader, but to determine that the candidate actually does have the abilities needed.

The solution to this problem for Bray and for many other writers is the assessment centre technique.

As indicated in the paper, more and more organisations have begun to realise the effectiveness and benefits of the assessment centre approach when compared to the evaluation and testing tools of the past. In their article, "Assessment Centres—Further Assessment Needed," Wilson and

23. Douglas W. Bray, "The Assessment Centre : Opportunities for Woman", *Personnel*, September-October, 1971, p. 31.
24. *Ibid.*, p. 31.

Tatge comment on this growing acceptance, of assessment centres[25] :

> In some companies, line managers, staff professionals, and industrial psychologists are strongly enthusiastic about its advantages when compared with more traditional approaches. For example, William C. Byhan, formerly Manager of Selection, Appraisal and General Management Development of J.C. Penney (who has developed centres and surveyed others), states : "While the effectiveness of an assessment centre has not been proved beyond the shadow of a doubt, all the research, both published and unpublished, seems to indicate that the method has more validity than other existing methods.

Ginsburg and Silverman in their article, "The Leaders of Tomorrow : Tneir Identification and Development", provide us with a short summary of some important points[26] :

> Compared to other forms of personnel appraisal, this method [assessment centre] is seen to be more effective because all assessees (1) have an equal opportunity to display their talents, (2) are seen under similar conditions in relevant situations designed to bring out the particular skills and abilities needed for the position or positions for which they are being considered, and (3) are evaluated by a team of trained assessors, unbiased by past association, who are intimately familiar with the position requirements and the institutional climate.

Probably one of the most convincing arguments is from William C. Byham in one of his many articles on this topic. According to him, a company that uses the traditional techniques is putting itself in a weak and dependent position. He explains[27] :

> When a company uses psychological tests alone, or sends

25. James E. wilson and Walter Ashton Tatge, "Assessment Centres—Further Assessment Needed", *Personnel Journal*, March, 1973, p. 173.
26. Lee R. Ginsburg and Arnold Silverman, "The Leaders of Tommorrow : Their Identification and Development", *Personnel Journal*, September, 1972, p. 663.
27. William C. Byham, "Assessment Centre for Spotting Future Managers", *Harvard Business Review*, July-August, 1970, p. 155.

candidates to an outside psychologist for evaluation, it is in reality weakening itself because its executives are becoming dependent on others.

The assessment centre method not only improves the assessee but the assessor improves as well, and thus the entire company benefits.

Chart II illustrates assessment centre benefits by comparing it with other methods.

CHART II

Comparison of Assessment Centre Method with Typical Use of Panel Interviews and Testing

Assessment Centre	*Panel Interviews*	*Paper & Pencil Test*
Built around dimensions carefully defined through job analysis, and all dimensions are systematically covered.	While dimensions from research may be used, more often no list is used or an inadequate list is used. No real attempt to cover all of the dimensions is made in the interview due to the usual lack of structure.	Tests may be selected by job analysis but tests only attempt to predict certain of the dimensions. For example, tests are poor at determining interpersonal dimensions.
Dimensions are agreed upon by management before use. This creates an acceptance and understanding of them.	Usually not the case	Usually not the case.
The involvement of higher-level manager in the selection of assessment centre dimensions and as assessors allows them to make effective use of assessment centre reports and to believe in the results because they understand the system.	Membership of higher-level managers on interview panels often increase their distrust of the Panel Interview process as they feel it is unreliable. Thus they discount the results.	Unless a specific cut-off score is used as in Civil Service Examinations, the users of the test results seldom know how to integrate the test results with other performance data.
Multiple exercises are used. The participant can be observed in different situa-	Single exercise.	Tests may be slightly different depending on tests used but all generally

CHART II *(Contd.)*

Assessment Centre	*Panel Interviews*	*Paper & Pencil Tests*
tions : group and non-group; small and large group exercises that require preparation and those that do not; exercises where the participant is a subordinate, peer, supervisor; exercises requiring oral, written and other skills.		emphasise written and cognitive skills.
Uses multiple judgements (3 to 6 assessors) which increase accuracy and decrease bias.	Uses multiple judgments.	Quantitave score. Use of score may be judgmental.
Trained observers are used.	Participants in panel interviews are seldom trained and seldom have adequate time to plan the interview.	
Assessors usually do not know participants.	Interviewers usually do not know participants.	
Assessors are several levels above participants and thoroughly know the target-level job.	Interviewers are several levels above participants and thoroughly know the target-level job.	
Real behavirous observed.	What a participant says he would do or has done is determined. Follow-up of important areas possible.	Participants often say what they think will get a high score in nonability tests.
Formal method of recording observations used.	Usually no formal method of recording observations of behaviour or insights.	Formal method of collecting data used.
Large amount of data on participant obtained.	Small amount.	Small amount.
Procedure delays final decision until all information about participant is obtained.	Research indicates that interviewers quickly jump to a decision and their subsequent questions are often an attempt to reinforce the first decision.	Highly quantitative.

CHART II *(Contd.)*

Assessment Centre	*Panel Interviews*	*Paper & Pencil Tests*
Highly-structured programme producing quantitative results	Low in structure. Low in quantitative results.	Highly quantitative.
High reliability.	Low reliability.	High reliability.
Validities usually around 4 to 5.	Little known about validity.	Seldom above 3.
Technique flexible to various jobs.	Technique flexible to various jobs.	Less flexible because content validation for supervisory and managerial jobs is more difficult to achieve.
Relatively easy to establish content validity (job-relatedness).	Difficult to establish content validity (job-relatedness).	Difficult to establish content validity (job-relatedness).
Criterion-related validity research should be conducted.	Criterion-related validity research should be conducted.	Criterion-related validity research should be conducted.
Produces insights into development needs that can be benefical whether or not the participant is promoted.	Not usually the case	Not usually the case.
Process is understandable to participants, they see it as a fair means of evaluating all areas of management potential.	Participant evaluation of fairness depends on interviewers. Most interviewers feel interview covers only a portion of important management skills.	Often misunderstood, biases carried over from negative school experiences.

Source : William C. Byham and Carl Wettengel, "Assessment Centres For Supervisors and Managers...An Introduction and Overview," *Public Personnel Management,* September-October, 1974 , p. 359-60.

Assessment Centre

As previously stated, the assessment centre method is not a place but a technique for evaluation, selection, development and training of company personnel. Under common operating procedures, a dozen individuals or assessees undergo a battery of simulated, job-related exercises over a

period of 3½ days. With one assessor for every two assessees, the entire programme normally lasts five days. After the assessees or candidates finish their tasks and leave, the remaining time is spent by the assessor in their evaluation and report preparation regarding individuals examined. At this point the following happens. William C. Byham and Carl Wettengel describe the typical flow of events[28] :

> After the centre, the participants return to their jobs while the assessors spend from one to two and one half hours discussing individual observations of each participant .. Considering all the observations of behaviour during the centre, assessors eventually agree on an evaluation of the participants' strengths and weaknesses relative to each of the dimensions sought A written report of the centre results is prepared by the centre administrator and is distributed to the participant and/or higher level management.

To better develop the typical assessment centre and its activities, let us see how a typical centre might operate the organisation, and the various functions that are required. *Harvard Business Review* provides us with what one could consider a typical assessment cycle to contain based on the programme of the J.C. Penney Company.

While this approach is typical of most assessed centre operations, variations do exist. The Wolverine Tube Division of Universal Oil Products, Allen Park, Michigan, for example, has developed an abbreviated approach. *The Society for Advance Management Journal* reports that Wolverine Tube Company had "developed and validated a one-day assessment centre, thereby reducing considerably the length of time necessary to assess 12 people".[29] Let us now view in greater detail the important aspects of the assessment approach.

A. KEY DIMENSIONS

The first important step and consideration of any evaluation, training or selection programme is the determination of specific qualities or

28. William C. Byham and Carl Wettengel, "Assessment Centres for Supervisors and Managers..... .. ...An Introduction and Overview", Public Personnel Management, September-October, 1974, pp. 353-54.

characteristic abilities required for satisfactory performance. Ann Howard, Director of Research at L. F. McManus Co., Worcester, Mass., identified fifteen management qualities upon which an individual should be critiqued[30]. Because of the growing interest in this field and possible lack of uniformity, and because "many lists of management traits, abilities, and characteristics are available,"[31] the American Management Association decided to direct attention into this area and develop an assessment centre programme, generalised and applicable to many varied business situations. According to John H. McConnell, writing in *Personnel*, the AMA listed twelve "Management traits, abilities, and characteristics"[32] they consider important and are as follows[33] :

Functional ability : Existing successfully in one's environment.

Planning : Developing a course of action to achieve an objective.

Organising : Structuring or arranging resources to accomplish the objective of a plan.

Controlling : Maintaining adherence to a plan, modifying it if necessary, to achieve the desired result.

Oral communication : Transferring a thought from one person to another by speech, adjusting to audience reaction.

Written communication : Transferring a thought from one person to another by writing, without the possibility of response to audience reaction,

Company orientation : Identifying the organisation's goals and values as complementing one's own.

Leadership : Getting people to work toward reaching an objective.

Decision making : Consciously weighing and selecting one or two or more alternatives.

29. *Society for Advanced Management Journal*, "The Assessment Centre Technique", October, 1973, p. 27.
30. Ann Howard, "An Assessment of Assessment Centres", *Academy of Management Journal* Volume 17, No. 1, March, 1974, p. 117.
31. John H. McConnel, "The Assessment Centre : A Flexible Program for Supervisors", *Personnel*, September-October, 1971, p. 36.
32. *Ibid.*, p. 36.
33. *Ibid.*, p. 36.

Creativity : Developing alternate solutions to problems.

Initiative : Introducing one's own thought or action into a situation.

Flexibility : Adjusting to changing internal and external conditions, both personal and impersonal.

Once the critical dimensions for assessment have been determined, the appropriate measurements and testing devices or exercises can be developed to evaluate and select management potential.

B. SELECTION TECHNIQUES, DEVICES AND EXERCISES

With the desired managerial abilities and strengths in mind, appropriate exercises or tests can be developed and implemented to 'tap' or determine what and where potential might lay. Chart No. III is typical of the assessment centre exercises.

In the report, "The Use of the Assessment Centre in a Government Agency's Management Development Program" (June 29, 1972), various segments of the Metropolitan Transit Authority Assessment Programme are discussed, which is based on the American Management Association Assessment Centre Programme[34] :

> The eight Management Simulation Workshop exercises are designed to provide a method of clearly observing and evaluating performance in all 12 of the supervisory management abilities. These exercises, therefore, reflect typical problems and situations encountered by managers. The workshop exercises are :
>
> An *Interview* based on a background information form completed by each participant.
>
> A *Management Questionnaire* of ten questions concerning supervisory problems.

34. "The Use of the Assessment Centre In a Governmental Agency's Management Development Program, "The Metropolitan Transit Authority of New York City, June 29, 1972, pp. 4-5 (Unpublished).

An *In-basket* of supervisory mail handled by the participant in the role of a supervisor and followed by a role-played interview with a superior.

CHART III

Description of Exercises

Assigned Role Group Discussion
In this leaderless group discussion, participants, acting as a city council of a hypothetical city, must allocate a one-million-dollar federal grant in the time allotted or make other judgments on the varying proposals offered. Each participant is assigned a point of view to sell to the other team members and is provided with a choice of projects to back and the opportunity to bargain and trade off projects for support.

Non-assigned Role Group Discussion
This exercise is a cooperative, leaderless group discussion in which four short case studies dealing with problems faced by executives working in state government agencies are presented to a group of six participants. The participants act as consultants who must make group recommendations on each of the problems. Assessors observe the participant's role in the group and the handling of the content of the discussion.

In-basket Exercise
Problems that challenge middle and upper-level executives in State government are simulated in the in-basket exercise. These include relationships with departmental superiors, subordinates and peers, representatives of other departments, representatives of executive and legislative branches, the public, and the news media. Taking over a new job, the participant must deal with memos, letters, policies, bills, etc., found in the in-basket. After the in-basket has been completed, the participant is interviewed by the assessor concerning his/her handling of the various in-basket items.

Speech and Writing Exercises
Each participant is given a written, narrative description of a policy, event, situation, etc. and three specific situational problems related to the narrative, each requiring a written response. The participant is also required to make a formal oral presentation, based upon the background narrative description, before a simulated news conference attended by the Capital Press Corps and interested government officials and citizens (assessors).

Analysis Problem
The analysis problem is an individual analysis exercise. The participant is given a considerable amount of data regarding a state agency's field operations, which he/she must analyze and about which he/she must make a number of management recommendations. The exercise is designed to elicit behaviors related to various dimensions of managerial effectiveness. The primary area of behaviour evaluated in this exercise is the ability to sift through data and find pertinent information to reach a logical and practical conclusion.

Paper and Pencil Tests
Three different commercially-available objectively scoreable tests are included in the assessment : a reading test used for self-development purposes, a reasoning ability test, and a personality test. The latter two are being used experimentally at present, and as with the reading test, are not made available during assessor discusions.

Source : William C. Byham and Carl Wettengel, "Assessment Centres for Supervisors and Managers, ... An Introduction and Overview", *Public Personnel Management*, September-October, 1974, p. 355.

A *Luncheon* meeting in a group of three participants with an assessor.

A *Film Case Discussion* involving an employee promotion.

A *Selection simulation* in which criteria for supervisory selection and success are reviewed.

A *Management decision game* having to do with running a small company and handling merger negotiations.

Participant's written evaluations of their own performance.

One might legitimately ask at this point how typical are these exercises and functions presented by the AMA. Joseph M. Bender did just this to find out just what was typical of assessment centres. After contacting 38 organisations employing assessment centre techniques, in the US and Canada, he put together a summary[35] as shown in Chart IV.

CHART IV

Primary Evaluation Devices Used by Companies Operating Assessment Centres

	Yes	*No*	*Not Checked*
In-basket exercises used	31	3	4
Business game exercises used	30	4	
Assigned roles	19	11	4
Non–assigned roles	20	12	2
Leaderless group discussion exercises used	31	0	3
Assigned roles	23	9	2
Non-assigned roles	23	9	2
Films used	5	29	
Video tapes used	15	19	
Psychological tests used	20	13	1
For the most part, assessment devices are locally produced	23	10	1
For the most part, assessment devices are purchased externally	9	24	1
Ann-depth background interview is given to assessees	22	12	

Source : Joseph M. Bender, "What 'is Typical' of Assessment Centres?", *Personnel*, July-August, 1973, p. 51.

35. Joseph M. Bender, "What is 'Typical' of Assessment Centres?", *Personnel*, July-August, 1973, p. 51.

We can see that there is indeed consistency of techniques among these user organisations. Strict adherence to predescribed principles or procedures, however, should be avoided. The approach or technique to be employed must depend on the particular circumstances, the personnel involved, and on a multitude of other variable factors. Customised or tailor-made procedures are usually necessary. Byham states that,[36]

> . . . there is no right or wrong way to structure a centre—the specific application must be designed to meet specific company needs and operating requirements. This flexibility is reflected particularly in the variety and combinations of exercises in centres. Each company chooses exercises that bring out the behaviour they desire to assess.

C. WHO IS TO BE ASSESSED?—CANDIDATE SELECTION

In a recent issue of the *Academy of Management Journal*, Ann Howard discusses this question of selection[37] :

> Typically, assessees are in their first management position or are being considered for management. Candidates for other jobs are rapidly being included in assessment programs. However, assessees are usually nominated by their supervisors to attend the centre. There is some contradiction in this, since a basic purpose is to find a better way of rating potential than reliance on the supervisor's judgment.

In a situation such as this, bias and favouritism can get in the selection process. The decision as to whether a subordinate is to go to assessment or not often lies solely with his superior which can be self-defeating. Byham comments[38] :

> One of the reasons for using the assessment centre technique in the first place is to overcome some of the prejudices and biases inherent in supervisory judgment; yet the super-

36. William C. Byham, *Op. Cit.*, p. 152.
37. Ann Howard, *Op. Cit.*, p. 119.
38. William C. Byham, *Op. Cit*, p. 155-56.

> visor is ordinarily made the sole judge of whether a person should be assessed.

Two alternative solutions to this problem have been suggested : 1 (let the employee decides himself if he wishes to attend assessment, or as Allen Kraut puts it, "invite candidates to nominate themselves to attend the assessment centres[39] ; " or 2) make assessment mandatory for everyone upon reaching a certain level in the organisation or for every promotion thereafter.[40]

As might be expected, significant costs are involved in these attempts to eliminate bias. Such additional cost will also have a limiting effect on the number of companies which can afford to install these safeguards. One last point to be considered and understood by any assessee selected for assessment is that success at the assessment does not mean immediate promotion or other mobility. Edwin B. Jelks, State Personnel Training Supervisor, Southern Bell, Atlanta, comments on this point[41] :

> Participation in the programme is strictly voluntary. Attendance at a centre does not guarantee or even imply immediate or future selection for a management position.

The assessment centre technique, if used properly, not only can help determine and select those with the most potential and probability of managerial success but also can help identify particular problems and provide insight for correction and elimination for those with weaknesses through appropriate training assistance. If properly organised, nobody should fail an assessment.

D. ASSESSOR SELECTION AND TRAINING

Ann Howard writes[42] :

> A typical assessment centre will have four to six assessors in anywhere from a 4:1 to 1:1 ratio to assessees . . .

39. Allen I. Kraut, *Op. Cit.*, p. 321.
40. William C. Byham, *Op. Cit.*, p 156.
41. Edwin B. Jelks, "The Assessment Centre," *Administrative Management*, October, 1971, p. 67.
42. Ann Howard, *Op. Cit.*, p. 119.

> Management members are usually two or three levels above the position for which the candidates are being assessed.

What criteria are necessary for assessor selection? The primary consideration should be the individual's track record or the history of past performance. Position in the organisation must also be considered. Assessors must necessarily come from the upper levels in the company in order to have greater insight into the functions and duties required of the position they are assessing and thus have a greater awareness of the characteristics an assessee should display. These are by no means the only considerations. Wilkstrom states[43] :

> Companies should seek assessors who seem to be perceptive in dealing with others, who seem able to establish rapport in talking with men and who have natural ability to understand what makes a man tick. Communications ability is required, both oral and written. Oral communication is important because the overall assessments are arrived at in conference with other assessors; reports of observations must be made clearly and concisely. The ability to write clearly is important for the many written reports of observations that will be required from a staff assessor during his term of service.

Similar to assessees, the assessor is also normally chosen to perform this function by his superior.[44] Similar prejudices, biases and other shortcomings may accompany this appointment to the staff.

Training normally consists of watching and doing the tasks and exercises that the assessee group must perform. Mrs. Howard writes[45] :

> They become familiar with the exercises by participating themselves, watching videotapes, or observing actual performances as non-voting members of the assessment team. The behavioural dimensions to be assessed are defined, and assessors are given practice and instruction in how to recognise these behaviours.

43. Walter S. Wilkstrom, *Op. Cit.*, p. 42.
44. William C. Byham, *Op. Cit.*, p. 156.
45. Ann Howard, *Op. Cit.*, p. 119.

The AMA multimedia Supervisory Management Course recognises this need for assessor training and lists various activities they consider prerequisite.[46]

CHART V

* Workbook programmed homework completed prior to each of four training sessions, covering the concepts and preparation necessary
* Role playing—to provide experience and practice with the various components of the assessment workshop
* Audio tapes—of actual assessor reports, to demonstrate the techniques used
* Simulation exercises—to provide experience in the workshop group exercises
* Programmed 16 mm film—providing interaction in the learning of observational techniques
* 16 mm training films—covering the visual parts of the assessment programme

A leader's guidebook provided for the assessment programme chairman, who is responsible for carrying out the assessor's training course

Source : John H. McConnell, "The Assessment Centre", *Personnel*, September-October, 1971, p. 38.

If an assessor is to be effective and perform his necessary duties well, adequate training and sound understanding of all aspects of the Assessment Centre is a prerequisite to his success.

Costs

Gino's Inc., a fast food organisation estimates that a one-week assessment of 12 individuals costs them between $5000 to $6000.[47] AT&T estimates, assessment cost to be approximately $500 per candidate.[48] IBM estimates its cost for 12 assessees to be $5000.[49] One might consider and include the expense of time lost from job for assessee and assessor alike. The Metropolitan Transit Authority of New York City (MTA) determines expenditures for its assessment programme in the following manner[50] :

46. John H. McConnell, *Op. Cit.*, p. 38.
47. Kristin Anundsen, "An Assessment Centre at Work", *Personnel*, March-April, 1975, p. 36.
48. William C. Byham, *Op. Cit.*, p. 160.
49. *Ibid.*, p 160.
50. "The Use of the Assessment Centre in a Governmental Agency's Management Development Program", *Op. Cit.*, pp. 20-1.

As with any such programme, the initial cost of both the programme and its administration must be considered along with its results. The initial cost of the AMA Assessment Centre included :

The cost of the total programme including film and training of two chairmen for one week.

The cost of training the assessors within MTA.

The cost of assessing each participant. Administration costs included :

The 12 participants, 4 assessors, and one chairman's time,

The cost of facilities

The cost of meals

The cost of consumable materials

For MTA the initial cost was approximately $6585. As the materials included in this cost are re-usable, the initial outlay will be over the next 5 years. Assuming 6 programmes a year, the cost per programme will be $219.50 which is $18.29 per participant.

The administration cost for assessing each group of 12 MTA participants was approximately $2135. This comes out to $177.92 per participant. The materials consumed in the programme are $9.58 per participant, so the total cost for assessing each participant's training needs for the MTA-AMA supervisory training course is $205.79

The cost of measuring each participant's change in supervisory behaviour due to training by conducting two assessment centres, one to training and one following training, is $393.29.

This cost level was well within reason and considerably below estimates for other assessment centre programmes and other methods.

Thus we see that costs can vary and can become quite substantial when significant numbers of individuals are to undergo assesssment. Yet, if we stop and add up the expense of promotion of one individual, the cost of trainning time, new job orientation, job time lost, and the months until he can perform the new duties in a productive and efficient manner and then discover he is unfit or ineffective, the assessment price tag may no longer be expensive.

Benefits

Gino's Inc. Vice-President Curt Russell comments on a problem facing his businesses and other firms today[51] :

> The company was expanding all over the place, and in just a short time we were approaching 200 million in gross sales... Everybody was concentrating on the entrepreneurial aspects of the business, and no one was paying any attention to manpower planning. Then we realised that we had people in managerial jobs they couldn't handle. If we were going to stay successful, we needed a programme for identifying managerial potential.

It was to the assessment centre technique that Ginos turned to resolve their problem. Management development became their number one concern and the assessment technique was the means they chose in order to (1) evaluate and select the best managerial potential and (2) evaluate and determine those who were weak and set about to eliminate the weaknesses, not the individuals. Kristin Anundsen, writing in *Personnel*, comments[52] :

> If a partIcipant has been found to be weak in certain areas of managerial expertise, the company will often pay for outside courses to develop these areas.

The important consideration is that assessment can help the determination of weakness as well as strength that otherwise might go undetected.

51. Kristin Anundsen, *Op. Cit.*, p. 29.
52. *Ibid.*, p. 34

Many users have begun to realise the significant role assessment centres can play in recognition of employee training needs. Byham and Wettengel write [53]:

> In addition to anticipated management development benefits of sizeable proportions from the candidate's increased insights into personal strengths and weaknesses, the programme will also provide the basis for a management development needs survey to guide allocations of developmental efforts and services.

Besides the more obvious benefits that can accrue to an organisation indirect benefits can also be realised. Some important factors are highlighted by Byham in his article in the *Harvard Business Review*[54] :

> The first and most obvious of these dividends is candidate training. Being involved and just doing any of the exercises and functions performed at the centre, some training of the individual will take place. Second, passing through an assessment centre has a positive influence on morale and job expectations. Not only are assessees positively motivated by just taking part in the assessment activities, for the first time, perhaps, a real glimpse of what managing is really like can be experienced. Individuals can as early as this point decide that managing is not for them.

Critics can take exception to this benefit and argue the possible ramifications regarding assessee selection. Kraut and Scott in the *Journal of Applied Psychology* identify two negative aspects which they label the "Crown Prince Effect" and the "Kiss of Death Effect." The crown prince is a point already discussed in this paper, that is[55].

> attendance at an assessment programme signifies one's special status to be accompanied by sure or rapid advancement.

53. William C. Byham and Carl Wettengel, *Op. Cit.*, p. 356.
54. William C Byham, *Op. Cit.*, p. 154.
55. Allan I. Kraut and Grant J. Scott, "Validity of an Operational Management Assessment Program", *Journal of Applied Psychology*, 1972, Vol. 56, No. 2, p. 127.

Probably the most important factor and benefit a company can receive from an assessment centre programme is that there are no absolute winners, nor does anybody lose; everyone benefits from this approach.

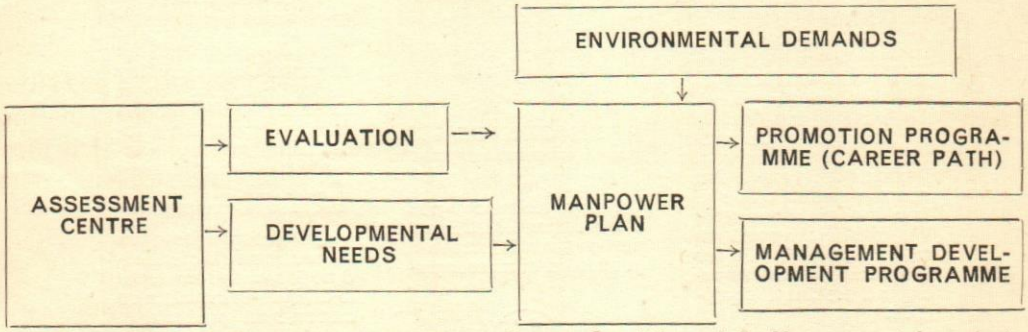
Evaluation : Conclusion

As one might presume, there are many ways to evaluate this relatively-new technique of assessment centres. The interested researcher could turn to several of the clinical and statistical studies that are available and deal with this assessment technique. Statistical analysis performed by individuals can and have indicated in concrete terms that assessment methods are superior to traditional technique.

What we have seen in this paper is not a technique that is a panacea or the ultimate selection device but rather, a methodology which when used in conjunction with the traditional means of evaluation and with significant amounts of commonsense can benefit employers and employees alike.

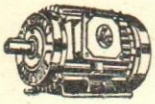
Chart VI illustrates the assessment centre as the future basis or foundation of what may be its direction in the future, or as Dennis Slevin sees it, as a significant part of "an effective and farsighted manpower plan.

CHART VI



Source : Dennis P Slevin, "The Assessment Centre : Breakthrough in Management Appraisal and Development", *Personnel Journal*, April, 1972, p. 261.

The assessment technique is just one further indication that business has begun to realise that human resources like other corporate assets must be guarded, protected and developed to ensure the continued vitality of the organisation, to ensure both survival and growth. □

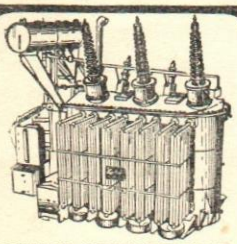


K. H. SERIES MOTOR

Kirloskar

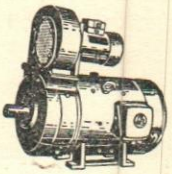


DIESEL WELDING SET

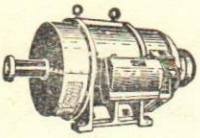


POWER TRANSFORMER

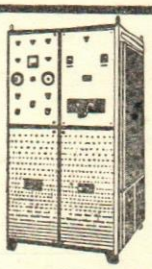
Kirloskar Electric . . . where diversification forms the nucleus of growth



D C MACHINE



ALTERNATOR



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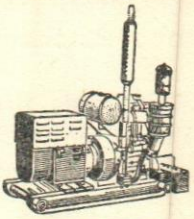

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Coking Coal Import : The Decision Problem

K. R. Shaligram*

Coking Coal (metallurgical grade, for use in the blast furnace) is an important input for the integrated steel plants. The recent debate between the steel and energy ministries, on the issue of import of coking coal, was the genesis of this paper. However, the objective of this paper is to discuss the decision problem involved.

Coking Coal

Coal is mineral in origin. It is constituted of volatiles (moisture and hydrocarbons), solid carbon, and a non-combustible solid residue called "ash". Coal for use in the blast furnace should possess the following properties :

1. The coal should be *Convertible to Coke,* by elimination of the volatiles, through the high-temperature carbonisation process. Incidentally, the elimination of volatiles implies that the percentage by weight of ash in *Coke* will be higher than the percentage in the *coal* from which it was made.

2. It should have *good caking properties.* In other words, the coke formed should be lumpy (not powdery) and hard, to withstand the compression and abrasion during its descent down the blast furnace. If the coke crumbles within the blast furnace, the fines will choke the passage of air, and cause serious problems in operations.

3. It should have *low percentage ash* by weight. The lower this percentage, the higher is the output of metal from the blast furnace. The prescribed norm is 18% under Indian conditions.

Blending of coals (a high-ash coal with a low-ash one, or a low-ash non-coking coal with a high-ash coking coal) prior to carbonisation, is one method of conserving coking coal, without sacrificing the properties

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of metallurgical coke. Efforts for blending of coal were, at least partly, frustrated by the erratic rail transportation (Johnson, p. 168).

Washing of coal, to separate the portions with low ash from those with high ash, is another method of utilising poorer grades of coal. However, the coal washeries in the country have not proved to be effective. Attempts have been made to partially substitute coke in the blast furnace with liquid fuels and pulverised coal, in an effort to conserve prime coking coal. Despite these practices, the industry still depends on bulk supplies of coking coal.

India has very limited reserves of coking coal, likely to be exhausted, within fifty years. This problem was created partly because of the use of coking coal with ash percentage as low as 9 to 10% for running the locomotives of the Indian Railways. This wastage was, of course mainly prevalent during the pre-Independence period. The ash content of coking coal had been increasing, because the low-ash upper seams in the older mines had been thus consumed. The currently-available coking coal contains upto 26% ash (*Times of India,* Jan. 14, 1978). Further, raising coal from deep mines involves many other problems. The managements of the integrated steel plants had been voicing their concern (from the early 1960's) about the rising percentage ash in the indigenous coking coal (Shaligram, p. 365). While they gained access to sources of good quality iron ore, the deteriorating quality of coking coal restricted the actual output of the blast furnaces. This was a national problem because steel is a basic industry. The country had to live with the problem, because internal economic conditions would permit no feasible solutions.

Decision Problem

In view of the comfortable foodgrain production and growing foreign exchange reserves, the Indian economy has lately been in an enviable position. With the changed economic conditions, the Government is planning to allow imports of crucial industrial inputs to utilise the foreign exchange reserves and to boost industrial output.

The steel ministry had estimated that by using an imported coking coal with less than 10% ash, the iron production (with the same blast

furnace) could be increased by 25 to 30 percent. "The ministry even tried a trial coal consignment in the steel plants. The initial results were rather good. The production did go up by 3 to 4 percent in spite of the severe power constraints during the trial period" (*Economic Times*, Dec. 1, 1977). Since the output of the same blast furnace can be increased with low-ash coking coal, the capacity utilisation is effectively higher. This increased productivity would be a contribution towards attaining the additional 1.3 million tonnes of ingot steel targeted to be achieved in 1978-79 (*Economic Times*, Jan. 4, 1978). The landed cost of the imported 4 percent ash coking coal may be of the order of Rs. 700 to 800 per tonne whereas the Indian 20 percent ash coking coal costs about Rs. 100 per tonne. These are essentially short-run considerations but the trade-offs involved are likely to remain valid in the long run also.

The decision problem, whether to import low-ash coking coal or not, can be expressed in terms of the following sequence of questions :

1. *Will the blast furnace technology survive for another fifty years?*

If the technology of iron-making changes so rapidly that the blast furnace process becomes obsolete (before the coking coal reserves run out) the best policy would be not to import coking coal. This is a problem in technological forecasting.

2. *What is the probable extent of deterioration of the Indian coking coal during the next 10 years or so?*

If the ash content is likely to increase rapidly, then perhaps, it would be better to begin importing low-ash coal to blend with the indigenous high-ash coal. Expert opinion would be required in assessing the extent of probable quality deterioration.

3. *What are the expected future prices of imported coking coal and indigenous coking coal?*

A detailed techno-economic study is called for. The price of the coking coal is linked with its ash content and location of the mines. An assessment of the improvement in blast furnace metal output for a 1 percent decline in coking coal ash content is necessary. Then the economics

can be worked out taking into consideration the incremental cost [Rs. 800—100=Rs. 700] of the low-ash imported coal, to be traded off against the realisation from the incremental output. As the prices of coking coals and steel are likely to increase over the years, these must be projected to serve as a basis for the analysis. If it is uneconomical to use only imported coal, the computations could be repeated for blends of indigenous coal with imported coal.

4. *What is the likely position of India's foreign exchange reserves over this period?*

An economic forecast would be required.

5. *Are there sufficient facilities at the ports to handle bulk imports of coking coal?*

This can be readily assessed.

These are complex questions which defy precise answers. The author is of the opinion that a decision based on approximate answers to these questions would be superior to an *ad hoc* decision.

Conclusion

Agnelli, who is regarded as an authority on steel, has predicted that the developing nations will begin to take over bulk steel production from the industrialised countries. The industrialised nations may gradually be constrained to produce more of special steels (*Economic Times*, Nov. 12, 1977). The Indian policy-makers have set fairly ambitious targets for steel production. This requires not only the establishment of new steel plants but also the operation at high efficiency of the existing plants. Increasing the productivity of the blast furnaces through the use of imported low-ash coal is a definite possibility. For instance, Japan has been importing *iron ore from India* and coking coal from other countries, and, due to operational efficiencies, has been selling finished steel in the international markets at a much lower price than quoted by India. India's comparative disadvantage is partly due to the use of indigenous high-ash coking coal. Analysis along the lines indicated in this paper would, hopefully, lead to a solution to the decision problem. □

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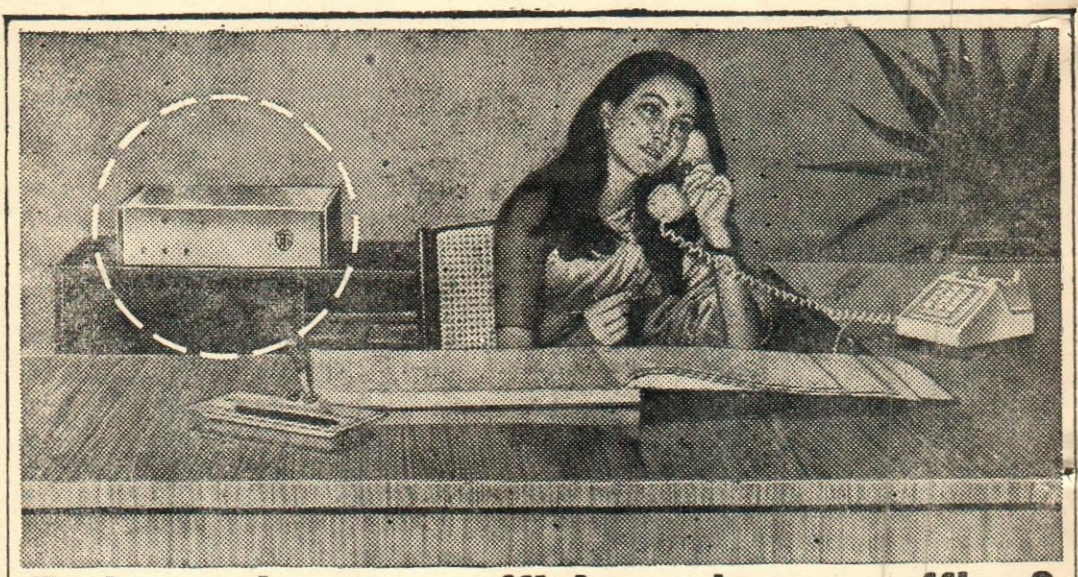

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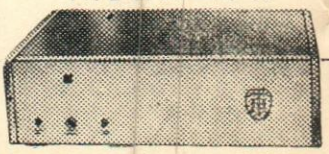

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Empirical Issues in Total Productivity Measurement : An Experiment with Cement Industry in India

S. Acharya* & N.K. Nair**

Introduction

Attempts to measure productivity in the Indian Industry in the post-Independence period have been numerous, the approaches varying from the methods of measuring partial productivity of individual inputs to the techniques of measuring total productivity.[1] It has also been often voiced that partial productivity indices, although of some limited use are not appropriate for the overall performance evaluation of any enterprise or industry. These sources emphasise that total productivity indices have to be constructed for the purpose. However, the concept of total productivity is subject to both measurement and interpretational difficulties. In this paper, an attempt has been made to highlight these measurement and interpretation problems and to suggest means to deal with them. The issues discussed are limited to those related to measurement and interpretation of total productivity at an aggregate (industry) level through a time series. The exercise is then extended to the empirical measurement of total productivity of Cement Industry in India.

Concept of Total Productivity

Total productivity is defined as the contribution of all the inputs, they being combined in some composite fashion. A time series of such an index could reflect the inter-temporal changes in the capacity of the production system to generate output. Traditionally these inter-temporal changes are attributed to the technical progress or to managerial

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1. For a critical brief survey of these studies see, National Productivity Council, (1977).

(organisational) innovations. Since the reference is to the capacity of the 'production system', only factor inputs are considered as constituting this system. Material inputs are excluded by implication. Total productivity indices implicitly involve the underlying production function of the activity which is under study. The simplest form of total productivity ratio, the 'Kendrick' index, is arrived at by an arithmetic combination of the weighted inputs, the weights being the factor prices at the base year.[2] This involves a linear production function. But since a linear production function holds good only under rare conditions, the residual factor method of total productivity, based on a neo-classical production function[3] is considered more realistic and hence, one variant or the other of such a function has acquired tremendous popularity in current literature. The method is briefly discussed here.

Let a homogenous production function of degree 1 be written as

$$Q = A(t) K^a L^b \qquad \ldots(1)$$

where

Q = Output, K = Capital, L = Labour

a & b = partial elasticity coefficients

and A(t), the total (residual) productivity component assumed to be containing an autonomously-generated residual (or disembodied) technical progress. The growth of total productivity can be derived from the above production function as ;

$$1/A(t).\ dA(t)/dt = 1/Q.\ dQ/dt - a/k.\ dk/dt - b/L.\ dL/dt \qquad \ldots(2)$$

---

2. The formula can be written as

$$\text{Total productivity} = \frac{P_o\ Q_t}{Wo\ L_t + r_o\ Kt}$$

Q, L and K refer to the output, labour and capital; P, W and r are the prices of outputs, labour L and capital K respectively. o & t refer to the base and current years. See for details Kendrick (1961).

3. See for details, Solow (1957).

The corresponding index of total productivity can be arrived at by using the formula :

$$A(t+1)=A(t)\ [1+(1/A(t).\ dA(t)/dt] \qquad \ldots(3)$$

The above index can be computed once the concerned production function is estimated.[4]

Some Measurement Problems

The above-said index, however, is subject to major measurement and interpretation problems, some of which are discussed in some detail below :

To begin with, consider the practice of quantifying the variables in financial terms at current market values. In such a case first, for very clear reasons, the relative price effect is likely to distort the marginal contributions of the factor inputs and secondly, there is likely to be a fallacy in the interpretation of coefficients. To elaborate the second point, consider the case of using the wage bill to represent the labour contribution. Wages are factor rewards and are not factor contributions of employment, and hence the partial elasticity would represent only the output elasticity of wages, which is not the same as the proportional contribution of labour from additional employment. Next, consider the use of factor inputs measured in physical units to overcome the problems mentioned above. In the case of labour, it is possible to take the total man-hours worked as a measure of labour input at the first instance but for capital, there exists no corresponding measure in physical terms. Similarly, when more than one product is manufactured in the same process, the output too is measured in financial terms at constant prices. However, though the use of figures at constant prices eliminates the quantitative biases in the coefficients of a production function, the reallocation effects of price movements stay, mainly because of the *ex-post* nature of the data.

4. The two approaches to total productivity measurement described above include only the disembodied technical progress. The methods of estimating embodied and induced technical progress are far from perfect. Some attempts have been made in Arrow (1962), Backmann and Sato (1968), Solow (1959).

Thirdly, there might be a discrepancy between the stock and flow concepts of the variables. While the output is a flow variable, capital refers to a stock. To overcome this problem, sometimes the machine-hours-worked are taken to represent capital.[5] This measure is also subject to serious limitations since 'homogeneity' of hours-worked by different machines is unattained. The argument is true in the case of labour measurement also. Since, the number of men employed is a stock factor, its corresponding flow factor, the total man-hours-worked is taken to represent labour input. But here again the addition of hours worked by workers of different skills yields erroneous results.

As far as the capital input valuation is concerned, the money-value of the stock of capital deflated by the use of perpetual inventory method, though not ideal, seems to be satisfactory. To arrive at a corresponding flow variable, this deflated capital stock can be adjusted with the capital-utilisation ratio.

As regards labour input measurement, only if variation in wages is preceded by a proportional variation in the quantum of workdone, can wages[6] be taken to represent labour. Since, this is not true almost anywhere,[7] wages cannot truly represent the actual labour input. Unfortunately, there seems to be no way out of this crude approximation.

Specification and Interpretation Problems

The foremost difficulty in the interpretation of a specified production function arises when changes in total productivity are identified with technical progress. The type of production function specified in equation (1) above represents only the disembodied technical progress and alternative specification is not attempted for reasons already mentioned (foot-note 4). Now since in real life, disembodied, embodied

5. See National Productivity Council (1976).
6. Since wages are supposed to be paid according to the skill levels of workers, it could be taken to represent a weighted index of workers' input, subject to other conditions being fulfilled.
7. Studies in wage determination often show a large number of wage variants. See for example, Papola (1972).

and induced technical progress all occur with time and often overlap each other, the time variable introduced to capture the disembodied technical progress would often also capture the contributions of embodied and induced technical progress. This causes two kinds of distortions in the results. First, the total productivity index is likely to have an upward bias. This is because of the fact that the coefficient of technical progress would include undefined effects of embodied and induced technical progress.

Secondly, since embodied technical progress renders the factors of production heterogenous through the time series as far as the flow of services is concerned, any attempt to 'homogenise' them through the introduction of a time variable would be a deliberate attempt to separate out all the contribution of technical progress—disembodied, embodied or induced. Thus the embodied technical progress, which augments the quality of factors of production in the subsequent periods is erroneously lumped with the disembodied technical progress and is not permitted to show the improved factor quality. As a result, the factor coefficients would be artificially depressed.

Jorgenson & Grilliches[8] consider the existence of total productivity purely due to erroneous measurement of inputs and outputs. They suggest that "within the framework of social accounting the hypothesis is that if real product and real factor inputs are accurately accounted for, the observed growth of total productivity is negligible." In other words, any technical progress/organisational efficiency is due to an augmentation in factor efficiency and a proportionate increase in factor rewards should follow. The errors, they point out, due to which a residual emerges are the same as those discussed above, i.e., due to aggregation of data, erroneous measurement of variables and inappropriate investment goods prices. Mo-huan Hsing[9] also maintains that the residual in a production function exists due to shifts in the demand and supply functions of factors of production and cannot be termed as due to total productivity augmentation.

In view of the above contentions, it is questionable whether a production function exercise to measure total productivity should be taken seriously.

8. Jorgenson & Grilliches (1964).
9. Mo-Haun Hsing (1976).

In what follows, it is argued that in a limited preview, some useful conclusions can still be drawn from such exercises.

It should be noted that if all the variables are measured in flow terms and in physical units, most of the discrepencies due to shifts in factor demand and supply and due to erroneous measurement of variables can be eliminated. This is because the variation in factor compensation due to shifts in demand or supply do not enter into the production function. However, this requires the use of short-time series.[10] The only discrepency which would still remain is the aggregation bias, say for instance, due to a horizontal summing of hours worked by men of different skills. This discrepency is unlikely to be corrected under conditions of imperfect markets.

Keeping the above in view, if an estimated production function gives rise to a significanct residual coefficient, it is solely due to total productivity agumentation, though with some aggregation errors. However, this contention would hold only if the time series is short enough, such that large non-neutral shifts in the production functions do not occur. How 'short' should be the time series, is the researchers' judgments based on how fast the production structure shifts with new innovations.

Production Function Estimation

In this section, a total productivity index is estimated using data for cement industry from the Annual Survey of Industries for the period 1959-71. Additional data on prices and capacity utilisation are obtained from the Reserve Bank of India Bulletins and the Cement Controller's Office.

This time-series is considered short for a capital intensive industry like cement, where relative homogeneity can be assumed to exist over at least a decade, considering the large cost of mass replacement of machinery and equipment.

To begin with, the form of the production function is specified on the

10. This runs contrary to the statistical requirements.

basis of the estimated elasticity of substitution from the following equation :[11]

$$\text{Log}\left(\frac{VA}{L}\right)=a_o+a_1 \log\left(\frac{WS}{L}\right)+a_2 t \qquad \ldots(4)$$

where

VA = Value added

L = Labour input

WS = Wages & Salaries

t = time

a_1 would give an estimate of the elasticity of substitution for the family of production functions included in the CES production function category. Details of the choice of variables used for estimating equation (4) and the corresponding production function are explained below :

Since cement is more or less a single product industry, the quantity of cement (output) is measured in lakh of tonnes. Labour input is measured in lakh of man-hours-worked. The capital input is arrived by deflating the annual additions to the book-value of fixed assets by the index of whole-sale prices of machinery on the basis of the perpetual inventory method. This is then further adjusted to capacity utilisation of the industry in each period to arrive at the capital flow variable. Capital is measured in lakh of rupees. The value added and wages and salaries are measured in lakh of rupees at current prices since equation (4) is unaffected by differential price movements of inputs.

The estimates of the elasticity of substitution are given in Table 1. The Equation No. 1 of the table is considerably distorted due to multicollinearity, the simple correlation between (WS/L) and t being of the order of 0.99. Equation No. 2 in Table 1 can be chosen to determine the elasticity of substitution.

Equation No. 2 in Table 1 shows an elasticity coefficient of 0.86 which when tested is not significantly different from unity at 5 percent confidence level in a t-test. This implies that not much would be lost

11. See for explanation, Arrow, Chenery, Minhas and Solow (1961)

Table 1 : Estimate of the Elasticity of Substitution

Eqn. No.	Constant Term	Log(WS/L)	t	R^2	F	dw
1.	0.80	0.16 (0.12)	0.06 (0.55)	0.80	24.98	1.50
2.	0.97	0.86 (7.28)	—	0.81	52.99	1.56

Notes : (1) figures in the brackets are the respective t-values.
(2) the dependent variable in both the equations is log (VA/L).

in approximating the input-output relationship on the basis of a Cobb-Douglas production function. The results of the least squares estimation of the Cobb-Douglas function are tabulated in Table 2. The model is tried under alternative specifications to overcome problems of multi-collinearity.

Table 2 : Estimate of the Production Function

Eqn. No.	Constant Term	Log K	Log L	t	R^2	F	d.w.
1.	3.50	— 0.85 (10.38)	0.18 (0.95)	0.06 (5.00)	0.99	271.24	2.24
2.	4.16	0.59 (5.64)	0.56 (1.75)		0.95	106.48	2.23

Note : (1) K and L represent capital and labour inputs as defined earlier.
(2) Figures in brackets are the respective t-values.
(3) In both the above equations, the dependent variable is the output Q.

The Equation No. 1 in Table 2 is considerably distorted by multi-collinearity as the time trend variable is highly correlated with the other

independent variables. Equation No. 2 can thus be taken to represent the production function of the industry.

On the basis of the estimates obtained from the Equation No. 2 in Table 2, Eqation 2 mentioned in the section 2 is computed, using discrete time-interval data on Q, K and L. Accordingly, A(t), the total productivity index is calculated using equation (3) of section 2 and fixing the base year of A(t) as 100. Estimates of [1/A(t). d(t)/dt] and A(t) are presented in Table 3.

Table 3 : Total Productivity Estimates

Year	1/A(t). dA(t)/dt	A(t) (base 1959)
1960	0.011	101.1
1961	0.029	104.0
1962	0.043	108.5
1963	0.001	108.5
1964	—0.024	106.0
1965	0.030	109.0
1966	0.036	113.1
9167	—0.117	99.9
1968	—0.024	97.5
1969	0.057	103.1
1970	—0.064	95.5
1971	0.130	109.0

The inferences derlved from the production function estimates and the corresponding total productivity index can be summarised briefly as follows :

(1) The coefficient of capital is large and statistically more significant when compared to the labour coefficient, complying with the requireiments of a capital-intensive industry like cement. The labour coefficient ts significant only at 10 percent level of confidence (according to a t-test), implying that minor variations in labour input may not affect the output significantly, a typical characteristic of a capital-intensive process industry.

(2) There may be increasing returns-to-scale, implying that, technically, the industry can reap higher returns by expansion. However, since decisions of expansion are not solely dependent on the technical relationship between input and output, the result need not necessarily imply that the industry should expand. The evidence of increasing returns to scale needs to be verified by simultaneosly considering the supply functions of the factor inputs.

(3) The total productivity index shows no monotonic trend. There is a rise of about 13 percent, registered through 1959-66 followed by a steep decline in the following years even below the base year. Total productivity fluctuates alternatively thereafter, exhibiting a steep rise in the final year 1971. No stable growth is registered through the sixties. It can also be observed that the fall in productivity has occurred during the years 1966-68, the period of depression in India. □

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Design of Preventive Maintenance Schedule

A. D. Gupta* & S. P. Tanwar**

Introduction

With the rapid development of mechanisation and automation, the problem of machine maintenance has become very important for improving availability of equipment for productive use. The objective can partly be satisfied by designing the equipment for maintenance. Through perfect design and selection of suitable materials for various components of a system, the reliability can be improved so that the system functions satisfactorily most of the time. However, in spite of our best efforts, breakdowns cannot be eliminated and they occur as a matter of chance. An equipment should be designed such that its parts are easily accessible so that in case of a breakdown, it can be repaired back to working condition in a short span of time. Also, it is equally important to upgrade the equipment reliability when it is in service so that a breakdown is 'postponed' and the equipment remains productive for a longer period of time. This aim can be accomplished by performing preventive maintenance in anticipation of failure. The success of a preventive maintenance programme depends upon its appropriate scheduling.

If a machine breaks down when in use, it may have to remain idle for considerable length of time due to extensive repairs required. If the machine forms integral part of a unit, its failure may cause the entire unit to trip down. Sometimes a breakdown is a safety hazard and it may lead to catastrophic failure of the system. Therefore, a breakdown is usually very costly and the probability of its occurrence should be reduced through efficient Preventive Maintenance Planning. However, we should be cautious in deciding the level and frequency of Preventive Maintenance to be performed. If carried out too frequently, preventive maintenance itself may result in high idle time of the production facility.

This paper deals with the determination of preventive maintenance interval or period, taking into account the stochastic behaviour or failures

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A. Model for Known Distribution of Time to Failure

James A. Parson [3] and J.J. McCall [4] have developed a mathematical model for the case of known breakdown time distribution.

Let

t = Equipment failure time or free run time (non-negative random variable)

$f(t)$ = Probability density function of t

$F(t)$ = Cumulative probability density function of t

C_f = Average cost of a breakdown

C_p = Average cost of a preventive maintenance

t_o = Preventive maintenance period

$$F(t) = \int_0^t f(t)\,dt$$

$$S(t) = \int_t^{\infty} f(t)\,dt$$

$F(t)$ denotes the probability that the equipment fails by time t.

$S(t)$ denotes the probability that the equipment survives up to time t.

$$F(t) + S(t) = 1$$

Now average cost per unit time ($\bar{C}$) is given by

$$\bar{C} = \frac{C - (C_f - C_p)S(t_o)}{\int_0^{t_o} S(t)\,dt}$$

The cost $\bar{C}$ is calculated with different values of t_o and that value of

t_o ($^*t_o$) is chosen as optimum which gives minimum average cost per unit time. Preventive maintenance is performed after $^*t_o$ time of continuous operation without failure. If the system fails before time $^*t_o$, breakdown repair is carried out and preventive maintenance is rescheduled at time $^*t_o$ after failure repair.

B. Model for Unknown Distribution of Time to Failure

Sometimes, due to lack of information or data, the parameters (mean and variance) of failure time distribution cannot be determined, but there exists an estimate for the mean life (μ) of the equipment. In such situation, Chebyschev type Bounding Technique can be used to find preventive maintenance period [4]. The probability that equipment has not failed by age t is bounded from below by V(t).

$$S(t)=1-F(t)\geqslant V(t)=\begin{cases} e^{-\frac{t}{\mu}} & \text{if } t\leqslant\mu \\ o & \text{otherwise.}\end{cases}$$

Similarly, the probability of survival by age t is also bounded from above by w(t).

$$S(t)=1-F(t)\leqslant W(t)=1-x_o \text{ for } t>\mu$$

$$\text{where } x_o \text{ satisfies } 1-x_o = e^{-\frac{x_o t}{\mu}}$$

These bounds can be used to assess the relative merit of various preventive maintenance intervals.

The average cost per unit time with preventive maintenance period t_o is bounded by the following expression :

$$\frac{C_p W(t_o)+C_f[1-W(t_o)]}{\int_o^{t_o} W(t)dt} \leqslant \bar{C} \leqslant \frac{C_p V(t_o)+C_f[1-Vt_o)]}{\int_o^{t_o} V(t)dt}$$

The upper limit of cost $\bar{C}$ is calculated for different values of t_o and that value of t_o ($^*t_o$) selected as optimum which gives minimum upper bound.

The above models are applicable for equipments which exhibit increasing failure rate with time.

Determination of Time to Failure Distribution

For determining preventive maintenance schedule, it is required to estimate the inter-arrival breakdown time distribution. Two years' breakdown data (when there were no preventive maintenance policies) was collected from equipment history cards for Boiler Feed Pump. A histogram was drawn and parameters of the distribution estimated. The failure time distribution was found normal by applying Chisquare test of goodness of fit (Table 1).

Mean time to failure (μ) = 50 days

Standard deviation (σ) = 20 days

Therefore, probability density function

$$f(t) = \frac{1}{\sqrt{2\pi}\,\sigma} e^{\frac{(t-\mu)^2}{2\sigma^2}}$$

$$f(t) = \frac{1}{20\sqrt{2\pi}} e^{\frac{(t-50)^2}{800}}$$

By integrating probability density function f(t), other functions such as cumulative density function F(t) and reliability function S(t) can be evaluated (Model A).

For main Turbine, sufficient data was not available to find its failure distribution. However, the expected life (μ) was estimated as 60 days (Model B).

Table 1

Name of Equipment : Boiler Feed Pump

Time Interval (Days)	*Observed Frequency* (f_o)	*Expected Frequency* (f_e)	$\frac{(f_o-f_e)^2}{f_e}$
0—10	6	4	1.00
10—20	10	8	.50
20—30	13	16	.56
30—40	28	24	.75
40—50	34	30	.53
50—60	24	28	.57
60—70	22	21	·04
70—80	9	12	·75
80—90	5	6	.17
90—100	5	2	4.50

Sum x^2 = 9.37

Number of degrees of freedom = 10—1—2 = 7

For 5% error level, from Chi-square distribution tables, C = 14.07

Since $x^2 < C$, accept normality hypothesis

∴ Failures of Boiler Feed Pump follow a normal distribution

Cost Estimates

To determine optimum preventive maintenance schedule, it is necessary to estimate the average costs of a breakdown (C) and a preventive maintenance (C_p). Each maintenance (whether performed before or after failure) is associated with the costs of labour, spare parts and loss of production. Knowing the average manhours required (from past data) and payment rate, labour cost can be estimated. If we know the cost of spare parts consumed and number of maintenances performed in a year, we can estimate average cost of spares for each type of maintenance. Cost of production loss can be estimated as the revenue loss due to equipment downtime. For this pursose, average downtime (both for preventive maintenance and breakdown repair) and rate of revenue loss must be determined. Adding the three cost components, values of C_f and C_p were estimated as follows :

	C_f	C_p
Boiler Feed Pump	Rs. 7,980	Rs. 830
Main Turbine	Rs. 3,05,000	Rs. 58,900

Preventive Maintenance Schedule

Knowing failure density function, mean equipment life, average costs of a preventive maintenance and a failure, values of $\overline{C}$ (average total cost/day) were calculated with the help of computer. Various maintenance periods (varying in steps of 5 days) were tested (Table 2). Optimum preventive maintenance period, for which total daily cost is minimum, is 25 days for Boiler Feed Pump and 40 days for the Turbine. Optimum preventive maintenance period of 40 days (as compared to 60 days as per existing practice in the plant) for the main Turbine is expected to result in potential savings of the order of Rs. 4,000 per day. It would also improve equipment availability or utilisation from 82% to 90% due to reduction in equipment downtime.

Table 2

Equipment : Boiler Feed Pump

Preventive Maintenance Period (*Days*)	*Total Average Cost* (*Rs./Day*)
5	319
10	172
15	75
20	58
25 (optimum)	53
30	55
35	61
40	68
45	77
50	86
Equiptment : Main Turbine	
5	67,300
10	36,600
15	26,400
20	21,300
25	18,200
30	16,200
35	14,800
40 (optimum)	13,700
45	13,900
50	14,300
55	15,800
60	17,800

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Cost of Cultivation of Jute : A Case Study

Paresnath Chattopadhyay*

In this paper, an attempt is made to present a case study on the cost of cultivation of jute and mesta, pinpointing the inadequacy in the methods officially adopted therefor and the manner in which such costs should be collected, collated and presented for different purposes. The paper seeks to underscore that there exists a direct relationship between the productivity levels attained and the cost of cultivation incurred and/or imputed.

In calculating the cost of cultivation of individual crops, it would not be out of place to mention that the computational procedure would differ when single crops are raised during a crop season *vis-a-vis* multiple crops. The present methods of pricing of agricultural products do not distinguish between large and small farmers. Our pricing methods also do not distinguish between single crops and multiple cropping, not only during different crop seasons but also in the same crop season. A small instance will suffice here. In Bangladesh, there are several districts where farm lands remain inundated for a good part of the year. The months of *Chaitra* and *Baishakh* would witness sowing different varieties of seeds in the same piece of land covering such items as jute, aush and aman paddy. Aush paddy and jute would be harvested during the rainy season and the field would be occupied only by aman paddy which would be harvested towards the end of *Kartick* or *Agrahayana*. The decomposed roots of paddy and jute along with the deposit of rich alluvium would provide a natural manure system every year to compenstate any possible loss of fertility during the earlier year. To calculate cost of individual crops in such a case would raise complicated issues concerning allocation and apportionment of different types of costs relevant for raising these crops. In India, the variations in practice with respect to crops, crop seasons and crop-mixes have been wide, so that no one method would be completely satisfactory. Accommodating these possible variations, it is, however, necessary to devise systems of cost compilation and cost computation on the basis of which the farmers may remain informed and Government

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may adopt suitable and sensitive policies satisfying the ends of both producers and consumers. The case dealt within this paper raises some such issues.

The area under cultivation of jute and mesta in different States as also the total acreage and production of jute and mesta for the country as a whole have been presented in Tables 1 and 2. The trends in both area and production have been rather uncertain and increased production has come generally from extension of area under cultivation than from increased productivity. The statewise variations in productivity levels are also apparent from Table 5. Figures for this Table have been calculated on the basis of those in Tables 1 and 2.

Thus, as shown in Table 1, area under jute and mesta was 552 thousand hectares in 1967-68 of which that under jute was 496 thousand hectares and mesta 56 thousand hectares. In 1968-69, there was a sharp fall in the area under cultivation of jute coming to as low as 269 thousand hectares while that under mesta was only 42 thousand hectares, the total being 311 thousand hectares. The erratic behaviour in the area under cultivation ot jute in West Bengal will be seen from the fact that from 438 thousand hectares in 1969-70, the figure came down to 335 thousand hectares in 1975-76, raising to 441 thousand hectares in 1976-77. The area under mesta, on the other hand, declined from 62 thousand hectares in 1969-70 to 29 thousand hectares in 1976-77. In relation to 1975-76 figures, however, the position in 1976-77 is somewhat better. Thus, while in 1975-76 the total area under cultivation of jute was 335 thousand hectares, under mesta 32 thousand hectares and the total 367 thousand hectares, in 1976-77 the area under jute cultivation was 441 thousand hectares, under mesta 29 thousand hectares and the total 470 thousand hectares. The area under cultivation of jute and mesta in the other States like Assam, Bihar, Orissa, Tripura, Andhra Pradesh and Uttar Pradesh together comprises less than 50 percent of the total area under cultivation of these two crops. In terms of production, as shown in Table 2, more than 50 percent comes from West Bengal. Tables 1 and 2 together formed the basis of Table 5 wherein details of productivity of jute and mesta during the period from 1967-68 to 1976-77 have been given. The levels of productivity have not been uniform, either in the individual States in which jute and mesta are grown or in the same State over time.

On an all-India average basis, production of jute in bales per hectare has varied from 7.182 in 1967-68 to 7.235 in 1976-77. In between, however, the all-India average declined to 5.562 in 1968-69, 6.593 in 1970-71, 6.733 in 1974-75 and 6.974 in 1971-72. Mesta production in bales per hectare varied from 3.963 bales per hectare in 1967-68 to 3.236 bales per hectare in 1968-69, to rise to 3.509 in 1969-70 and 4.270 in 1974-75. Production of mesta in bales per hectare was 4.357 in 1975-76. Total of jute and mesta production on an all-India basis in bales per hectare showed a declining trend in 1968-69 when the figures stood at 4.755 as against 6.321 during the earlier year. During the period, the total figures stood below 6 bales per hectare in 1970-71 when production stood at 5.740. From then on, the trend has been upward rising to 6.446 in 1975-76, *albeit* being broken in between with slight decreases in 1972-73 and 1974-75 as against their respective earlier years.

Tables 3 and 4 present the estimates of cost of production of jute in terms of per acre cost and per quintal cost. Among the cost components, exhaustive details have been provided in the Table, thanks to the searching analysis made by the Committee on Public Undertakings in their Third and Eighth Report concerning Jute Corporation of India Limited, Jute and Exploitation of Jute Growers and on Jute Corporation of India Limited (Government's Unfair Pricing Policy for Raw Jute) respectively. These Reports were presented to Lok Sabha and laid in Rajya Sabha in April, 1978. These details are not only relevant for deciding on official policy but also essential from the point of view of the farmer in knowing and judging the direction of his effort and the likely returns on various crops. The per acre cost figures are, however, likely to vary from period to period, may be season to season and from crop to crop or even different varieties of each crop commanding different prices. The costs presented in the Table assume a productivity level of 6.30 quintals per acre. Though this level is well within bounds or possibility, variations in productivity levels as actually happened during the period from 1967-68 to 1976-77 would materially affect the per quintal costs of the individual items like jute and mesta. Tables 6 and 7 indicate such variations in respect of fixed and variable costs. However, in regard to the methodology of computation of these costs, the Committee took a serious view of the underestimation of these costs and pinpointed the deficiencies in this respect. Both the Agricultural Prices Commission and the Directorate of Economics

and Statistics have been rapped by the Committee for these inadequacies in the cost data presented and used by them for determining official policy concerning prices, etc. In this connection, the Committee also noted the divergence in the data presented by the aforementioned bodies and those collected by the State Department of Agriculture. Pinpointing the deficiency in calculations of Directorate of Economics and Statistics and the figures of cost as taken into account by the West Bengal Government, the Committee have presented relevant figures in Table 8.

One of the major purposes behind this study is that at present a good deal of time gap remains between the incidence of cost on the farm front and reporting thereupon to the official agencies at different levels like the State Government through different channels and the Central Ministry of Agriculture and Irrigation. The Committee on Public Undertakings in their Eighth Report underlined that under the comprehensive scheme for cost of cultivation of principal crops, data are collected *post facto* on the basis of an entire year.

Fixed cost elements and joint cost elements require apportionment which take an inordinately long time. This gap can be effectively bridged only when the farmers themselves start maintaining their records and present relevant information in some acceptable formats. Moreover, collection of figures of cost of cultivation under the comprehensive scheme by designated officers of agricultural universities in different States is a rather unsatisfactory arrangement in the sense that cost and management accounting has already attained a fairly-high degree of sophistication and some degree of knowledgeability should be shown right at the level of collection of data which provide the basis on which further edifices are built up at higher levels. In no case, the quality of the basic data can be improved at subsequent stages and its veracity of the field level data that should attract serious attention of all concerned. Moreover, one of the more-widely accepted tenets of cost and management accounting is its use as a mechanism of control. This control is most effective, as far as agriculture is concerned, at the level of the farmer himself and he should be oriented towards exercise of these controls, may be in a rudimentary form, may be unsophisticated, may be not complete in every respect, but must be truthful. It should not be expected that apportionment or allocation of individual items of expenditure to crops be made by the farmer himself

distinguishing between fixed and variable expenses and other requirements. Once all the details are available in a format chosen officially for the purpose, further sophistication should not be very difficult. The important point here is that the farmer should be given adequate know-how to control his costs and to explore ways of optimising his output *vis-a-vis* the inputs, physical and financial. It is in this respect that the cost and management accounting profession in this country has a significant role to play, perhaps in collaboration with the agricultural universities of different States in regard not only to calculation of actual cost of different crops during a season or a year but also to introduction of budgetary control and standard costing techniques at the farm level to let the farmer know and judge how he is doing *vis-a-vis* what he should have done.

Even now farm level records are not entirely absent. Schedules are prepared by different Argo Economic Research Centres under various universities of the country and also agricultural universities in different States as to the income and expenditure pattern of households from different occupations that broadly come under farming. In this respect also both the data and the method of their collection can be further sharpened and made increasingly more purposive if cost and management accountants are associated in different capacities. So far agricultural costing has been organised almost parallel to, and independent of, the cost and management accounting profession. This gap should be bridged before long, so that the cost and management accounting profession widens its horizon while the biggest industry in this country, namely agriculture, receives the benefit of top grade professional service.

Table 1 : Area Under Jute and Mesta

('000 hectares)

States	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	
West Bengal											
Jute	496	269	438	407	461	367	419	370	335	441	
Mesta	56	42	62	66	62	48	69	48	32	29	(28)
Total	552	311	500	475	523	415	488	418	367	470	
Assam											
Jute	146	108	122	129	143	134	149	121	94	105	
Mesta	9	7	7	6	10	8	13	12	10	11	(10)
Total	155	115	129	135	153	142	162	133	104	116	
Bihar											
Jute	158	90	138	142	131	131	144	105	100	126	
Mesta	38	25	33	36	32	31	38	28	20	31	(29)
Total	196	113	171	170	163	162	182	133	129	157	
Orissa											
Jute	52	42	45	44	52	42	57	47	38	47	
Mesta	26	25	28	29	31	26	36	37	37	38	(37)
Total	78	67	73	73	83	68	93	84	75	85	
Tripura											
Jute	12	7	7	8	9	8	8	6	6	6	
Mesta	13	7	8	9	10	10	11	9	10	10	(10)
Total	25	14	15	17	19	18	19	15	16	16	
Andhra Pradesh											
Mesta	85	87	86	87	91	101	107	88	95	106	(86)
Uttar Pradesh											
Jute	16	11	11	13	12	10	9	9	9	9	
Total											
Jute	880	527	768	749	815	700	793	664	587	739	
Mesta	321	280	322	330	296	293	370	319	314	324	(298)
Total	1201	807	1090	1079	1111	993	1163	983	901	1063	

Notes : (1) Figures for Assam include Meghalaya up to 1968-69.

(2) For 1976-77, figures for jute are final estimates and those for mesta are second estimates.

(3) Figures in brackets in column 11 are the corresponding estimates of area for 1975-76.

Source : Committee on Public Undertakings (1977-78), (Sixth Lok Sabha), Eighth Report on Jute Corporation of India Limited, (Government's Unfair Pricing Policy for Raw Jute), (Ministry of Industry), Lok Sabha Secretariat, New Delhi, April 1978, pp. 3-4

Table 2 : Production of Jute and Mesta

('000 bales of 180 Kgs. each)

State	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77
West Bengal										
Jute	3854	1330	3399	2684	3469	2712	3673	2608	2686	3473
Mesta	349	214	337	384	354	234	365	271	172	
Total	4203	1544	3736	3068	3823	2946	4038	2879	2858	
Assam										
Jute	1049	779	1082	937	1138	1010	1136	825	723	704
Mesta	32	27	28	24	36	32	48	43	39	
Total	1081	806	1110	961	1174	1042	1184	868	762	
Bihar										
Jute	833	400	668	773	470	687	842	546	612	602
Mesta	195	80	125	171	99	149	201	116	136	
Total	1020	480	793	944	569	836	1043	662	748	
Orissa										
Jute	362	290	315	328	380	382	491	333	291	405
Mesta	98	120	140	152	174	131	175	176	201	
Total	460	410	455	480	554	513	576	309	492	
Tripura										
Jute	92	45	57	65	68	58	49	50	45	37
Mesta	71	44	49	55	55	57	60	55	60	
Total	163	89	106	120	123	115	109	105	105	
Andhra Pradesh										
Mesta	386	271	278	296	309	418	438	524	569	
Uttar Pradesh										
Jute	132	88	86	103	102	88	79	75	46	81
All India										
Jute	6320	2931	5655	4938	5684	4978	6220	4471	4440	5347
Mesta	1272	906	1130	1255	1150	1112	1416	1362	1368	
TOTAL	7592	3837	6785	6193	6834	6090	7676	5833	5808	

Committee on Public Undertakings (1977-78), (Sixth Lok Sabha), Third Report on Jute Corporation of India Ltd, Jute and Exploitation of Jute Growers, (Ministry of Industry), Lok Sabha Secretariat, New Delhi, April 1978, p. 2

Table 3 : Estimate of Cost of Production of Jute

Items	Cost per acre
Human Labour	Rs.
Faimly	287.37
Hired	542.46
Bullock Labour	126.66
Seeds	19.04
Fertilizers and manures	63.79
Plant protection chemicals	12.87
Depreciation of implements	51.98
Irrigation	11.53
Land revenue and irrigation tax	5.69
Interest on capital	623.84
Management	480.00
MISCELLANEOUS	
(a) Chemicals other than fertilizers and plant protection chemicals	2.00
(b) Bamboo for drying fibre	4.84
(c) Weight (e. g. logs, banana trunks, etc.) for steeping jute plant	2.00
(d) Hiring of sprayers, seed-drills, wheel hoes, etc.	4.00
(e) Rent for hiring of retting tanks	8.41
(f) Others	0.50
MARKETING CHARGES	
(a) Cost of transport (up and down)	6.58
(b) Weight loss	12.38
(c) Rejection	3.92
(d) Storage and godown charges	5 60
(e) Brokerage	17.45
(f) Dhalta and iswarbritti	11.36
(g) Tola	7.00
(h) Others	5.00
TOTAL	2377.27
Yield per acre (Quintals)	6.30
Cost per quintal including by-product	Rs. 377.34
Cost per quintal excluding by-product	Rs. 344.34

Notes :

1. Both family and hired labour have been evaluated on the basis of statutory minimum wages of Rs. 8.10 per day of 8 working hours.

2. Interest on capital has been considered to be 12% per annum calculated for six months. Capital includes land as well as bullocks and other fixed assets of farmers and working capital, i. e., all paid-out expenses. Land values have been calculated on the basis of weighted averages of values of irrigated and unirrigated land in the various districts of the State.

3. Management costs have been assesssed @ Rs. 800.00 per month per 10 acres for a period of 6 months. This provision has been made for cost of management and supervision (including risk taking) which should be conceptually different from the cost of family labour. From the viewpoint of agricultural price policy, some 'normal' return to the managerial factor should evidently be included in the cost of production. Other evpenses have been calculated on the basis of actual field data and through contact with agricultural officials.

4. The cost estimates for the State as a whole have been derived on the basis of a weighted average of the cost estimates for the 3 zones, the weights being the relative production in the three zones. To be precise, these weights are 27, 65 and 8 for Zone I, Zone II and Zone III respectively out of a total of 100.

Table 4 : Estimates of Cost of Production of Mesta

Items	Cost per acre (Rs.)	Physical units
Human labour	615.60	76 mandays
Bullock labour	120.00	24 bullock days
Seeds	30.00	6.0 kg./acre
Fertilizers and manures	36.00	FYM-3 carts load/acre
Plant protection chemicals	6.40	
Depreciation of implements	13.50	
Irrigation	—	
Rent	4.00	
Interest on capital	229.40	Fixed and working capital @ 12% per annum
Management	480.00	@ Rs. 80.00 per acre per month for six months
Market charges	53.10	Transport, weight loss, rejection, brokerage, storage, dhalta, etc.
Miscellaneous	8.00	Cost of bamboo/logs for steeping, hiring of retting tank, etc.
TOTAL	1596.00	
Yield of mesta fibre per acre (quintal)	4.90	
Value of by-product (Rs.)	205.80	
Cost per quintal of fibre (Rs.) (excluding by-product)	283.71	
Cost per quintal of fibre (Rs.) (including by-product)	325.71	

Committee on Public Undertakings (1977-78), (Sixth Lok Sabha), Eighth Report on Jute Corporation of India Ltd. (Government's Unfair Pricing Policy for Raw Jute), (Ministry of Industry), Lok Sabha Secretariat, New Delhi, April 1978, pp. 15-16.

Table 5 : Productivity of Jute and Mesta

(Bales per hectare)

State	1967-68	1968-69	1669-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77
West Bengal										
Jute	7.770	4.944	7.760	6.595	7.525	7.390	8.766	7.049	8.018	7.875
Mesta	6.232	5.095	5.435	5.818	5.710	4.875	5.299	5.646	5.375	
Total	7.614	4.965	7.472	6.459	7.310	7.099	8.275	6.888	7.787	
Assam										
Jute	7.185	7.213	8.869	7.264	7.958	7.537	7.624	6.818	7.691	6.705
Mesta	3.556	3.857	4.000	4.000	3.600	4.000	3.392	3.583	3.900	
Total	6.974	7.009	8.605	7.119	7.673	7.338	7.309	6.526	7.327	
Bihar										
Jute	5.272	4.444	4.841	5.444	3.588	5.244	5.847	5.200	6.120	4.778
Mesta	5.132	3.200	3.788	4.750	3.094	4.806	5.289	4.143	6.800	
Total	5.204	4.248	4.637	5.553	3.491	5.160	5.731	4.977	5.798	
Orissa										
Jute	6.962	6.905	7.000	7.455	7.308	9.095	7.035	7.085	7.658	8.617
Mesta	3.769	4.800	5.000	5.241	5.613	5.038	4.861	4.757	5.432	
Total	5.897	6.119	6.233	6.575	6.675	7.544	6.194	3.679	6.560	
Tripura										
Jute	7.667	6.429	8.143	8.125	7.556	7.250	6.125	8.333	7.500	6.167
Mesta	5.461	6.286	6.125	6.111	5.500	5.700	5.455	6.111	6.000	
Total	6.520	6.357	7.067	7.059	6.474	6.389	5.737	7.000	6.562	
Andhra Pradesh										
Mesta	4.541	3.115	3.233	3.402	3.396	4.139	4.093	5.955	5.989	
Uttar Pradesh										
Jute	8.250	8.000	7.818	7.923	8.500	8.800	8.778	8.333	5.111	9.000
All India										
Jute	7.182	5.562	7.363	6.593	6.974	7.111	7.844	6.733	7.564	7.235
Mesta	3.963	3.236	3.509	3.803	3.885	3.795	3.827	4.270	4.357	
Total	6.321	4.755	6.225	5.740	6.151	6.133	6.600	5.934	6.446	

(The above figures have been computed from Tables 1 and 2.
(One acre equals to 0.405 hectare)

Table 6 : Matrix Showing Cost Variations of Jute Per Quintal at Different Levels of Productivity Per Acre

Cost of production→ / Items of cost ↓		Production of jute in quintals					
		4	5	6	7	8	9
Variable Costs							
Human labour		526.88	658.60	790.32	922.04	1053.76	1185.48
Bullock labour		80.44	100.55	120.66	140.77	160.88	180.99
Seeds		12.08	15.10	18.12	21.14	24.16	27.18
Fertilizers and manures		40.52	50.65	60.78	70.91	81.04	91.17
Plant protection chemicals		8.16	10.20	12.24	14.28	16.32	18.36
Depreciation of implements		33.00	41.25	49.50	57.75	66.00	74.25
		701.08	876.35	1051.62	1226.89	1402.16	1577.43
Marketing charges		44.00	55.00	66.00	77.00	88.00	99.00
		745.08	931.35	1117.62	1303.89	1490.16	1676.43
Fixed Costs							
Irrigation	11.53						
Land revenue and Irrigation tax	5.69						
Interest on capital	633.84						
Management	480.00						
Miscellaneous	21.75						
	1142.81	1142.81	1142.81	1142.81	1142.81	1142.81	1142.81
Total Costs		1887.89	2074.16	2260.43	2460.70	2632.97	2819.24
Cost per quintal (Rs.)		471.97	414.83	376.74	349.53	329.12	313.25

The above figures have been computed from Table 3

Table 7 : Matrix showing Cost Variations of Mesta per Quintal at Different Levels of Productivity per Acre

Cost of production→		Production of Mesta in Quintals				
Items of cost ↓		3	4	5	6	7
Variable Costs						
Human labour		376.89	502.52	628.15	753.78	879.41
Bullock labour		73.47	97.96	122.45	146.94	171.43
Seeds		18.36	24.48	36.60	43.92	42.84
Fertilizers and manures		21.96	29.28	36.60	43.92	51.24
Plant protection chemicals		3.93	5.24	6.55	7.86	9.17
Depreciation of implements		8.28	11.04	13.80	16.56	19.32
		502.89	670.52	838.15	1005.78	1173.41
Marketing charges		32.52	43.36	54.20	65.04	75.88
		535.41	713.88	892.35	1070.82	1249.29
Fixed Costs						
Rent	4.00					
Interest on capital	229.40					
Management	480.00					
Miscellaneous	8.00					
	721.40	721.40	721.40	721.40	721.40	721.40
Tota lCosts		1256.81	1435.28	1613.75	1792.22	1970.69
Cost per quintal (Rs.)		418.94	358.82	322.75	298.70	281.53

The above figures have been computed from Table 4.

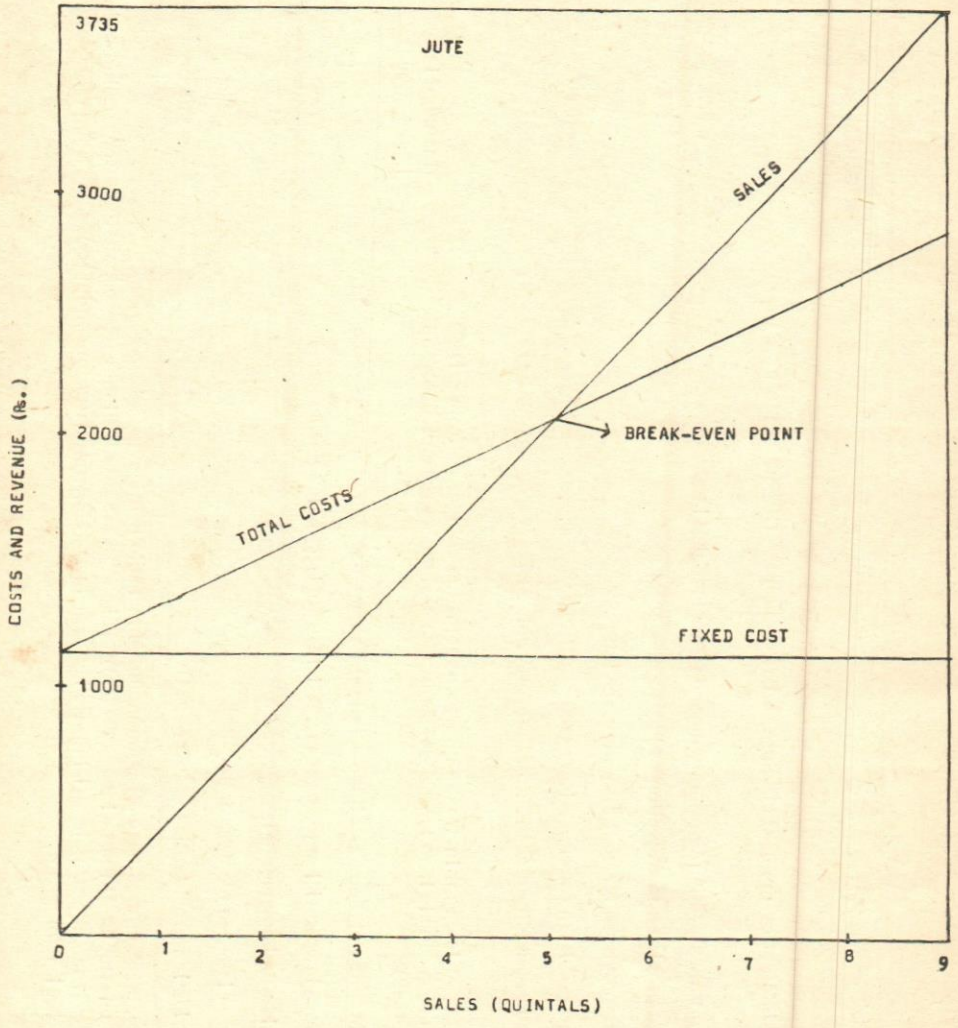
Table 8 : Deficiency in Calculations of Directorate of Economics and Statistics

Sl. No.		Cost in respect of the item in column (2) as taken by West Bengal Government (Rs. per acre)
1.	Instead of interest on the cost of land (part of capital) the Directorate takes a token rental value of the land	623.84
2.	The cost of transportation to primary market is not included in the data	6.58
3.	There is no provision for rejection of jute by the purchaser	3 92
4.	There is no provision for cost oft soring the jute	5.60
5.	There is no provision for supervisory cost	480.00
6.	There is no provision on account of 'hazards' which have very often to be faced by jute cultivators	-
7.	There is no provision for interest on borrowings by the cultivators from private money-lenders. (This item is only deemed to be covered as part of cash and kind expenses).	(Included in item 1 above)
8.	The cost of human labour and bullock labour has been shown at a very low scale (Rs. 530)	997.49
9.	There is very low provision for cost of pesticides (only 71 paise per hectare)	2.00
10.	Depreciation on implements is provided for on a very low scale	51.98
11.	No provision is made for cost of packing	-
12.	Cost of irrigation provided is too low (Re. 1)	11.53

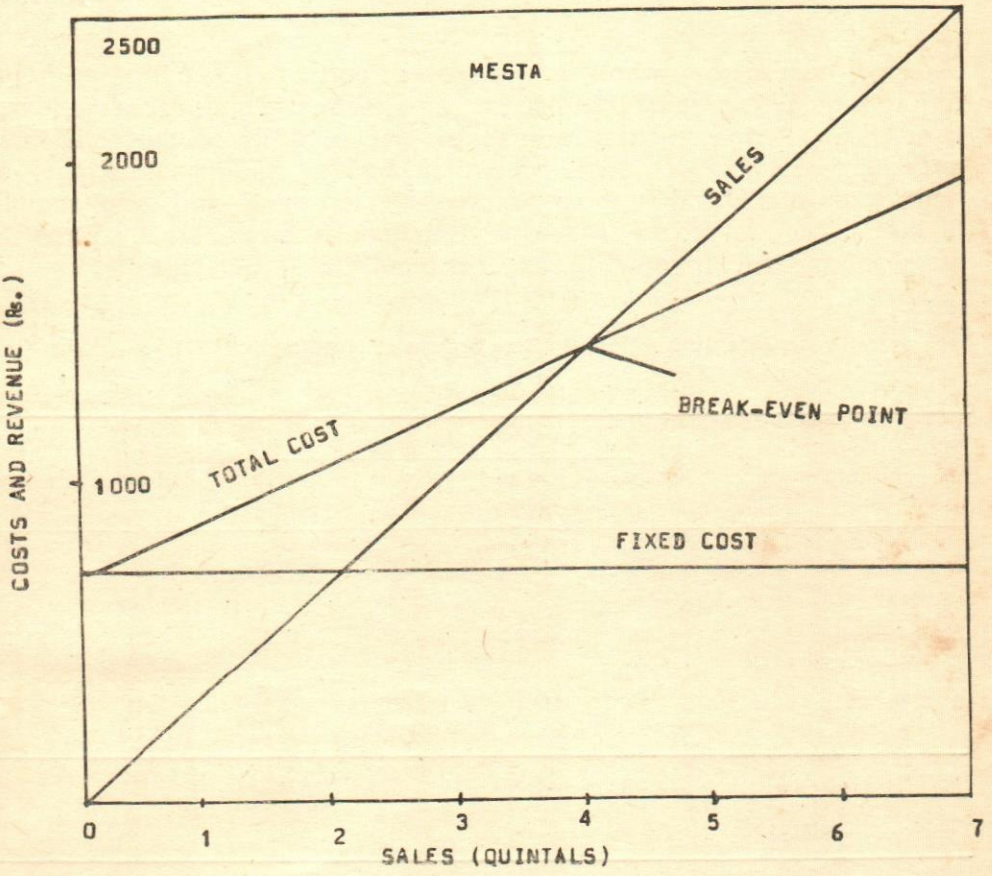
(Incidentally, these figures have all been included in Table III).

Committee on Public Undertakings (1977-78) (Sixth Lok Sabha), Eighth Report on Jute Corporation of India Limited, (Government's Unfair Pricing Policy for Raw Jute), (Ministry of Industry), Lok Sabha Secretariat, New Delhi, April 1978. p. 11.

Break Even Chart I



Break-Even Charat II



(On the basis of figures presented in Tables 6 and 7, break-even charts have been drawn indicating the break-even points. 10 percent margin on cost of production has been assumed for determining sales revenues. It has been further assumed that the entire production has been sold at the same price. The charts broadly indicate the profitability paths above the break-even point and the levels of production which have to be attained for recovery of fixed costs).

APPENDIX

Jute is grown almost wholly in the eastern part of the country aggregating to a modest area of 8,54,000 hectares, essentially under unirrigated conditions. Irrigated area represents just one-fifth of the total area under jute cultivation. Jute cultivation in the country is largerly an activity of small and marginal holdings. The small and semi-medium holdings account for a little over one-half of the total area; and the marginal and sub-marginal for another one-fifth.

Jute Cultivation By Size Groups of Holdings, 1970-71

(Area in 000 hectares)

Sl. No.	Size-Group	Area				Total	Percentage
		Irrigated	Percentage	Unirrigated	Percentage		
1.	Less than 1.0 hectares	32 (19.5)	19.4	133 (19.4)	80.6	165 (19.4)	100.0
2.	1-0 - 2.0 hectare	70 (42.7)	29.7	166 (24.2	70.3	236 (27.8)	100.0
3	2-0 - 4.0 hectares	29 (17.7)	13.4	187 (27.2)	86.6	216 (25.4)	100.0
Sub Total	1.0 - 4 0 hectares	99 (60.4)	21.9	533 (51.4)	78.1	452 (53.2)	100.0
4.	4.0 - 10.0 hectares	20 (12.2)	12.5	140 (20.4)	87.5	160 (18.8)	100.0
5.	10.0 hectares and above	13 (7.9)	17.8	60 (8 8)	82.2	73 (8.6)	100.0
	All Groups	164 (100.0)	19.3	686 (100.0)	80.7	850 (100.0)	100.0

All India Report on Agricultural Census, 1970-71, Ministry of Agriculture and Irrigation, (Department of Agriculture), Government of India, New Delhi, 1975, p. 39. □

Growth Performance of Punjab Agriculture (1950-51 to 1974-75): An Analytical Study

A. J. Singh*, Inder Sain* and A. S. Joshi*

Whereas it is common knowledge that Punjab is one of the most progressive agricultural states, there is little empirical evidence on the nature and pace of its growth performance. There is also insufficient evidence on how the relative contribution of different components to agricultural growth has varied over time. This study was, therefore, undertaken to examine the growth performance in Punjab agriculture for two periods, pre-green revolution period from 1950-51 to 1965-66 and post-green revolution period from 1965-66 to 1974-75.

Specifically, the objectives of the study were :

i) to estimate the compound growth rates of area, production and yield for selected crops; and

ii) to examine the contribution of different components to agricultural production and productivity.

Methodology

Data on production, prices, yield and acreage of important crops grown in the Punjab State i.e. wheat, gram, maize, paddy, sugarcane and American cotton were obtained from Statistical Abstracts, Punjab.

Compound growth rates for area, production and yield for the pre-green revolution period from 1950-51 through 1965-66 were taken from an earlier study on 'Agricultural Growth Rates in the Punjab, conducted by the Department of Economics and Sociology, Punjab Agricultural University, Ludhiana in 1968[1]. Compound growth rates for the post-green revolution period from 1965-66 through 1974-75 were calculated by the authors. These compound growth rates were worked out both at the state and the district level. The data were properly adjusted in relation to the change in district boundaries both in the pre-green revolution period because of merger of PEPSU with Punjab on the eve of re-organi-

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sation of states in 1956 and also in the post-green revolution period because of the division of Punjab in 1966 and the creation of Faridkot district in 1972.

The compound growth rates of area, production and yield were calculated by the least squares method of fitting the exponential function $Y = AB^x$ where Y is the variable for which growth rate is calculated and x is the time, $B = 1 + r$ where r is the compound growth rate. The standard errors of the growth rates were found by using the formula :

$$SE(r) = \frac{100\ B}{Log_{10}^{e}} \sqrt{\frac{\left[\Sigma(\log y)^2 - \frac{(\Sigma \log y)^2}{N}\right] - \left[\log_{10} B\right]^2 \left[\Sigma X^2 - \frac{(\Sigma X)^2}{N}\right]}{(N-2)\left[\Sigma X^2 - \frac{[\Sigma X]^2}{N}\right]}}$$

Student's 't' test was applied to examine the significance of the growth rates.

Since increases in production are the net result of the changes in acreage, yield and cropping pattern, it was considered important to examine how the relative contribution of these factors has changed from the pre-green revolution period to the post-green revolution period. For this purpose the Minhas-Vaidyanathan Additive Model [2] was used for the post-green revolution period to compare the relative contribution of area, yield, cropping pattern and interaction of yield with cropping pattern for the second period with the first period for which the estimates were available under the previous study.

However, some recent studies have indicated that in addition to area, cropping pattern and yield, price structure is also an important factor which needs to be taken into consideration [3]. An attempt has also been made to decompose change in productivity and production to take care of price structure as follows :

$$Y_1 - Y_o = \triangle Y = \Sigma a_c^{\circ}\, y_c^{\circ}\, \triangle p + \Sigma a_c^{\circ} p_c^{\circ} \triangle y + \Sigma y_c^{\circ}\, p_c^{\circ} \triangle a + \Sigma a_c^{\circ} \triangle p\, \triangle y + \Sigma y_c^{\circ}\, \triangle a \triangle p + \Sigma p_c^{\circ} \triangle a \triangle y + \Sigma \triangle a \triangle y \triangle p \quad \ldots \quad \ldots \quad (1)$$

$$Q_1 - Q_o = \triangle Q = A^1 Y^1 - A^{\circ} Y^{\circ} = (A^1 - A_o)\Sigma a_c^{\circ}\, y_c^{\circ}\, p_c^{\circ} + A^1 \Sigma a_c^{\circ}\, y_c^{\circ}(p_c^1 - p_c^{\circ}) + A^1 \Sigma\, a_c^{\circ}\, p_c^{\circ}\, (y_c^1 - y^{\circ}) + A^1 \Sigma y^{\circ} p^{\circ} (a^1 - a^{\circ}) + A^1 \Sigma a_c^{\circ}\, (y_c^1 - y^{\circ}) + (p_c^1 - p_c^{\circ})\ A^1\, \Sigma y_c^{\circ}\, (a_c^1 - a_c^{\circ})\ (p_c^1 - p_c^{\circ}) + A^1 \Sigma p_o^{\circ}\, (a_c^1 - a_c^{\circ})\ (y_c^1 - y_c^{\circ}) + A^1 \Sigma\, (a_c^1 - a_c^{\circ})\ (y_c^1 - y_c^{\circ})\ (p_c^1 - p_c^{\circ})$$

where y_c=yield of cth crop, a_c=proportion of gross cropped area of cth crop, p_{cr}=current price of cth crop, Y=level of productivity in value terms, A_c=gross area under c^{th} crop, Q=gross agricultural output in value terms, Q_c=physical output of cth crop, p_c=deflated price of cth crop. The superscripts ° and ' refer to the base and current periods.

Decomposition of productivity in equation (1) gives us effects of price, yield, cropping pattern, interactions of price and yield, cropping pattern and price, cropping pattern and yield and the interaction of cropping pattern, yield and price structure. Decomposition of production gives us area effect in addition to the other terms.

Results and Discussion

Table 1 presents the compound growth rates of area, production and yield for selected crops for the two periods 1950-51 to 1965-66 and 1965-66 to 1974-75 for Punjab State. It would be seen that the growth rates of area increased significantly for paddy and wheat with those two crops emerging as a dominant rotation particularly in areas provided with assured irrigation in Punjab. There was a deceleration in the growth rates in area under maize and American cotton. Sugarcane and gram experienced negative growth rates in the second period.

It would also be seen from the above Table that the sharpest increases in growth rate in production were recorded by paddy, wheat and sugarcane in that order. There was a deceleration in growth rates of production of maize and American cotton and a negative growth rates of production of gram over the period.

The sharpest growth rates for yield took place for sugarcane, gram, paddy and wheat. It would be seen that the yield breakthrough for sugarcane made it possible to record a compound growth rate of 10.07 on production in spite of a negative growth rate of 5.03 in area for second period. But the negative growth rate of area under gram was huge enough to more than swamp and sharp positive growth rate of yield for the second period resulting in a negative growth rate of production for this crop. The sharpest increase in production of paddy and wheat over the post-green revolution period were made possible by increased relative

profitability of these crops which caused a shift in the cropping pattern in favour of these crops.

Tables 2, 3 and 4 present the district-wise picture of area, production and yield of selected crops during the two time periods. It would be seen that there have occurred significant shifts in this growth rates of production of some important crops which in turn are due to ths sharp increases in yields made possible by sustained research for the evolution and adoption of high-yielding variety crops coupled with increased use of complementary inputs like chemical fertilizers, weedicides, etc., on areas provided with assured irrigation. The extension agencies have also played crucial role in extending the results of the biological and chemical innovations to the farmer's fields.

The sharpest growth rate of area for paddy were recorded for Ludhiana followed by Jullundur, Ferozepur and Patiala during the post-green revolution period. In case of maize, the sharpest growth rate of area was recorded for Jullundur, followed by Ludhiana and Sangrur; for wheat the sharpest growth rates were recorded in Sangrur, Bhatinda, Kapurthala and Ferozepur, sugarcane, bajra and gram recorded negative growth rates during the post-green revolution period. American cotton recorded positive growth rate of 9.10 percent and 5.30 percent both for Bhatinda and Ferozepur districts during the post-green revolution period.

The sharpest growth rates in production of paddy period-II were recorded for Ludhiana, Jullundur, Ferozepur, Patiala, Ropar, Kapurthala, Hoshiarpur, Gurdaspur and Amritsar in that order, while for maize the highest growth rates were estimated for Bhatinda, Sangrur, Kapurthala Ropar, Hoshiarpur, Ludhiana and Gurdaspur. The most spectacular growth rates were recorded for wheat production for Hoshiarpur, Ropar Sangrur, Patiala, Jullundur, Ferozepur and Amritsar. Despite a general decline in the growth rates of area under sugarcane, bajra and gram, some districts did record increase in production under these crops. Sugarcane recorded growth rates of 6.90 for Ropar, 6.40 for Gurdaspur, 5.90 for Kapurthala and 3.50 for Sangrur over the post-green revolution period. Similarly, bajra recorded a growth rate of 28 40 percent in Kapurthala, 6.90 percent for Bhatinda, 1.80 percent for Ferozepur and 1.30 percent for Gurdaspur and gram recorded a growth rate of 10 10 percent for Hoshiarpur and 7.84 percent for Bhatinda and 0.60 percent

for Ropar. American cotton showed positive growth rates of production for the post-green revolution period for Bhatinda (12.10) Sangrur (0.40%), Ferozepur (8.80%) and Amritsar (1.40%) over the post-green revolution period.

Coming to an analysis of the compound growth rates of yield for the selected crops, it would be seen that the sharpest growth rates were recorded for rice in Ludhiana, Bhatinda, Ropar, Jullundur, Sangrur in the post-green revolution period, whereas the growth rates for rice yield were highest for Patiala, Sangrur and Kapurthala districts in the pre-green revolution period. This is because of the fact that Ludhiana, Bhatinda and Ropar which were not paddy growing areas in the pre-green revolution period adopted this Kharif enterprise in a big way in the post-green revolution period due to the increased availability of assured irrigation facilities against the back-drop of phenomenal yields realisable from high-yielding varieties of this cereal crop. The growth rates of yield were particularly high in these districts during the post-green revolution period as they started almost from a scratch. Jullundur, Sangrur, Patiala, Ferozepur and Kapurthala experienced relatively lower growth rates of yield as this crop was already grown in these districts and the existing levels of yield were fairly high. For maize, the growth rates of yield were the highest for Gurdaspur followed by Amritsar and Kapurthala over the same period. Wheat recorded the sharpest growth rate of productivity for Patiala (15.60), followed by Hoshiarpur (10.80), Sangrur (8.10), Jullundur (7.10), Gurdaspur (6.80), Ropar (6.00), and Bhatinda (5.00). Sugarcane recorded the highest growth rates of yield for Bhatinda (10.90), Ropar (8.80), Patiala (8.00), Kapurthala (6.80), Gurdaspur (6.60), Hoshiarpur (6.30), Jullundur (6.00) and Amritsar (5.80). Similarly, American cotton recorded the highest productivity gains for Amritsar (7.30), Ropar (5.80), Sangrur (4.70). Bajra showed the highest growth rates for Kapurthala (16.20) followed by Hoshiarpur (8.10), Patiala (7.80) and Gurdaspur (6.80). Gram indicated the highest growth rate of Hoshiarpur and Ludhiana (12.70) followed by Gurdaspur (11.50).

The decomposition of the relative contribution of different factors to foodgrain production through the Minhas-Vaidyanathan model for the post-green revolution period is depicted in Table 5 along with the results already available for the pre-green revolution period. It would be seen that whereas in the pre-green revolution period, acreage contribution was 45.71 percent and yield contribution 17.38 percent, in the

post-green revolution period, the roles seem to have been reversed with yield effect contributing 50.70 percent and the acreage merely 12.34 percent. Further, as price has been identified as an important factor contributing to changes in value product per hectare, the decomposition was also attempted by taking this factor into consideration in addition to area, yield and cropping patterns.

The results of this analysis are presented in column 2 of Table 6 which indicates that in the decomposition of increase in value product per hectare, price structure, interactions of price and yield, cropping pattern and price, cropping pattern, yield and price made negative contributions. However, yield and cropping pattern made significant positive contributions to value productivity per hectare and their interaction was also strong and positive which contributed 14.06 percent to value produce per hectare.

However, decomposition of value product per hectare is a partial analysis in as much as it conceals the area contribution. So, an attempt was also made to decompose the increase in the value of output of crops considered in this analysis and the results are indicated in column 3 of Table 6. It would be seen that the value of crop output increased by Rs. .2596 million over the period. Out of this increase, 20.79% was contributed by area, 72.23% by yield, 10.85% by shift in the cropping pattern and 11.13% by the interaction of cropping pattern and yield. Price structure, interaction of yield and price structure, cropping pattern and price structure and the combined interaction of cropping pattern, yield and price structure made negative contribution to the extent of 5.69%, 8.81%, 0.46%, and 1.04% respectively.

Conclusion

From the foregoing analysis it can be concluded that there have been significant changes in the compound growth rates of area, production and yield of the selected crops from the pre-green revolution period to the post-green revolution period. Due to the technological breakthrough paddy-wheat rotation has become a dominant crop rotation of Punjab. The decomposition of agricultural production and productivity has revealed that there has occurred a sharp shift in the relative roles of yield and area in particular with the yield assuming the role of a dominant

contributor to the increase in production and productivity in the post-green revolution period as compared to area which played a prominent role during the pre-green revolution period. Further, the more detailed decomposition of production and productivity revealed that price structure has been making a negative contribution which points to the urgency for reorienting agricultural production and price policies for regulating the cropping pattern in favour of more-remunerative crops and/or providing price support for the less remunerative crops if their production is to be maintained in social interest.

Table 1

Compound Growth Rates of Area, Production and Yield of Selected Crops in the Punjab State, 1950-51 to 1965-66 and 1965-66 to 1974-75

Crops	*Area*		*Production*		*Yield*	
	Period I 1950-51 to 65-66	*Period II 1965-66 to 74-75*	*Period I 1950-51 to 65-66*	*Period II 1965-66 to 74-75*	*Period I 1950-51 to 65-66*	*Period II 1965-66 to 74-75*
Rice	6.375***	8.20***	9.131***	18.40***	2.56***	9.20***
Maize	3.93***	3.40***	6.20***	3.70***	2.235NS	0.20NS
Wheat	3.22***	4.80***	5.48***	11.20***	2.19***	6.10***
Sugarcane	4.08***	—5.03***	6.224***	10.07***	1.22NS	10.62***
American cotton	8.53**	4.40***	9.23***	7.60***	1.74***	3.10***
Bajra	—2.484***	2.98*	0.02NS	2.06NS	2.67NS	1.40NS
Gram	3.385**	—8.30***	3.735NS	—5.86**	0.19NS	10.27***

*Significant at 10 percent level
**Significant at 5 percent level
***Significant at 1 percent level
NS stands for not significant

Table 2

Compound Growth Rates of Area of Selected Crops in Different

Crops/Districts	Rice		Maize		Wheat	
	1950-51 to 65-66	*1965-66 to 74-75*	*1950-51 to 65-66*	*1965-66 to 74-75*	*1950-51 to 65-66*	*1965-66 to 74-75*
Ludhiana	—	19.20*	5.11†	7.20†	3.31†	5.60†
Bhatinda	—	—11.30NS	—	—8.40†	4.435†	4.20↓
Ropar	—	3.60↓	—	3.60†	—	6.80†
Kapurthala	11.18†	6.20†	4.96†	0.60NS	2.67†	3.50†
Ferozepur	2.93†	10.80†	7.38†	—7.10†	2.21†	2.70*
Jullundur	15.705†	19.00†	4.44†	13.80†	2.04†	1.50†
Hoshiarpur	5.98†	4.60†	1.095↓	4.10†	—0.145NS	4.70†
Sangrur	15.63†	9.60↓	3.35†	6.0↓	3.53†	4.70†
Patiala	11.85†	10.40†	0.78NS	2.50†	3.67†	3.89†
Gurdaspur	4.305†	5.00†	0.97NS	1.90†	1.055NS	1.80NS
Amritsar	7.025†	6.60†	3.03†	—1.63NS	1.29†	5.30†

*Significant at 10 percent level

↓Significant at 5 percent level

†Significant at 1 percent level

Districts of Punjab State Through 1950-51 to 1965-66 and 1965-66 to 1974-75

Sugarcane		*Cotton Am.*		*Bajra*		*Gram*	
1950-51 to 1965-66	*1965-66 to 74-75*	*1950-51 to 65-66*	*1965-66 to 74-75*	*1950-51 to 65-66*	*1965-66 to 74-75*	*1950-51 to 65-66*	*1965-66 to 74-75*
3.355†	—6.70†	—	—10.20†	—	0.20^{NS}	—2.943†	— 17.60†
—	—7.50↓	—	9.10†	0 968^{Ns}	— 3 70↓	1.63^{NS}	—7.60↓
—	1.50^{NS}	—	- 27.50†	—	—	—	- 2.90†
—	—8.20†		— 14.20†	—	— 25.70↓	—4.772^{NS}	- 27.20↓
—	—3.70^{NS}	—	5.30†	—	— 3.40*	— 3.264†	—7 40†
1.954†	— 4.45†	—	3 00^{NS}	—	— 9.40*	—0.543^{Ns}	—28.90†
—0.761^{NS}	— 3.20*		—11.20↓		—18.90†	0.09^{Ns}	—0 40↓
3.38†	— 2.43^{NS}	—	0.10^{NS}	—3.165†	- 3.62^{NS}	—0.991^{NS}	—9.62†
5.475†	—7.40†	—	- 11.63†	—	—5.86^{NS}	6.76†	— 7.26†
1.78↓	—0.98^{Ns}	—	—16.55†	—	4.40^{NS}	1.55^{NS}	—12.04†
0.13^{NS}	—7.08†	—	- 5.42↓	—	—1.58^{NS}	—3.674†	—16.40†

Table 3

District-wise Compound Growth rate of Production of Different Crops in the Punjab through 1950-51 to 1965-66 and 1965-66 to 1974-75

District	Rice		Maize		Wheat		Sugarcane		Am. Cotton		Bajra		Gram	
	1950-51 to 65-66	65-66 to 74-75	1950-51 to 65-66	65-66 to 74-75	1950-51 to 65-66	65-66 to 74-75	1950-51 to 65-66	65-66 to 74-75	1950-51 to 65-66	65-66 to 74-75	1950-51 to 65-66	65-66 to 74-75	1950-51 to 65-66	65-66 to 74-75
Ludhiana	—	39.30†	9.06	4.40†	7.025†	9.40†	4 84†	—21.20*	—	—9.20*	—	—3.20NS	—1.816NS	—16.20†
Bhatinda	—	—10.10NS	—	5.80*	7.68†	9.60**	—	—2.60NS	—	12.10†	—0.694NS	8.90**	1.56NS	7.94NS
Ropar	—	18.40†	—	4.50*	—	14.00**	—	6.90NS	—	23.50*	—	—	—	0.60NS
Kapurthala	16.335†	16.40†	2.78NS	4.80NS	2.765NS	6.60**	—	5.90**	—	—7.40*	—	28.40NS	—4.508NS	—19.10NS
Ferozepur	3.185**	22.80†	5.93**	—5.80NS	3.40**	11.10**	—	—10.70†	—	8.80†	—	1.80NS	—3.239NS	—6.30*
Jullundur	4.45**	31.80†	6.37†	2.80NS	4.035†	12.60†	2.74**	1.40NS	—	—17.10†	—	—14.20NS	0.515NS	—14.00**
Hoshiarpur	4.45**	14.80†	7.93**	4.40NS	0.345NS	15.80†	—	1.90NS	—	—9.20NS	—	—7.60NS	—2.134NS	10.10*
Sangrur	17.835†	3.85†	2.54NS	6.30†	6.34†	13.20†	6.125†	3.50NS	—	10.40NS	—1.698NS	—0.50NS	2.695NS	—8.7†2
Patiala	19.84†.	21.00**	1.61NS	3.30**	7.33†	12.70†	4.595†	—0.03NS	—	—10.42†	—	0.70NS	7 195**	—8.59**
Gurdaspur	2.81NS	13.60†	3.22NS	4.20NS	2.095NS	9.50†	4.53†	6.40†	—	—10.56†	—	1.80NS	—0.795NS	—1.17NS
Amritsar	5.33†	12.70†	3.62NN	3.50NS	3.555†	10.40†	2.263NS	—2.34NS	—	1.40NS	—	—1.49**	—1.853NS	—15.11†

*Significant at 10 percent level
**Significant at 5 percent level
†Significant at 1 percent level
NS stands for not significant

Table 4

District-wise Compound Growth Rate of Yield of Different Crops in the Punjab through 1950-51 to 1965-66 and 1965-66 to 1974-75

District	Rice		Maize		Wheat		Sugarcane		American Cotton		Bajra		Gram	
	1950-51 to 1965-66	65-66 to 74-75	1950-51 to 65-66	65-66 to 74-75	1950-51 to 65-66	65-66 to 74-75	1950-51 to 65-66	65-66 to 75-76	50-51 to 65-66	65-66 to 74-75	50-51 to 65-66	65-66 to 74-75	1950-51 to 65-66	65-66 to 74-75
Ludhiana	—	15.80†	3.23NS	0.20NS	3.54†	3.50**	1.193NS	4.70**	—	0.90NS	—	3.12NS	1.15NS	12.70NS
Bhatinda	—	14.90†	—	1.20NS	4.20†	5.00**	—	10.90NS	—	1.80NS	0.985NS	2.30NS	—0.148NS	2.50NS
Ropar	—	14.50†	—	0.80NS	—	6.00**	—	8.80**	—	5.80NS	—	—	—	3.80NS
Kapurthala	6.57†	9.70†	—2.232NS	4.20**	—1.1585	3.00NS	—	6.80†	—	2.00NS	—	16.20**	—1.735NS	3 00NS
Ferozepur	1.85NS	11.10†	—1.091NS	—3.70NS	0.92NS	4.70**	—	1.00NS	—	2.40†	—	5.60**	0.04NS	0.90NS
Jullundur	1.70NS	11.20†	1.86NS	—1.60NS	2.07**	7.10†	1.052NS	6.00†	—	0.20NS	—	—6.40**	—	7.80**
Hoshiarpur	0.155NS	7.10NS	6.39†	0.20NS	0.42NS	10.80†	—	6.30NS	—	2.50†	—	8.10NS	—2.188**	12.70NS
Sangrur	7.003†	11.10†	0.83NS	—0.18NS	2.71†	8.10†	2.19NS	6.10**	—	4.70†	1.32NS	3.90NS	0.92NS	0.90NS
Patiala	8.75†	0.51†	0.56NS	0.20NS	3.35†	15.60**	—0.161NS	8.00†	—	1.80NS	—	7.80NS	0.54NS	—1.55NS
Gurdaspur	0.09NS	8.50†	2.19NS	5.20**	1.08NS	6.80**	2.648†	6.60**	—	2.80**	—	6.80**	—0.64NS	11.50*
Amritsar	—0.741NS	5.60†	2.445NS	5.00NS	2.245**	4.70**	2.97†	5.80**	—	7.30†	—	1.30NS	1.79**	1.90NS

*Significant at 10 percent level
**Significant at 5 percent level
†Significant at 1 percent level
NS stands for not significant

Table 5

Percent Contribution of Different Factors to Total Increased Food Grains Production in Punjab through 1951-52 to 1964-65 and 1965-66 to 1974-75

Variables	*1951-52 to 1964-65*	*1965-66 to 1974-75*
Acreage	45.71	12.34
Yield	17 38	50.70
Croad Pttern	34.33	17.26
Interaction	2.53	19.72

Table 6

Relative Contribution of Different Factors in the Growth of Productivity and Production

Effects	*Productivity*	*Production*
Individual effects		
Area	—	20.79
Price structure	—7.18	— 5.69
Yield	92.45	73.23
Crop pattern	13.70	10.85
Interaction effects		
Crop pattern yield	14.06	11.13
Yield & price structure	—11.13	8.81
Crop pattern & price structure	—0.58	—0.46
Yield, crop pattern and price structure	— 1.31	—1.04

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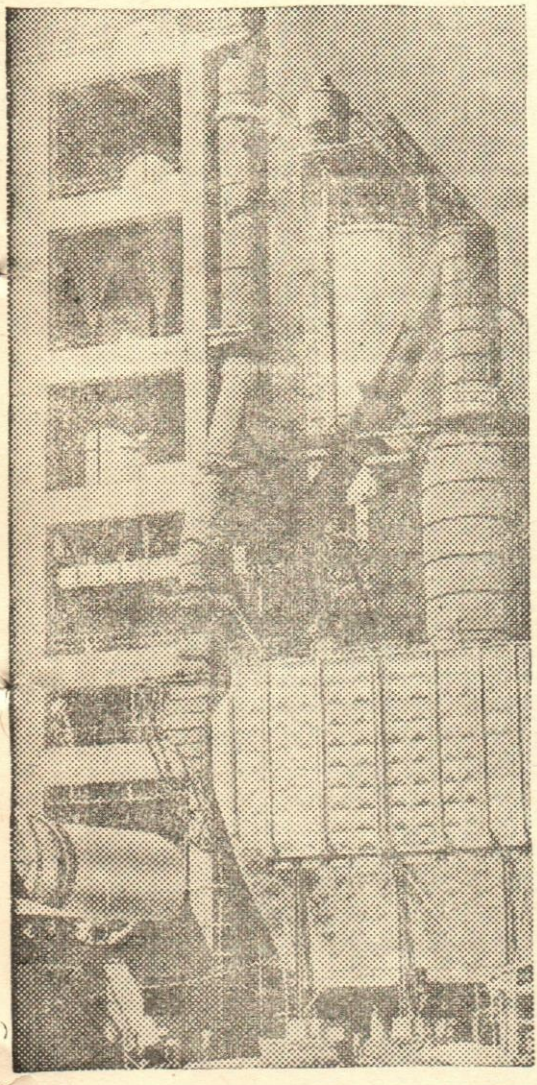

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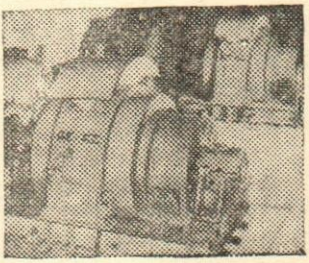

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Book Reviews

Consultancy Services in the U.S.A., Canada, India

I. Moses

Administrative Staff College of India, Hyderabad, 1977, pp. 151, Rs. 75.00

Reviewed by S. A. Khader*

This publication is the outcome of a study sponsored by Federation of Indian Export Organisations, New Delhi (FIEO). The study was aimed at providing insight into working methods of consultancy organisations in the USA and Canada and comparing the same with that of Indian institutions for beneficial ends and developing guidelines for extending our consultancy services to the developing world. FIEO selected no less a person than Irudianathan Moses of ASCI, a well-known figure in Management Consultancy, for taking up the study tour of these countries.

In contrast to the situation abroad, Moses finds that this profession of consultancy in our country has neither created the desired impact nor achieved the trust and professional integrity it should have. He points out that disciplined approach and professional competence of the consultants and their organisations would only be able to establish the profession of consultancy in a developing economy like ours. There is a great need to ascertain that the consultants and consultancy organisations work either with certain self-imposed discipline and professional integrity or they are controlled by certain regulatory agencies to maintain and uphold the professional excellence. The publication also outlines in brief the philosophy and working of two voluntary regulatory bodies like Association of Consulting Management Engineers of America (ACME) and Canadian Association of Management Consultants (CAMC). These agencies are instrumental in maintaining high professional standards through periodic review of membership and subjecting the Consultancy organisations to a strict code of professional conduct and practice. When the ever-increasing number of free-lance consultants and consultancy firms in our country are controlled through a regulatory agency, only then this profession of consultancy will be well received by our entrepreneurs and managers. One such voluntary agency in the name of Management Consultants Association of India (MCAI) has come into vogue in Bombay. Possibly, an Association having national

* Deputy Director, National Productivity Council, Chandigarh

standing with certain statutory powers may be able to provide better service to the profession of consultancy.

The other aspect equally stressed by Moses is the need for improving the professional calibre of our consultants both in technical and managerial skills, if we are to be successful in other countries. He identified that right type of training of consultants should assume vital importance in the growth and development of this profession. In the light of his observations in the USA and Canada, he goes on to outiine the nature and mode of training to be given to an individual in shaping him up as a professional consultant. Existence of the locally-developed 2-year consultant development programme of the National Productivity Council, New Delhi, in the areas of Industrial Engineering, Fuel Efficiency, Behavioural Sciences, Plant Engineering, Financial Management, Marketing Management and Agricultural Productivity would be of interest in this context. The study brings out a host of other recommendations that would go a long way in making the consultancy profession more useful and acceptable in our endeavours.

We have been largely successful in exporting our industrial goods and agricultural produce. It is in the fitness of things that we also try to extend our services in the form of technical and managerial consultancy services to the developing world. This step of FIEO, in initiating a study of this nature and its findings through this report would enable our consultancy organisations to develop themselves to meet the expected professional standards and take up joint as well as independent ventures in other countries. □

Project Formulation in Developing Countries

P. K. Mattoo

Macmillan Company of India Ltd., New Delhi, pp. 268, Rs. 30.00

Reviewed by Ram Prakash*

Project selection is regarded as a vital process in the success of development Plan. Draft Five Year Plan (1978-80) and various reports

* Management Analyst, Planning Commission, New Delhi

of the Committees on Public Undertakings emphasise that inadequate initial planning of projects had led to wrong investment decisions. In this context, this book dealing with all aspects of project formulation from the stage of identification to its final presentation in a form facilitating investment decisions, could justly claim to be of topical interest. The author correctly mentions "very little guidance and literature on the subject are available". Probably, he means, in a comprehensive and compact form. The author through this book "seeks to fill this void".

Project formulation, according to the author, is an investigating process which precedes investment decision. The preparation of Detailed Project Report is rightly regarded as "the work of different nature and magnitude from Pre-Investment Report". The book, among others, has discussed the technique of PERT/CPM in nearly one-fourth of the total number of pages. PERT/CPM is commonly accepted as a tool of Implementation Planning—a stage following after pre-investment decision. A reader may justly differ with the author on his decision to include this technique within the scope of the book. In describing various components of Feasibility Report and different techniques, one important omission is Project Location and the manner in which it is decided. The procedure to determine the requirements of cash over the life of the project are described under Cash Flow Statement rather than under the commonly-used term Liquidity Statement. The book advocates use of Discounted Cash Flow Techniques for assessing the investment worthiness of a project, but skips over description of various known short-cut methods of calculating IRR. At many places, the book gives an impression of undigested financial concepts. For instance, in the application of techniques of Net Present Value and Internal Rate of Return, financial experts do not take depreciation as an item of expense for reason to avoid double counting. This book in its check list, prepared to explain the mechanics of Liquidity Analysis and DCF techniques, mentions depreciation as an item of cost. The generalised conclusion made "The social costs of the project are in reality less than the financial costs" is true only in a limited sense. In fact, foreign exchange component is likely to enhance the cost of project from social point of view. The author rightly advocates need for rigorous analysis and critical examination of different components of feasibility report without mentioning the effective project design criteria. Illustration of all the tests of effective project design, viz., measurability, feasibility,

On the whole, the book is a good introductory reading and a poineering attempt in the development of management aid for project formulation. Two merits of the book are the exhaustive list of references for additional reading and the low price. □

Management By Motivation

Saul W. Gellerman

Taraporevala Publishing Industries Pvt. Ltd., Bombay, in arrangement with American Management Association, Inc., 1977, Price Rs. 38.00

Reviewed by P. Chattopadhyay*

Motivation and Productivity, by the same author, published some years ago and brought out in an Indian edition, attracted a good deal of notice both in academic and in industrial circles the world over. Unfolding the characteristics of human behaviour in productive circumstances and the factors that motivate human beings towards greater effort and achievement, the author did in that volume open up several new approaches to the question of improvement of performance. Motivation theory at ad

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The author makes a strong plea that application of behavioural science knowledge to organisations can usually be accomplished best through

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wiser and more imaginative administration in the main, while use of the sophisticated techniques of behavioural research and development is not discarded. In this respect the author emphasises that behavioural science involves application of techniques which demand a detailed understanding of social and psychological processes and as such be left under the care of the professional behavioural scientist Such application of behavioural science techniques by quacks may not only spoil the broth but may also create lasting dismemberment of individuals in contradistinction with the organic unity that an organisation must have for team effort. Indeed, such dangers have been widely noticeable and conclusions from similar situations have appeared widely different, confounding the confusion that exists. Even the subtle nuances of different motivation theories require close examination, appreciation and zealous, possibly meticulous, application. The ground is extremely delicate and the balancing act has to be performed with dexterity if success in the effort towards application of motivation theories in practice is aimed seriously.

The author does his job in fourteen chapters, covering some two hundred and seventy four pages, apart from the index which runs into another twelve pages. The organisational situation in which motivation has a significant role to play is delineated with reference to different problems faced over time in the first chapter which provides the setting of the book. The essence of motivation theory is explained in chapter two. The findings of some recent research on the subject are examined in chapter three in which the author underlines that motivation is a dynamic concept that changes all the time, usually too slowly to be noticed, usually fortuitously, sometimes for the worse; but sometimes it is changed deliberately and sometimes for the better. A behavioural explanation of the strategy of selection is presented in chapter four. He goes into really intricate problems of daily life of an executive. Just as war is too important to be left to the generals, selection is too important to be left in the hands of the experts, so he asserts. Management can and should control its own selection system. All this is easier said than done. However, he believes that first it must get rid of some of the prevalent illusions. indeed, these illusions are far too many and relate to different questions. The difficult art of choosing people, dealt with in chapter five, has several important things to say about the selectors and those selected. Different fallacies are pinpointed here to which selectors generally succumb without knowing it most of the time. For instance, the hero fallacy, the descriptive fallacy, the permanence fallacy and the fallacy of determinism. These

fallacies in different ways play their part in most organisations, private and public, and individuals either suffer or benefit from them depending on the situation in which they are placed. However, his pointer is highly significant that if a person has been found good for a certain purpose it is not necessary that he would be so for another. Even for the same purpose over time evaluation may vary widely because the individual may be good or very good at a point in time but not always necessarily. This creates problems of continuous evaluation for determining the suitability of individuals to jobs. Most of the time the managers consider themselves rather immune from such assessment and they remain busy prying into how others below are doing. The growing number of non-managers in managerial positions would attest the truth of this observation.

The context of enlargement of competence and the various theories and approaches that have been evolved to know and judge competence have been examined in chapter six of the study. He recommends that there are at least seven functions whose control should be centralised in the career management group. They relate to assessment of potentialities of managers for acquiring competence to handle heavier responsibilities, appraising performance; reviewing individual development plans and promotion plans for ensuring that stretching concept is being implemented judiciously yet without excessive timidity; scheduling, and helping superiors to prepare for career counselling; determining proper time for formal management training for each manager and the types of course content most suitable for him during each of his exposures to formal instruction; selection, training, assigning and varying management counsellors; and maintenance of an up-to-date, relevant and reasonably complete inventory of managers. Spotting the most-suited individuals to tasks calling for varying capabilities and developing them for the purpose have long remained the most demanding yet rather indifferently-handled areas. These enlisted functions warrant the utmost attention in an attempt to bridge the gap.

An important chapter in the book relates to predicting and measuring managerial performance. His distinction between selection and appraisal with reference to managerial performance is not only apt but significant; while the prediction of future performance is the essence of selection, that of appraisal is the evaluation of current performance. He ascribes four reasons why it is imperative to define effective managerial

performance more precisely. One, the principal ingredient of most management selection programmes is and will unduly continue to be nomination. He contests the very basis of this idea of nomination in the sense that it is absurd as a premise of managers who, because they are managers, somehow know how to identify potential managers. The frivolity of the long standing premise has been succinctly brought out. Two, most attempts to measure the effectiveness of selection systems in his view, have run into a sort of semantic sound barrier, going to the elusive nature of the things that selection systems are supposed to predict. Three, it is important to define managerial performance from the point of view of morale. The higher one goes in management, the more ambiguous the requirements of the job become, with the result that performance is not really measured so much as it is reviewed. Four, it is important to have a definition of effective performance in view of the fact that fixation of limits of acceptable and unacceptable behaviour imposes a sort of discipline on top management to stay within them, so that with their own judges more predictable, managers down below are less likely to be defensive. It should follow from this that the business of the organisation can then proceed in a more straightforward manner, with more emphasis upon results and less upon safety, popularity, and second-guessing the men at the top. The author brands morale as a spring which is neutral, indifferent and motionless. Relieving a negative pressure upon morale would mean that the *status quo ante* would be restored. It would require further effort to boost it to a level desired. This positive lead and the removal of negative pressure are discrete in his view and should be treated as such.

Loss of competence is the subject matter of chapter eight in which the author underlines that competence loss is not a well-studied, well-understood phenomenon. It is not the inevitable fate of anyone, in many cases it is indeed preventable. Age, he mentions, is no longer the advantage which once was, since education increasingly offsets experience and wisdom is often no match for being technically uptodate. He asserts that whenever a man's effectiveness declines sharply after some kind of blow to his self-esteem, to reassure him with that his future performance has not been prejudged would help him regain his poise. Failure to do this would be tantamount to writing off an asset that might otherwise have had considerable value. He makes the point that money can motivate exceptional accomplishments, first of all, by way of offering prospects of becoming wealthy and secondly by way of freeing the

individual of both real dependency and the tendency of others to suspect him of the tactics of dependency.

Analysing the theories propounded by Douglas McGregor, he asserts that Theory X and Theory Y were not simple devices for side-stepping the issue as to which managerial approach was right and which was wrong. In fact, they were not even opposites. Theory X denotes the more or less traditional set of assumptions about human nature on which management practices have been built since the Industrial Revolution enjoining that work was not a natural activity for most people, and that intelligent cooperation within an organised system was equally contrary to most men's instincts. In view of the fact that industry required both work and cooperation of its employees, theory X acted primarily through various ways of manipulating the economic dependence of the average employee upon his employer. He pleads for an appropriate approach, based on an examination of organisational realities rather than upon reactions of any kind. This approach was the essence of Theory Y, insisting that managerial strategies be based upon examination, not assumption, and that there were no eternal verities upon which management could rely so faithfully that a close examination of its own organisation became unnecessary. The defect in Theory X, according to him, lay not in its assumptions, but in its rigidity—its tendency to suggest that other approaches would not be appropriate, even in other circumstances. This is a revelation indeed and McGregor himself tried to explain the premises of his Theory X and Theory Y in his book, *The Professional Manager*. Unfortunately, this elaboration of the theories expounded earlier did not receive as much attention as these theories did. This aspect indeed deserves wide notice providing, as it does, a bigger handle for management practices.

While explaining the negative or demotivating aspects of budgets considered real and serious at times, he notes that budgets can, under certain circumstances, have a positive motivating effect leading to sustained improvement in performance provided that certain prerequisites are observed such as sensitive communication, effective participation and internalisation of goals. Coming to grips with organisational climates that make less than optimal use of available human resources is a gigantic problem but has a high potential payoff. Finding the right methods and making them work, therefore, hold the key. A good deal of emphasis comes naturally on organisational development stressing

clarification of roles, respecting tenets of group behaviour and group effectiveness. The last chapter deals with possible ways of handling the problems and the direction that organisations are struggling for in maximizing individual's contributions to the organisation and his satisfaction in belonging to it. The loose threads are far too many. While a good lot of them have been successfully tied up, several others call for organised, concerted action.

In all, this book has a wealth of material to commend itself for wide readership among managers, teachers, researchers and students of management and behavioural sciences. □

Personnel Management

P. C. Tripathi

Sultan Chand & Sons, New Delhi, 1978, pp. 270, Rs. 35.00

Reviewed by (Mrs.) B. Chopra*

The last decade has marked the beginning of an encouraging, though gradual, trend of Indianisation of management science by Indian scholars. There has been an increasing number of Indian publications over the last ten years, touching various aspects of management discipline, even though each of these publications cannot be said to have contributed to the Indianisation trend. But, the book under review is certainly a fairly successful attempt in this direction and the author deserves to be complimented for his efforts.

The book is an achievement of author's stated objectives of providing a text book on Personnel Management, and making it well balanced in theory and practice, incorporating mainly Indian personnel practices. And, it does meet both these objectives.

The book nearly follows the format of a standard foreign text book on Personnel Management and exposes various topics, though much more briefly, in broadly identical sequence. But, it makes its contribution in

*Managing Editor, *'Management and Labour Studies'*, Jamshedpur

terms of presenting each topic in Indian context. As a result, the contents of the book are a well-woven presentation of theory and Indian practice.

The presentation is in simple language; since the book has been written on the basis of the syllabi of personnel management courses in various universities, the content compared to that in any foreign text book is restricted and selective. However, almost all the important concepts from various areas like procurement, development, performance appraisal, wage and salary administration have been dealt with.

A discussion on evolution and growth of Personnel Management in India; the profession as it is understood and practised in India today—the extent of maturity or perfection the personnel practices possess or lack; the factors contributing to or impeding its growth; and on the future of the profession in this country makes the text meaningful and relevant. Reference to a number of Indian studies in the field further adds to the authenticity.

In the chapter 'Industrial Relations and Collective Bargaining', an attempt has been made to present a complete picture of legislative and voluntary framework of Indian industrial relations to facilitate readers' understanding. Some of the important legislations governing different aspects of labour-management relations have been introduced. This gives a rather clear idea about industrial relations status in India. Apart from such factual knowledge, the chapter also gives an evaluative and judgmental opinion about the Indian industrial relations scene, which perhaps the students should be encouraged to evolve themselves. On the whole, this chapter is well handled and is lucid in style.

Though there is an attempt to refer to recent studies for supplementary reading, yet, except for wage and salary administration, the references throughout seem to be predominantly restricted to literature published in 1960's. Perhaps a little more effort in this direction would have been very rewarding both for the author and the reader.

However, the book makes a good introductory text, and can be recommended to students at various universities. It can also be a good introduction for those middle level practitioners who have not been formally exposed to the subject. □

Manual on the Planning of Labour-Intensive Road Construction

Allal & G.A. Edmonds (in collaboration with A. S. Bhalla)

International Labour Organisation, Switzerland, 1977, pp. 254+xii, 40 Swiss Francs

Reviewed by J. D. Verma*

Road construction is one of those economic activities which have experienced the most rapid change of technology, with each stage becoming progressively more expansive than its predcessors. This is because of the fact that road development in any form, has become a vital ingredient of economic development programme besides being an equally-vital ingredient for the defence of a country. This has, therefore, prompted the Governments, particularly, those in the wealthy industrial countries to pour vast resources for perpetual advancement of road construction activity including construction of additional roads, maintenance and improvement of the existing ones. Accordingly, the developing countries which are often described as "Third World" have also to launch road construction programme in their respective countries to such an extent as would link all parts of the country so that the other programmes included in the national economic development plans get proper infrastructural and other associated facilities for their implementation.

True, developing countries do not have adequate funds; they suffer from lack of latest technology and know-how to use modern machinery, yet they cannot afford to sit idle and postpone such an important economic activity. They are, however, faced with a dilemma as, on one side, they want to plan the construction of most modern and all-wheather roads which are lasting as well as ensure maximum social benefits and, on the other, they have to depend on labour-intensive methods in almost every economic development activity mainly to ensure maximum employment opportunities to a large number of people who otherwise remain without a job. When confronted with such a situation, the concerned Governments look around and consider ways and means to launch the road construction programme in such a way as would enable them to adopt a

*Director, Small Industries Development Organisation, New Delhi.

technology which is in keeping with the available resources, the level of human skills and above all with, how far it is possible for them to manufacture/import the proper machinery and equipment. It is in this context that the International Labour Office, Geneva, has brought out a Manual on the Planning of Labour-Intensive Road Construction mainly for the use of those who are engaged in the planning, evaluation and design of road construction projects. These are the persons who are generally responsible for coordinating and implementing road construction programmes in their respective countries. The Manual is divided into two parts—(i) the options and, (ii) the institutional setting.

Part I highlights road planning, road design, methodology of production, the range of labour-intensive technique available, the road construction cost, maintenance cost, users' cost and indirect benefits available to the users, evaluation of alternative technologies both at the market price and the shadow price and lastly the incidence and impact of taxes, foreign loans and grants on the overall road development programme. Part II of the manual deals with the policy choices both physical and financial and the organisational and management strategies to be adopted and lastly the conditions for the tenderers and contractors.

It must be said at the outset that the manual is a treatise dealing with all important aspects of road planning and construction programme. It highlights the considerations which are before the planners and the administrators while taking a decision with regard to construction of a road, the technical ingredients required to make it purposeful, the cost involved, benefits available to the users and above all the financial and technical capacity of a country. A logical treatment has been given to every aspect as mentioned earlier so that the planners and the administrators have full benefit of the choices open to them. Depending on the national priority to a particular road construction programme as also the technical and financial resources available for the purpose, they can take rational view of the situation. No doubt, this is very necessary as otherwise all drawbacks emerging from an unplanned development programme and that too of road construction would follow and lead to economic waste, social disquiet and ultimate loss to the national economy. However, how many of the planners and administrators in developing countries, for whose benefit the manual is claimed to be very essential, are equipped with necessary faculties to examine and evaluate these norms, is a debatable issue. Likewise in democracy

where the economic planning is many a time influenced by the political considerations, it becomes difficult to adopt and follow the ethics of road construction programme as brought out in this book. Nevertheless this does not minimise the usefulness of the suggestions made in the manual which are not only logical but also are backed by the statistical and economic arguments.

One of the objectives before the ILO in bringing out this manual is to afford an opportunity to the developing countries, which are normally faced with the problem of lack of modern technical knowhow as also modern and sophisticated machinery and equipment, to decide on appropriate level of technology which they should follow in their road construction programme. Mr. E. F. Schumacher, the author of the term "intermediates technology" had thought that 'Small is Beautiful'. He was, of course, guided by the maxim that in developing countries where scarcity of material resources, slow development and consequential adoption of most sophisticated technology, the alternative left is to devise and adopt intermediate technology in all spheres of economic activities. In doing so an ideal combination of the resources available, their optimum allocation to various sectors of economy has to be worked out and adopted. Of course, this has to be coupled with the most judicious management of the whole exercise. Certain operations in the road construction activity in a developing country, for example, need better be done by adopting labour-intensive methods. This is particularly true in earth work, which involves a lot of excavation and loading. Even as it is, so far no small manually operated machines appear to have been developed for excavation and loading. Tools used in these operations are basic farm implements such as picks, hoes, shovels and spades. However, these methods are competitive only if the height to be covered is small. Likewise for rock excavative and crushing may also be done within reasonable levels of efficiency by improving the working management at both the input and output stage. The manual has in this regard spelt out the range of labour-intensive technique which could assist the road construction management authority to make a judicious choice of various operations to be done by labour-intensive technique and identify others for which use of machinery may be essential.

Authors of the manual have, in this connection, dwelt on the analysis and interpretation of the data already available with the ILO and other

organisations. This is supplemented with the construction cost as have been modelled in the relevant chapter followed by information on ingredient of maintenance user cost and the resulting benefits both direct and indirect from these costs. All this undoubtedly enhances the usefulness of the manual and to that extent it is expected that administrators, planners and the contractors concerned with the road construction programme will derive maximum benefit from the manual. However, there are limitations with each developing country. These may be of the resources, technology and skills and above all the *inter-se* priority given to road construction programme. Accordingly they will have to devise and adopt the ideal method to accomplish the task which may be assigned to them in this regard. The manual will undoubtedly be of great help to them in arriving at such an ideal combination. In practice, however, guidelines given in the manual will have to be followed with necessary adjustments depending on the overall objective of the programme as also the resources provided for implementing the programme. □

Public Finance in Ancient India

K. R. Sarkar

Abhinav Publishers, 1978, pp. xiii+271, Rs. 60.00

Reviewed by V. S. Mahajan*

How does the system of public finance in ancient India compare with modern concepts of public finance? The author of the book under review addresses himself to this basic issue. He points out that the system that prevailed in the country in the period lost in history compared favourably with modern fiscal and financial system. For instance, the use of currency was widely practised. In other words, a monetised economy was quite popular. There also existed markets where purchase and sale of goods was carried out and secret transactions were discouraged. Strikingly, the traces of modern price

*Reader, Department of Economics, Punjab Univerisity, Chandigarh

[illegible] accordance with their tax paying capacity. Also inventory of all possible details of individual, household, like nature of property owned and income derived was prepared. Care was taken in preparing final statements of accounts which were regularly audited.

Thus one finds that the system of taxation, collection of revenue from different sources, the mode of taxation, the mode of disbursement of such revenue over different heads of expenditure and financial administration—as practised in ancient India had a good deal of similarity with the modern mode of taxation and fiscal administration

The author has successfully undertaken the difficult job of spelling out and supporting from ancient texts particularly from Manu's Arthashastra and other sources, the system of public finance as practised in ancient India and by making comparison with the present system of public finance he has proved that the ancient Indian system was improvement in certain respects over the modern system of public finance. This book would be found useful by researchers and students of public finance and economic historians. □

Books Received

Personnel Investment Planning by N. J. Yasaswy Published by Management Education Services, Ravindra Nagar, Hyderabad, March 1978, pp. 304, Rs. 40.00.

mechanism are also to be found in ancient India where prices of commodities were determined through the interaction of demand and supply forces. For borrowing money for financing trade and business there existed individual bankers and also guild banks (forerunners to modern commercial banks). The usual rate of interest charged on such borrowings was 15 percent per annum—a figure very near to the existing commercial rate of interest. Land revenue and custom duties were the major sources of the state income—this shows that trade constituted an important part of India's ancient economy. And interestingly, such pattern of government revenue continued to dominate this country right up to 1950.

The criterion of taxation was the potential paying capacity of tax-payer, rather than actual possession of wealth and income—as is the practice of taxation in modern times. In this way, the author is justified in asserting that the traditional system of taxation in India was an improvement over the modern system. Land which yielded the maximum revenue was surveyed regularly and details like its area, quality, ownership, boundary, etc., were all recorded. This helped updating the land records and introduced an element of equity in land taxation which was based on its productive capacity. The State enjoyed monopoly over salt, wine, mineral and forest products and also operated workshops for the processing of these products.

The state also derived considerable revenue from the sale of these products. During emergencies, the rates of taxation were enhanced. But at the same time care was taken that additional taxes were levied with great foresight. These who contributed their services during this period were exempt from additional taxes.

The revenue thus collected was utilised productively. Besides meeting the expenditure of civil and military administration, the State

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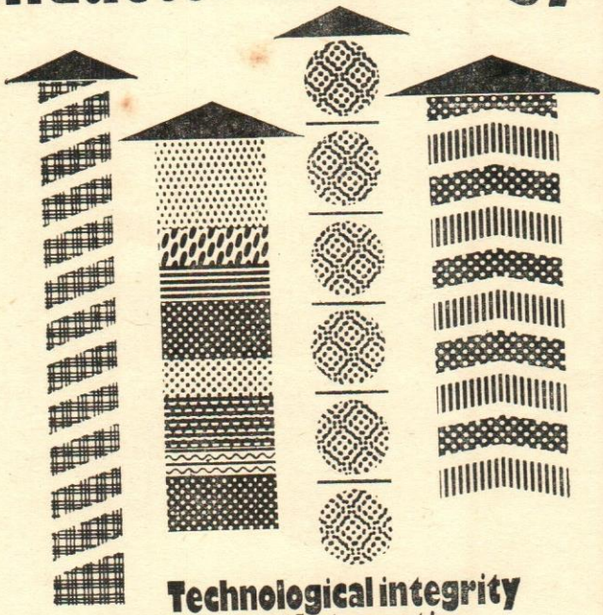

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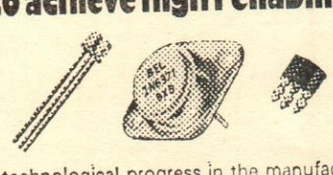

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New Books : Annotated List*

Ideology of Work

Anthony, P. D.

London, Tavistock, 1978, pp. 340, £ 2.40

The book examines the way in which attitudes to work have been intensified in order to keep pace with the process of industrialisation. Its author argues that two views have subsequently developed : an official view, representing the basis of the employers' injunction that work should be well done, and a radical view that work should be re-organised. He develops his argument to suggest that the official and the radical views have more in common than is often assumed.

Industrialisation, Employment and Income Distribution : A Case Study of Hongkong

H sia, Ronald and Chau, Laurence

London, Croom Helm, 1978, pp. 205, £ 8.95

This is a study prepared for the International Labour Office within the framework of the Research Programme on Income Distribution and Employment of the World Employment Programme. It assesses the impact of Hong Kong's industrialisation and employment growth on its income distribution. Through an analysis of the changes in industrial and occupational structures, employment status, household size, labour participation rate, inflow of labour and wage and employment structures, it considers not only how income distribution alters with economic development, but also the mechanism that has brought about these changes.

*Prepared by S.N. Vig, Documentation and Information Officer, National Productivity Council, New Delhi

Jargon of the Professions

Hudson, Kennelte

London, Macmillan, 1978, pp. 146, £ 7.95

In this book, the author is concerned with what he calls the Professions, the Near-Professions and the Would-Be-Professions. 'Technical Language', he points out, is not in itself a jargon, and it is not in itself a moral or criminal offence to write or speak in a way that is not immediately understood by the man on the street. Every profession necessarily has its own terminology, but much supposedly technical language is bogus, existing only to impress the innocent and unwary. The author provides a useful league table of the worst offenders, and concludes that jargon is the natural weapon of highly paid people with nothing to say and everything to lose.

Managerial Dynamics : A Multi-Dimensional View

Sethi, Narendra

New Delhi, Sterling Publishers, pp. 272, Rs. 70.00

The book cuts across a number of important concepts of general administrative utility blended through a case-oriented workshop approach. The cases are provided with a view towards their domestic and international utility in the global business environment. The book would prove useful for aspiring executives interested in getting an appreciation of the universal compass of managerial theory.

New Dimensions of Cooperative Management

Kamat, GS

Bombay, Himalaya Publishing House, 1978, pp. 503, Rs. 45.00

This book examines the factors which have contributed to a some what chaotic situation in the cooperative sector. It underscores the importance of professionalised management techniques if the cooperative movement is to redeem the promise of the high performance expected of it. It

comments constructively on the role of the state in the growth and effectiveness of the cooperatives and the instabilities from which they have suffered because of the variations in the policies of state governments. It also examines and analyses the importance of management techniques in the cooperative sector in such aspects of business as consumer activity, credit and banking, marketing and processing, and their relevance to Indian situation.

Organisation Development in Public Administration, Part I: Organisation Properties and Public Sector Features

Golembiewski, Robert I and Eddy, William B. Eds.

New York, Marcel Dekker, 1978, pp. 268, $ 9.75

This book brings together important papers dealing with organisation development as applied specifically to public agencies. It considers a number of ethical and value issues associated with OD applications, introduces some basic empirical processes and dynamics that explains why OD works, and provides guidelines and perspective on whether to use OD in public agencies.

Project Formulation in Developing Countries

Mattoo, PK

Delhi, Macmillan Co. of India, 1978, pp. 268, Rs. 70.00

This book deals with all aspects of project formulation—from the stage of identification of the project idea till the stage of final presentations, in the form of a fully documented and data based report. The techniques discussed in this book include system analysis, operations research, techno-economic analysis, PERT/CPM, input analysis, financial analysis and social cost-benefit analysis.

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Role of Rural and Small Industries†

B. Sivaraman*

Productivity is no doubt important but the means by which it is reached has also become important for the countries of Asia. The vast population which shows no signs of slowing down in growth and the late entry into the industrial revolution, thereby having restricted opportunities for employment in the industrial sector, have created serious problems of fruitful employment for the population in the developing countries. A large sector of the population is left largely dependent on agriculture and rural economy for employment and maintenance. Studies in India have shown that chronic unemployment is low but the employment that an individual gets is mostly part employment and an employment without proper remuneration. Thus, a vast number of the population which can contribute to productivity, given the right opportunity, is now left under-employed and not fully remunerated. Rural and small industries has been suggested as an important programme to bridge this gap.

Dependence on the rural sector is very large in most countries of Asia and particularly in India where about 80 percent of the population depend on the rural sector for their employment and maintenance. Agriculture obviously comes to our mind as the panacea. All the countries of South Asia can do with greater productivity. But employment does not grow proportionate to productivity. The proportion is normally not more than about 1 : 2. Agricultural growth itself can only be a slow process.

An average growth of 3 to 4 percent over a long period can be considered very good from our past experience. With a population growth of more than 2 percent per year, the agricultural growth of 3

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*Member, Planning Commission, New Delhi.

†Based on the Address delivered by Mr. Sivaraman, on 4th December 1978, in New Delhi to the participants of the Training Programme on "Project Management for Rural and Small Industries Development', sponsored by the Asian Productivity Organisation, Tokyo, and conducted by the National Productivity Council, New Delhi.

to 4 percent cannot sustain the need for employment of the growing population.

The Employment Scenario

From Indian experience, it is expected that given a very optimistic growth rate of 4.0 to 4.5 percent in agriculture till the end of the century, out of about 250 million labour seeking employment in rural India by 2000 A.D., only about 169 to 175 million can be absorbed in agriculture and allied sectors leaving approximately 30 percent to the secondary and tertiary sectors in the rural areas. On a rough guess, India has to find about 54 million more opportunities for employment in the secondary and tertiary sectors by 2000 A. D. Some of the countries of South Asia may have a better balance between the industrial and agricultural sectors than what India has and may not have to depend so much on the rural sector. Their industrial and the tertiary sectors may be absorbing a greater percentage than in India. Yet, it is not unlikely that they will also have to find a large number of employment opportunities in the secondary and tertiary sectors in the rural areas. All of us can learn from the experience of Japan. This country with a massive industrial sector of the most sophisticated technology has yet retained its balance of employment and investment in the small sector.

There is always a controversy as to whether India is not opting against the basic principles of economics in trying for a maximum thrust in the field of village and cottage industries in its economic planning. A capital-short country—and most of the South-East Asian countries are capital short—has to opt for technology which gives a lower capital/output ratio. A country looking for greater employment of its population looks for a lower capital/employment ratio. At the same time, one has to ensure that the technology is sound enough to give a product which can compete with the mass production technology in the industrial giants of the world or has its own protective market. It is not always possible to get all these benefits out of any one technology. This is the case of small industries. When we go to village and cottage industries we face further the question of uniform quality in a quality-conscious market which obviously a widely scattered village and cottage industry cannot hope to achieve. This does not mean that the case of small industries and village and cottage industries

is lost from the start. It cannot be if the experience of Japan is any indication.

The Japanese Experience

In March 1976, Prof. Kazushi Ohkawa and Dr. Mutsuo Tajima of the International Development Centre of Japan had issued a working Paper* on "Small-medium scale manufacturing industry : A comparative study of Japan and developing nations". This study compared the position in Japan in 1909 after the Ruso–Japanese war with the position in 1961 after the Second Great War. The result is very interesting. Small industries were those with less than 50 employees, medium those between 50 and 499 employees and large those emloying 500 and more. Appendix I gives the comparative figures over the years from 1909 to 1961. Whilst over the years the total number of employees in industries rose ten times, the proportion of the employees in the small sector had changed from 45.7% in 1909 to 37.6% in 1961 with fluctuations in between. At the other end, porportion of employees in the large industries had changed from 20.7% to 27.2% The study also pointed out that the employment distribution during the upward swings in labour absorption (years 1909-1919; 1931-1940; 1953–61) tends to be in favour of large sector whereas the down-swings 1919-31; 1940-53) tend to be in favour of small industries. The study also analysed the position into three groups. Group-I consists of food and kindered fields, lumber and wood products; ceramics, stone and clay products; printing, publishing, and allied industries; and miscellaneous industries. Group-II consists of textile products, apparel and other finished products. Group-III consists of chemicals, petroleum and coal products; rubber, transportation machinery, etc.—all modern industries. Apendix-II gives the analysis. It will be observed that in Group-I the employment in the total increased from 24.8% to 33.0%. The small sector share varied from 67.6% in 1909 to 54.2% in 1961. In Group-II, though in the total the share went down from 62.8% in 1909 to 17.2% in 1961, the small sector increased from 37.4% in 1909 to 44.9% in 1961. Considering that Japan is an industrial giant these figures are very significant. Particularly it will be noticed that in periods of growth in employment the large sector predominates but when the growth slows down the

*IDCJ Working Paper Series No. A-02, IDCJ, Tokyo, Japan.

small sector starts predominating. This appears to be a sociological adjustment to the needs of the nation. Japan, no doubt, has an exceedingly refined sociological response to economic factors which India does not certainly expect to achieve. At the same time, it does stress the obvious that a national will has to answer sociological problems.

In small industries, Japan has set a lead. Prof. Ohkawa's Working Paper explains an important aspect of it, *viz.*, 'skill' in the following words :

> "The traditional elements which have historically developed differ from one country to another and we have to pay attention to their function. For example, Japan had the craftsmen's skills and techniques of local indigenous industries such as Arita, Kutani and Setoyaki ceramic industries; Yuzen printed silk and Bishijin silk industries; Nambu iron kettle casting, gunsmith and swordsmith industries, and others, all inherited from the Tokugawa era. It may be said that their highly-trained skills and techniques were the basis of the rapid adaptation of many small and medium enterprises to the transplanted industries during the initial growth phase in Meiji Japan. A similar situation is found in some of the comtemporary developing nations".

There is no doubt at all that in many of the Asian countries such traditional skills do exist and can be used for the advancement of small industries. Japan's small industries are of two kinds : one the ancillary industries supplying parts to the major industries and the other direct production for consumption. In the latter, Prof. Ohkawa's Working Paper explains that Japan is helped by the development of a wholesaler class which he described as follows :

> "Another illustration, viewed from an institutional-organisational aspect, is the traditional wholesalers' role in the development of technology of small-medium scale enterprises. There had gradually developed many wholesalers engaged not only in earning profits through buying and selling goods but also purchasing needed materials and, if necessary, even planning production schedules in place of

the small-medium manufacturer concerned. The latter, thus, had been able to devote themselves to production activities almost without paying any attention to marketing. They could develop their technology through daily work".

Significant Role of Ancillary Industries

Ancillary industries have a definite role in the economics of industrial production. Capital investment in land or space can be much less for an ancillary industry than what is required in a big industry which seeks to manufacture these ancillaries also in the main plant. Decentralisation of many ancillaries to the rural centre is possible, thereby reducing substantially capital cost and maintenance cost. Further, labour wages can be much lower than in metropolitan centres. All of us can learn from this experience. The development of a wholesaler class is very much a part of Japan's culture. The division of labour between the producer and the marketeer is wonderfully developed in Japan whether it is small industry or large industry. It may not be possible to reproduce this culture elsewhere. India is trying to introduce a common marketing organisation in the sector of small industries to standardise production and organise common marketing for reducing expenditure. There is a long way to go.

Technological and Economic Feasibility of Rural Industries

It is in rural industries *per se* or what in Indian nomenclature is called village and cottage industries that there is a lot of argument about the technology and the economics thereof. It is generally assumed that village and cottage industries are economic only when large subsidies are provided by the general economy. From Indian experience this does not appear to be so. A little detailed explanation is desirable of some of the village and cottage industries which clearly are amenable to the rural industries approach because of favourable economics. India has opted heavily for handlooms as against powerlooms and organised textile industries. The level of production for textile industries has been more or less frozen and the increased demand has been distributed between powerlooms and handlooms with reservation especially of some of the varieties for handlooms. A detailed analysis has been done by Nitin Desai of the Planning Commission of India on the relative economics of the three methods of production in 20s

and 40s count cloth. In Apendix III the method of analysis has been given for those interested in technicalities. The table below gives the analysis of the cost in the three methods.

Cost Of Grey Cloth In Different Techniques

(Rupees/Metre)

	Mill	*Powerloom*	*Improved Handloom*	*Handloom*
20s×20s				
At actual input prices	3.37*	2.82	2.81	2.80
At identical input prices	2.80*	2.65	2.63	3.26
40s×40s				
At actual input prices	3.34*	2.67	N.A.	3.18
At identical input prices	2.68*	2.47	N.A.	3.94

*Excluding the quality premium on mill cloth which would be of the order of Rs. 0.30/metre.

It will be seen that improved handlooms compete fully with powerlooms and textile industries in 20s count cloth also. Data for 40s for improved handlooms is lacking but a recent analysis of the actual cost of production of controlled cloth broughtforth the information that the textile industries require a subsidy of Rs. 1.80 per sq. metre for producing controlled cloth out of 20s and 28s count yarn. On the other hand, handloom is able to produce 40s count cloth with only a subsidy of Re. 1.00 per sq. metre. This is on actual cost. If identical cost is used, which means cutting out Excise and Duty and taking labour cost in all the three sectors at Rs. 5.00 per day per labour, the balance is slightly tilted in favour of the powerlooms for 40 counts. But we know that labour rates in powerlooms are always more than that in handlooms and in the textile industries it is similarly more than that of the powerlooms. There are, therefore, definite sectors of cloth production where improved handlooms have an edge over the mechanised power system. If to this is added the preference for handlooms in the world market because of the variety especially in the fine and superfine counts, handloom is economic. India proposes to lean heavily on this sector to meet the rising demands for cloth in the country. The present intention is to increase the percentage in the total output of the cloth in favour of handlooms in the following manner.

Composition of Cotton Cloth Production

(Million Metres)

	Production	
	1975	*1982-83*
Handloom	1750	3700
Mill/Powerloom	6250	6000
	8000	9700

At present it is estimated that the handloom production in India can give full employment to two millon workers. We may compare this with employment of 350 thousand full-time workers in the textile industries. The answer is obvious for a country seeking employment for its population.

India has identified the sector of sericulture including tasar culture as one having a high potential as a cottage industry. The technology for both is based on intensive agriculture of the feed plant for the silk worm or tasar caterpillar and developing cocoon by intensive feeding of selected races of silk worm for silk and tasar caterpillar for tasar. This feeding and tending of the worms and caterpillars have to be done carefully and sometimes regularly 24 hours a day during the moulting period of the worms and caterpillars. The tasar caterpillars no doubt feed directly on the plant but change of the bushes to allow for the heavy feeding in the later moults is a time consuming manual job. Reeling of cocoons through cottage basin can also be a cottage industry. Thus the entire process is very much amenable to concentration in the rural sector as a cottage industry. There does not appear to be any argument of large or small in this country. Japan and South Korea who have developed sericulture in a big way and China with its tasar culture have perforce to keep this in the fully-manual village sector.

Another sector, which is by economics and by technology fully amenable to the cottage industry, appears to be carpet making especially of the high-quality variety. In designs and finish, India has found that the manual operation has a monopoly in this quality. The machine no doubt is producing medium-quality and coarse-quality carpets through mechanical process. But as long as there is a consumer market for high-

quality carpets the industry has a future. India is investing in training a large number of carpet weavers and is producing carpets for export.

Traditionally, it is found that in India there are 23 village and cottage industries which employ a large number of families in the rural areas. Of these, (a) food and beverages, (b) textile apparels, (c) wood work and (d) ferrous and non-ferrous metal ware are important. Now food and beverage need close attention. Prof. Ohkawa analyses the food and beverage industry in Japan in the following manner:

> "In Groups I and II, industries of traditional characteristics are contained, and it would be reasonable to say that irregular points in the slope suggest the co-existence of the traditional and the modern sector. For example, such as sake brewing, soy sauce brewing, tea manufacturing, cheap candy manufacturing, etc., where smaller-scale enterprises are prevailing among producers, *vs.* such as sugar refining beer brewing, cracker manafacturing, etc., where larger-scale enterprises are dominant, despite both being classified in the same industry of food processing. Both sectors developed independently, side by side, since these are usually not directly related to each other in terms of either the market for their products, or their techniques".

This analysis brings out that in food and beverages there are two different markets, one is rural and the cheap market and the other is urban and the sophisticated market. The types of goods produced in two sectors are quite different even though both go by the name of food and beverages.

India's experience is that the cheap market is quite active. This is the reason why as many as 10 million persons have been estimated to have been occupied in this sector in the rural areas in 1968-69. Food preservation and food processing are both necessary so that the seasonal production of fruits and vegetables and so on are suitably preserved for annual consumption and at the same time the consumer taste is titillated. *Papads* in India are one such example. In the developing nations, where there is a large population at low levels of income, the sophisticated food processing industry has a very limited market. In the developed countries the cost of sophisticated products may

be five times of what the producer of raw materials, namely fruits and vegetables and cereals, may get for his produce. Where the population is finding it difficult to even buy the raw material for food to one's full satisfaction, such sophisticated technology is very much beyond the bulk of the population of the developing countries. Hence the role of the village and cottage industries in this sector can be almost monopolistic. Asian countries will have to use this temporal advantage.

Similarly in carpentry there are two sectors where the machine cannot compete. One is the highly-artistic carpentry of furninture and fittings where the artisan is supreme. The other is the cheap market in the rural areas where the quality is not so much the need as utility and cheapness. The only need is that the village artisan is helped in getting his raw material, *viz.*, timber at a fair price in small lots when he really needs them. Here a covering organisation by the forest department of the country can undertake this work without much difficulty.

Need for Organised Marketing for Rural Produce

The village and cottage industry can and do cater to a special clientele, *viz.*, the rural low and medium income groups. If Japan, with its high per capita income, still needs the services of this sector, the developing nations with a large, low and medium income group in the rural areas can and should closely investigate the potential of this sector. No doubt some of these goods can be copied by the large sector. It is also true that Coca Cola, for example, could persuade the rural population of India to buy its ware at Rs. 1.25 a bottle whereas a well-organised milk system can supply the same quantity of nutritive milk at Rs. 0.50. This does not make out a case for the more-costly material but bring out the inherent contradiction in a poor country not orgnising its production and distribution to the poor sectors properly. India recognised the weaknesses in the marketing and promotion systems and has opted for active promotion of the village and cottage industries. Such items as are of necessity in the rural areas and can attract by their own strength the customers of the large, low and medium income groups in the rural areas are proposed to be suitably tapped. The edge which the large producers with massive marketing organisations has due to the present disorganised marketing system in small sectors can exist only as long as the small sector is not well organised and the marketing and promotion are

not developed. Appendix IV gives the list of village and cottage industries actually supported in India.

Even though village and cottage industries may be location specific, the demand does not always build up with the production capacity. A comprehensive and active marketing system, which can lay down standards and ensure quality and organise distribution, is very much necessary. In some sectors of artisan excellence including *khadi* it is found that today there are sophisticated markets waiting for supplies of such material with an assured quality granted. It is in the interest of the developing countries to improve the organisation through the institutions themselves or back this where necessary through state organisations. This is what India is trying to do.

APPENDIX I

Employment Distribution by Scale (Employees per Establishment) : Factory Manufacturing in 1909—1961 (Selected years)

Unit: Thousand; (%) : In parentheses

	Total Employees	*Small (S) (fewer than 50)*	*Medium (M) (50—499)*	*Large (L) (500 and over)*
1909	821 (100.0)	375 (45.7)	276 (33.6)	170 (20.7)
1919	1,809 (100.0)	614 (34.0)	625 (34.5)	570 (31.5)
1931	1,842 (100.0)	695 (37.6)	675 (36.7)	472 (25.7)
1940	4,486 (100.0)	1,636 (36.4)	1,228 (27.4)	1,622 (36.2)
1946	3,321 (100.0)	1,364 (41.1)	1,405 (42.3)	552 (16.6)
1953	4,658 (100.0)	2,022 (43.4)	1,433 (30.8)	1,208 (25.8)
1958	6,110 (100.0)	2,633 (43.1)	2,066 (33.8)	1,411 (23.1)
1961	8,187 (100.0)	3,078 (37.6)	2,884 (35.2)	2,225 (27.2)

Source: Ministry of International Trade and Industry *Kogyo Tokei 50 Nenshi*, A 50—year History of Manufacturing Census except for 1961, which is from the Manufacturing Census for that year and from the same source.

APPENDIX II

Employment Distribution by Scale (Employees per Establishment): Broad Industrial Groups of Manufacturing in 1909-1961 (Selected Years)

Unit : %

	Group – I				Group II				Group – III			
	Total	*S*	*M*	*L*	*Total*	*S*	*M*	*L*	*Total*	*S*	*M*	*L*
1909	24 8	67.6	29.5	2.9	62.8	37.4	34.2	28.4	12.4	42.9	38.4	18.7
1919	20.9	59.9	33.6	6.5	54.8	26.7	35.7	37.6	24.3	27.8	32.4	39.8
1931	21.8	69.8	25.1	5.1	54.3	25.5	41.2	33.6	23.9	36.1	35.3	28.6
1940	18.8	70.3	23.9	5.8	24.4	38.2	33.2	28.6	56.8	24.5	25.7	49.8
1953	30.5	66.5	26.0	7.5	23.1	41.7	35.8	22.5	46.4	29.1	31.5	39.4
1958	32.0	61.9	30.9	7.2	20.0	45.4	36.9	17.7	48.0	29 0	33 4	37.6
1961	33.0	54.2	35.2	10.6	17.2	44.9	36.8	18.3	49.8	24.1	34.7	41.2

Source: The same as for Appendix I

Notes :
1. Percentage for "Total" is for total manufacturing.
2. Percentages under S, M, and L are for the total of each group.
3. For group classification, see page 443.

APPENDIX III

Results of Programming Exercises

The programming model has been specified as a constrained cost minimisation problem with constraints on output, employment and capital investment.

I. Objective Function

The objective function is to minimise the total cost of (a) production of 20s count grey cloth and (b) production of 40s count grey cloth. In each case the objective function is defined in terms of unit costs at (i) actual input prices, and (ii) identical input prices. A quality premium of Rs. 0.30/metre has been allowed for higher quality mill cloth.

20s × 20s

The two objective functions are :

(i) Minimise (at actual input prices) $3.10X_1 + 2.82X_2 + 2.81X_3 + 2.80X_4$

(ii) Minimise (at identical input prices) :
$2.53X_1 + 2.66X_2 + 2.63X_3 + 3.26X_4$

where X_1 = output of mills (in million metres),
X_2 = output of powerlooms (in million metres),
X_3 = output of improved handlooms (in million metres), and
X_4 = output of handlooms (in million metres).

40s × 40s

The two objective functions are :

(i) Minimise (at actual input prices) :
$30.40X_1 + 2.67X_2 + 3.18X_4$

(ii) Minimise (at identical input prices) :
$2.38X_1 + 2.47X_2 + 3\ 94X_4$

The constants are production costs in rupees per metre. For fine cloth (40 × 40) data for improved handlooms are not available.

II. Output Constraint

It is the cost of additional output which is to be minimised. The Working Group on textiles has estimated the total production of cotton textiles in 1982-83 to be 9200 million metres. This represents an increase of 1255 million metres over the 1976 production.

The output constraint would therefore be :

$$X_1 + X_2 + X_3 + X_4 \geqq 1255$$

III. Employment Constraint

Three alternative employment constraints have been formulated. Employment growth should be

(i) at least 1.5 times the rate of growth of output,

(ii) at least the same rate of growth of output, or

(iii) at least 2/3 the rate of growth of output.

Thus the constraints for 20s count would then be :

(i) $0.021\ X_1 + 0.025\ X_2 + 0.09\ X_3 + 0.23\ X_4 \geqq 192.16$ (million persondays)

(ii) $0.021\ X_1 + 0.025\ X_2 + 0.09\ X_3 + 0.23\ X_4 \geqq 128.11$ (million persondays)

(iii) $0.021\ X_1 + 0.025\ X_2 + 0.09\ X_3 + 0.23 X_4 \geqq 85.38$ (million persondays)

The employment co-efficients of X_1, X_2 and X_4 for 40s count cloth are 0.024, 0.029 and 0.38 person days per metre respectively.

IV. Capital Constraint

Three alternative capital constraints for each objective function have also been formulated. Capital availability should be :

(i) Less than or equal to the mean of the investment needed to produce the incremental output with each of the four technologies;

(ii) Less than or equal to 1.5 times the mean investment (i); or

(iii) Less than or equal to 0.5 times the mean investment (i). Thus :

20×20

(i) $0.7\ X_1 + 0.35\ X_2 + 0.22\ X_3 \leqq$ Rs. 398.46 million,

(ii) $0.7\ X_1 + 0.35\ X_2 + 0.22\ X_3 \leqq$ Rs. 597.70 million, or

(iii) $0.7\ X_1 + 0.35\ X_2 + 0.22\ X_3 \leqq$ Rs. 199.23 million.

40×40

(i) $0.8\ X_1 + 0.4\ X_2 \leqq$ Rs. 502.0 million

(ii) $0.8 \times_1 + 0.4 X_2 \leq$ Rs. 753.0 million, or

(iii) $0.8 X_1 + 0.4 X_2 \leq$ Rs. 251.23 million.

The results of the above exercises are given below :

Share of Each Technology in Output

	Mills	*Powerlooms*	*Improved Handlooms*	*Hand-looms*
	1	*2*	*3*	*4*
1. RESULTS FOR 20s COUNT :				
A. At actual Input Prices (All cases)	—	—	—	100%
B. At Identical input prices				
(a) High Employment Constraint				
(i) Low capital contraint	—	—	55%	45%
(ii) Medium/High capital constraint	—	—	55%	45%
(b) Medium Employment Constraint				
(i) Low capital constraint	—	—	73%	27%
(ii) Medium/High captal constraint	—	—	91%	9%
(c) Low Employment Constraint				
(I) Low capital constraint	—	—	72%	28%
(ii) Medium/High capital constraint	20-32%	—	80-68%	—
2. RESULTS FOR 40s COUNT				
A. At Actual input prices				
(a) High Emp. Constraint				
(i) Low capital constraint	—	50%	n.a.	50%
(ii) Medium/High capital constraint	—	65%	n.a.	35%
(b) Medium Emp. Constraint				
(i) Low capital constraint	—	50%	n.a.	50%
(ii) Med./High capital cons[t]raint	—	79%	n.a.	21%
Low Employment Constraint				
(i) Low capital constraint	—	50%	n.a.	50%
(ii) Med./High capital constraint	—	89%	n.a.	11%

	1	2	3	4
B. At Identical Input Prices				
(a) High Emp. Contraint				
(i) Low capital constraint	—	50%	n.a.	50%
(ii) Med. capital constraint	36%	28%	n.a.	36%
(iii) High capital constraint	64%	—	n.a.	36%
(b) Medium Employment Constraint				
(i) Low capital constraint	—	50%	n.a.	50%
(ii) Medium capital constraint	21%	58%	n.a.	21%
(iii) High capital constraint	72%	6%	n a.	22%
(c) Low Employment Constraint				
(i) Low capital constraint	—	50%	n.a.	50%
(ii) Med. capital constraint	11%	77%	n.a.	11%
(iii) High capital constraint	62%	26%	n.a.	12%

Note : Data on improved handlooms is not available for 40s count cloth.

APPENDIX IV

Village Industries

1. Khadi (cotton, woolen and silk)
2. Processing of cereals and pulses
3. Ghani oil
4. Manufacture of cane-gur and khandsari
5. Palm gur making and other palm products
6. Cottage match
7. Non-edible oils and soap
8. Handmade paper
9. Beekeeping
10. Village pottery
11. Flaying, curing and tanning of hides and skins and ancillary industries connected with the same and cottage leather industry
12. Fibre other than coir
13. Manufacture of gums and resins
14. Lime manufacturing
15. Collection of forest plants and fruits for medicinal purposes
16. Blacksmithy
17. Carpentry
18. Manufacture and use of mathane (gobar) gas from cowdung and other waste products (such as flesh of dead animals, night soil, etc.
19. Manufacture of shellac
20. Bamboo and cane work
21. Manufacture of khatha
22. Fruit processing and fruit preservation
23. Manufacture of household utensils in aluminium.

Small Industries in Rural Development: Assessment and Perspective

Dennis A. Rondinelli*

INTRODUCTION

The growing realisation that expansion of economic participation is essential to sustained development has brought about a dramatic shift in development policy over the last ten years. National Governments and international assistance agencies that once sought growth in GNP through large-scale, capial-intensive, export-oriented industrialisation, now seek to build more balanced domestic economies that meet basic human needs and reduce high levels of abject poverty. But achivement of such goals depends on the expansion of labour-intensive, smaller scale and more widely distributed agricultural and manufacturing industries. That, in turn, requires increased investment in social and physical infrastructure through integrated rural development, more decentralised planning and administration, and greater access for marginal groups to economic resources and opportunities.

This shift in development strategy is especially important in Asia, where the effects of dual economies have been most visible and adverse. National growth over the past three decades has been sporadic, limited to a relatively few countries and concentrated in a few urban centres within those countries.[1] Although substantial progress has been made in some sectors of nearly all Asian economies, the World Bank estimates that over 600 million Asians—almost two-thirds of the region's population—still earn incomes of less than $75 a year. At the beginning of the 1970s nearly 40% of Asia's population was living in "absolute poverty."[2]

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1. See Dennis A. Rondinelli, "National Investment Planning and Equity Policy in Developing Countries : The Challenge of Decentralised Administration," *Policy Sciences*, Vol. 9, No. 2 (1978).
2. International Bank for Reconstruction and Development, *Rural Development Sector Policy Paper*. Washington : World Bank, 1975.

The key to development in Asia, and the rest of the developing world, clearly must be in the expansion of participation in productive activity, an objective that depends primarily on the ability of governments to accelerate the commercialisation of agriculture and to expand employment through promotion of small-scale industries in both rural and urban areas. These two sectors—agriculture and small-industry—provide the greatest potential for achieving equitable growth in nearly every Asian society. Indeed, experience clearly indicates that farmers simply will not produce more unless they can market and receive a fair price for their goods, and obtain fertiliser and other inputs needed to increase output. Expanding agricultural production requires increased processing capacity in rural areas, and production of farm implements, fertilisers, irrigation equipment and light construction materials at prices farmers can afford. Through creation of smaller industries, widely dispersed in market towns and intermediate size cities, developing nations can substantially increase opportunities for employment in the non-agricultural sector, expand the production of inputs needed to increase agricultural output and multiply the number of plants available for processing farm commodities.[3]

Where a deliberate government policy of promoting smaller industry is seriously attempted, it can significantly stimulate rural resource mobilisation, capital investment and entrepreneurship. Smaller industries are usually the primary, and sometimes only, means through which rural people, serving as apprentices, can obtain specialised skills and vocational training. They are seedbeds of entrepreneurship in many rural villages, where apprentices often form their own shops once they have acquired skills and experience. Smaller industries can also be important sources of new employment. In Japan, which has strongly supported such entrepreneurial efforts, small and medium size firms now represent well over 90 percent of the total manufacturing establishments, employing almost 70 percent of all nonagricultural industrial workers.[4] Small industries not only provide

3. Small-scale industry is defined differently in various Asian countries, but generally refers to establishments employing from 5 to 50 workers. Medium scale industry generally employs from 50 to 200 people. Both have relatively low levels of capitalisation.

4. M.A. Oomen, "A Report on Small-Scale Industry Development Based on A Study Tour of Japan, the Philippines and Thailand," *Small Industry Bulletin for Asia and the Far East* No. 8 (1971), pp. 106-119.

a greater quantity and diversity of goods in rural areas at prices within the reach of lower income groups, but the experiences of India, Japan and Korea show that they can also contribute to export production. Where they have been successful, small-scale industries generally require lower investment costs per job, use labour more intensively, have lower capital requirements and make use of more local resources and materials than large industries. Small-scale industrialisation can thus serve as the base for a strategy of attaining more equitable distribution of income, overcoming regional disparities and transforming stagnant rural villages into more viable and productive economic communities.[5]

But rural entrepreneurs and small-scale industrialists face myriad problems in establishing themselves and surviving in developing nations. They often lack the skills necessary to identify good potential investments, to prepare projects for external funding, to test their feasibility or to negotiate loans from commercial banks and government agencies. They generally lack access to skilled manpower needed to produce and sell their goods. They finance their activities from family savings or credit obtained at high interest rates through money-lenders or buyers. In much of Asia small industries have low levels of productivity, poor quality output, inadequate technology, obsolete equipment, and limited and uncertain markets. In addition to poor access to credit and finance, small scale industrialists generally have insufficient raw materials and lack the managerial skills and knowledge of modern packaging, marketing, production and accounting methods that might help them increase profits. Without resources they lack access to technical assistance and managerial advice. They are often discriminated against in government programmes offering financial aid, subsidies, preferential

5. For a detailed evaluation of the role of small-scale enterprises in stimulating economic growth in developing nations see Dennis A. Rondinelli and Kenneth Ruddle, *Urbanisation and Rural Development : A Spatial Policy for Equitable Growth*, New York : Praeger, 1978; Frank C. Fairchild and Hiromitsu Kaneda, "Links to the Green Revolution : A Study of Small Scale Agriculturally Related Industry in the Pakistan Punjab," *Economic Development and Cultural Change*, Vol. 23, No. 2 (January 1975), pp. 249-275; United Nations Industrial Development Organisation, *Small Scale Industries in Arab Countries of the Middle East*, (New York : United Nations, 1970) Doc. ID/ZI; John C. DeWilde, *The Development of African Enterprise* (Washington, D.C. : The World Bank, 1971) Report No. AW-31; UNIDO, *Small Scale Industry in Latin America*, (New York: United Nations, 1969) Doc. ID/27.

purchasing and export assistance to large industries, and often fail because they lack the knowledge to operate new ventures efficiently after they are established.[6]

But barriers to increased participation in Asian economies can be overcome through concerted government efforts to increase the access of the rural poor to resources and opportunities for ownership and employment in small-scale agricultural and industrial enterprises. An essential to increasing that participation is improved capacity of government agencies to stimulate public and private organisations, small-scale farmers and potential entrepreneurs to search for investment opportunities. Indeed, these are objectives expressed in the development plans of nearly all Asian governments with mixed economies.

This paper reviews the problems of stimulating rural investment and the major obstacles facing government agencies in assisting rural industrialists. It contends that a project management approach is the most effective means of formulating and implementing small-scale industrialisation policies, and that it can serve as a coherent conceptual framework for problem identification and diagnosis, and for organising government incentives, technical assistance, research, consultancy and training activities.

PROJECT MANAGEMENT APPROACH TO ADMINISTRATION OF SMALL-SCALE INDUSTRIALISATION POLICY

A project management approach offers a coherent and comprehensive framework for organising small industries promotion programmes for a number of reasons. First, projects are, by definition, manageable units of activity with well-defined goals, clearly delineated tasks, limited in size, scope and location, with work systematically scheduled

6. Some of the problems facing small-scale industrialists are discussed in P.M. Mathai, "Rural Industrialisation and the Maximisation of Employment Opportunities in India, "*Small Industry Bulletin for Asia and the Far East*, No. 9 (1972) pp. 59-64; O.P. Jain, "Small Industries for Rural Areas : Planning Aspects," *Small Industry Bulletin for Asia and the Pacific*, No. 11 (1974), pp. 18-28; P. Narisiah, "Export Promotion of Small Industry Products," *Small Industry Bulletin for Asia and the Far East*, No. 7 (1970), pp. 33-44; Medium Industry Bank, Republic of Korea, "Small Industries Policies," *Small Industry Bulletin for Asia and the Far East*, No. 8 (1971), pp. 84-86.

to accomplish their objectives within a limited time period and budget.[7] They are generally considered to be innovative ventures, at least for those undertaking them. Projects are temporary activities; that is, they should have a definite beginning and an end. The use of such a framework requires perceiving of the creation of small industries as "projects," which begin with the identification of an investment opportunity and culminate in the creation of a production process that is subsequently managed as a small business. New ventures for increasing agricultural productivity, establishing agricultural processing plants and initiating small manufacturing firms can be managed as projects until their success is assured and then become routine production or service delivery operations.

Second, project management is not only a systematic means of organising work to achieve defined goals, but is also a way of thinking and a set of skills essential to the success of public efforts for increasing employment and prodution and for establishing new entrepreneurial activities. All projects—no matter how large or small, simple or complex, long or short in duration—involve similar managerial tasks (Chart 1). In smaller, shorter-range projects many of the management functions are performed informally, or even intuitively, while in larger, longer, more complex ventures the activities must be formalised and sometimes require more sophisticated management techniques. In any case, a project management framework is one means of standardising government activities in ways directly related to the needs of small-scale industrialists.

Third, it has become increasingly clear in the past few years that project management skills are seriously inadequate in developing nations and that the shortage of experienced project managers in both public and private sectors is a bottleneck to economic progress in Asia.[8] The low level of managerial skills among small-scale

7. The characteristics of development projects are defined in Dennis A. Rondinelli, "Planning and Implementing Development Projects : An Introduction," in Dennis A. Rondinelli (ed.) *Planning Development Projects*, (Stroudsburg, Pa. : Dowden, Hutchinson and Ross, Inc., 1977), pp. 1-28.

8. The Asian Development Bank, in a review of its lending experience argues that the "shortage of the expertise required to formulate, implement and administer projects and programmes in developing countries is a constraint in the development process." See ADB, *Annual Report 1973*, (Manila, 1974), p. 4.

Chart 1: Integrated Project Management Cycle

Stage of Cycle	*Major Tasks and Activities*	
Project Identification and Definition	— Identify opportunities for new ventures, diversification or expansion of existing activities	— Estimate other resource needs
	— Initially define purposes, objectives, and scope of the project	— Evaluate current assets, resource commitments and magnitude of external financing
	— Establish need or justification for the project	— Identify potential sources of funding
	— Determine potential profits, returns or benefits	— Obtain preliminary assessments of technical and managerial feasibility
	— Estimate "order of magnitude" costs	— Consider appropriate alternative locations
Project Formulation, Preparation and Feasibility Analysis	— Define project objectives and targets	— Analyse technical, commercial, economic, financial, locational and managerial feasibility
	— Define project components and elements	
	— Perform market or demand studies	— Obtain preliminary review by potential funding sources, government agencies or other sponsors
	— Prepare project justification	
	— Prepare cost, return and borrowing estimates and preliminary financial plan	
Project Design	- Identify specific activities or tasks to be performed	— Prepare initial production, resource, input and distribution plans
	— Select site for project location	— Determine labour, managerial and other personnel needs
	— Prepare blueprints and specifications for equipment and facilities	— Analyse alternative organisational arrangements for implementation
	— Prepare operating plans, work schedules, life of the project budget	— Prepare formal operations plans
	— Estimate technological requirements and make plans for technology acquisition	

Appraisal, Selection, Negotiation and Approval	—Establish credit-worthiness —Obtain formal appraisal from funding sources	—Secure government clearances and licenses —Negotiate acceptable loan conditions —Sign loan agreements
Project Activation and Organisation	- Adapt or redesign project to conform to loan agreement —Establish or refine project management and organization plans —Recruit and train personnel —Arrange for procurement of facilities, equipment, supplies and materials	—Request bids and tender contracts for construction and other work —Clear import licenses and export requirements —Set up management and production processes —Establish marketing and distribution channels
Implementation, Operation and Control	—Procure resources, raw materials and supplies —Test and adapt technologies and managerial arrangements —Adjust production and distribution procedures	—Establish accounting, disbursement, and payment procedures —Create monitoring, inventory control and programming procedures —Establish repair and maintenance procedures
Completion, Output Diffusion, Transition to Normal Administration	—Plan for transition to full-scale production and management —Initiate loan closeout —Begin transfer of excess assets —Coordinate with goods and services users	—Establish arrangements for loan repayments —Train and redeploy project personnel —Activate organisation for full scale production
Project Evaluation and Follow-up Activities	- Perform audits and post assessments —Identify potential components for replication or expansion	—Identify linkage or spillover investments —Prepare follow-up investment proposals

entrepreneurs in agriculture and industry is especially crucial. Small-scale industrialists often operate enterprises in which there is little or no management specialisation and have little time to acquire formal training; lessons are learned through trial-and-error, often at the cost of failure. Rural entrepreneurs are generally uneducated, and sometimes illiterate, having obtained their technical skills through apprenticeships or nonformal education. Thus, the organisation of government assistance programmes using a project management framework can be a means of introducing project management concepts and skills to government staff and potential industrialists so that the latter can also apply in the operation of their enterprises.

Finally, government policies and programmes for industrial promotion in rural areas should be directly related to the problems and needs of clients. The project management framework can provide an overview of the stages or processes through which most small-scale investments evolve and be used to identify the tasks or steps through which an entrepreneur must proceed in establishing a small industry, describe the problems and constraints that might be anticipated at each stage, and array the management solutions that can be used to overcome those problems.[9]

Although most projects evolve through a number of well-defined stages following or approximating those illustrated in Chart 1, in reality, many of the tasks are performed simultaneously rather than in the sequence outlined; others may be added, combined or not performed at all.[10] But the cycle provides a basic framework for viewing a project in its entirety and for indentifying essential management activities. Moreover, the success of projects often depends as much on coordinating the entire project cycle as on performing any particular task, especially in projects that require approval by different organisations at different stages, or that are dependent on inputs, cooperation, or support from a large number of public and private institutions. Thus, it is important that

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9. See Dennis A. Rondinelli (ed.) *Planning Development Projects,* (Stroudsburg, Pa.: Dowden, Hutchinson and Ross, Inc., 1977), especially pp. 29-44, 95-139, and 169-190.

10. A discussion of major factors to be taken into consideration in analysing a project is found in Dennis A. Rondinelli, "Preparing and Analysing Case Studies in Development Project Management," *Techons*, Vol. 5, No. 2 (1976), pp. 29-40.

government officials, assistance organisations and private entrepreneurs engaged in small industry development understand the entire project cycle and that those involved in training, consultancy and research use a consistent framework to identify potential problems and management solutions. To illustrate the usefulness of a project management approach, each stage of a small-scale industrialisation project will be identified, the major problems facing Asian small-scale industrialists described, and possible government policy and programme responses suggested.[11]

1. Project Identification and Definition

The stimulation of productive economic activities depends on the ability of potential entrepreneurs or government agencies to identify opportunities for making investments in new ventures, diversify existing activities or expanding current operations. In many developing nations, projects are identified informally by businessmen through their knowledge of markets and familiarity with basic economic trends and competitors' operations, or by risk-taking entrepreneurs or innovators with ideas for new products. But in most countries, projects must be identified by national planning agencies or operating ministries or through technology transfer, the activities of multinational corporation or ideas proposed by commercial banks and international assistance agencies.[12] In whatever way the opportunity is first perceived, however, it must be defined in some detail so that the project's purposes, expected results and scope can be explained to those who will be asked to provide resources, and so that the sponsor can subsequently do more detailed planning. Expected profits, returns and costs must be estimated and other resources such as labour, equipment and operating facilities identified. The entrepreneur must evaluate his own assets and resources, outstanding

11. As with any conceptual framework or model, the project cycle described here should be a "takeoff point" for description, diagnosis and analysis rather than a set of invariable prescriptions for action. The value of any model is in the degree to which it represents reality or lends greater understanding to the processes described. Thus, this framework should be adapted and modified to provide greater understanding of the project management process and the conditions, needs and problems of small enterprises in specific countries.

12. The sources of project identification and definition in developing countries are discussed in greater detail in Dennis A. Rondinelli, "Project Identification in Economic Development," *Journal of World Trade Law*, Vol. 10, No. 3 (1976), pp. 215-251.

debts and commitments, and borrowing capacity to determine the amount of capital that will be needed from external sources. Potential lenders must be found and perhaps approached informally for an initial assessment of the idea. If a location has not already been determined appropriate possibilities must be considered. For most project sponsors these elements of identification are intuitive and are informally considered prior to preparing a formal proposal.

The potential small-scale industrialist in most developing countries, however, rarely has the resources to systematically identify sound investments, and in rural areas project identification must often be stimulated by government agencies, commercial banks or public development organisations. Entrepreneurship in rural areas is sporadic and the initiation of new ventures is often a "hit or miss" proposition, in which individuals or families commit small amount of savings, or cash obtained from the town moneylender at high rates of interest, to a small scale production or processing operation serving neighbours and nearby villages. Small-scale industrialists often have little information about the market or potential demand for their product, and indeed, in initial stages may only make marginal profits. Other small enterprises evolve through imitation of successful ventures.

Morever, traditional values and orientations or the lack of achievement motivation make most rural people unwilling to take risks or face the uncertainties of starting a new venture.[13] Thus, government must often initiate project identification and preparation or provide the preconditions that allow dispersal of industries currently concentrated in large urban centers to rural towns.[14] India's experiments with pilot rural industries projects where agricultural conditions seem favorable and production is increasing, in high unemployment areas, in tribal and economically lagging regions, and in areas where large industrial

13. In many Asian Countries the highest levels of entrepreneurship are found among minority groups or outsiders who are not bound by traditional obligations, practices or perspectives. See, for instance, O. Poponoe, "A Study of Malay Entrepreneurs," in David Lim (ed.) *Readings on Malaysian Economic Development*, (New York : Oxford University Press, 1975), Chapter 4.

14. See Dennis A. Rondinelli and Kenneth Ruddle, "Integrating Spatial Development," *Ekistics*, Vol. 43, No. 257 (1977), pp. 185-194; S.J. Burki, "Development of Towns : The Pakistan Experience," *Asian Survey*, Vol. XIV, No. 8 (August 1974), pp. 751-762; Fairchild and Kaneda, *op. cit.*

projects, rural universities or research institutes provide potential opportunities through linkage activities, for instance, have made significant progress in generating employment.[15] Government-sponsored regional "technical assistance and service centres" located in rural areas may also be needed to stimulate project identification. Areawide industrial, economic and market survey, and proposal identification and preparation assistance services, could help generate larger numbers of rural industrial projects. In some places government-organised entrepreneurial search, selection and traing programmes may be the only the means of initiating small-scale investment.

In seriously underdeveloped areas, where individual entrepreneurs may be unable or unwilling to risk their capital in setting up small industries, more direct government intervention may be needed. In Orissa, (India) for example, stimulation of small-scale industrialisation is the responsibility of the *Panchayat Samithi* Industries Programme, through which village governments set up industrial cooperatives comprising agricultural labour, artisans and local and state government representatives. A small industries corporation in Orissa identifies and selects appropriate activities, constructs factory buildings, supplies machinery, trains workers, procures raw materials, gives technical advice and assists in marketing surplus products. The units are managed by a state government or industrial extension officer. They provide on-the-job training for employees and potential managers.[16] This type of promotion can lead to imitations or replications by other entrepreneurs and create employment until project identification and investment can be initiated by small-scale industrialists without direct government control. In other cases, industrial extension services must assist with project identification, and local branches of commercial or rural banks must be prodded into actively seeking out and aiding potential entrepreneurs with project identification.

2. Formulation, Preparation and Feasibility Analysis

Once the investment is initially defined, a prospectus or proposal must

15. P.M. Mathai, "Rural Industrialisation and the Maximisation of Employment Opportunities in India," *Small Industry Bulletin for Asia and the Far East*, No. 9 (1972), pp. 59-63.

16. O.P. Jain, "Small Industries in Rural Areas : Planning Aspects," *Small Industry Bulletin for Asia and the Pacific*, No. 11 (1974), pp. 18-28.

be prepared to allow an evaluation of its feasibility by lending agencies, Objectives must be described in more detail, the elements, components and scope of operations defined, and a financial plan indicating estimates of costs and returns, borrowing needs and payback schedules prepared, especially if the proposal is to be submitted to a commercial or government development bank for financial support. Market information on the products to be manufactured or processed must be gathered and technical requirements for production analysed. The funding organisation will often test the proposal by its own technical, location, commercial, managerial and financial feasibility criteria, sometimes requesting changes in the scope or size of the project before subjecting the proposal to more formal appraisal methods. At this stage, it is also necessary for the project proposer to obtain preliminary estimates of the availability of materials, equipment and facilities.

Small-scale industrialists are also at a disadvantage in this phase of project management. Low levels of education or illiteracy make it difficult for them to prepare proposals acceptable to commercial lending institutions. Their inability to hire consultants and management experts to prepare feasibility analyses and their lack of access to information concerning domestic markets and export potential often exclude their proposals from serious consideration by commercial credit institutions. And they are often at a disadvantage in choosing the most appropriate locations for their enterprises. Analysis of the large number of criteria that should be considered in choosing a location is usually beyond their capability.[17]

A substantial amount of government assistance must be given to small-scale industrialists in formulating concise and acceptable project prospectuses and in analysing the various elements that contribute to feasibility. Training courses are conducted by some Asian governments, covering the types of skills needed by small entrepreneurs in project formulation, preparation and feasibility analysis. They generally include training in the basic principle of marketing analysis, demand and supply forecasting, analysis of technology needs, plant and facilities location and layout, accounting and financial analysis, and elements of organisa-

17. These include product market characteristics; distance from major market centres; availability of transport, communications, raw materials, semi-finished inputs, water and power; the appropriateness of physical conditions for producing and distributing the products; accessibility of skilled labour; and adequate facilities.

tional and managerial planning, in language that laymen with minimal education can understand, and the training is often supplemented by field visits to plants and factories. Such programmes as those conducted by the University of the Philippines' Institute of Small Scale Industries, which assists entrepreneurs in preparing, formulating and analysing the feasibility of proposals, presenting them to government and commercial lending representatives and providing critiques for revision and improvement, have led to the funding of a significant number of projects.

Other policies and programmes are also needed at this stage of the cycle. Industrial or resource-development feasibility studies for specific regions or small towns conducted by government industrial promotion agencies or planning consultants might both assist entrepreneurs to identify potential projects and generate much of the information needed in formulating proposals. Location analysis and selection training is also important. A government subsidy or incentive programme might encourage smaller enterprises that are contemplating expansion or diversification to consider rural villages or market towns as alternative locations to larger cities.

3. Project Design

The point at which a project is designed in detail depends on the requirements of financial organisations – some aspects of design must be included in the project proposal, others should await preliminary review and approval. In a sense, design is a function that continues throughout the life of a project, since modifications must be made after approval, during organisation and when operations are under way.

Once the initial proposal is deemed feasible, however, sepcific tasks, activities and components must be considered in detail. A site for the project must be selected. If construction is involved, engineering and architectural plans must be drawn, and specifications and blueprints prepared for equipment and facilities. The financial aspects of the venture must be made more definitive : a life-of-the-project budget should be calculated and work schedules for subsequent stages of implementation established. Issues of activating, oraganising, operating and evaluating the project must be contemplated at this time. Initial

organisational and managerial plans should be made ; labour, managerial and other personnel requirements considered ; production, resource or input delivery schedules established and marketing plans prepared. Technology requirements and sources must be determined with more specificity and preliminary plans made for project supervision and control, and the distribution of outputs.

Small-scale industrialists face myriad problems in project design, sometimes for reasons beyond their control. Most rural entrepreneurs have little or no knowledge of technological requirements—they imitate other small operations, improvise machinery or buy discarded equipment, or simply use manual techniques But in most Asian countries, smaller industries remain inefficient because of their inadequate or inappropriate equipment or faulty plant layout and production design. Small enterprises often lack the capital to acquire the kinds of equipment that could expand their volume and quality of production and generate greater employment opportunities. Moreover, adequate physical infrastructure and utilities—roads, water, power and waste disposal—are rarely available in rural areas to support efficient operations. Plant and facilities for very small industries are often located in make-shift quarters or attached to the owners' houses, making efficient layout and design difficult.

The ability of small entrepreneurs to plan efficiently the production and marketing aspects of their projects is hampered, because of their dependence on distributors or large buyers to set terms and prices, and unreliable contracting arrangements. Finally, rural, family-owned enterprises are often too small to obtain economies of scale in production, access to reliable markets or adequate supplies of raw materials—all of which complicate attempts to design effective production plans.

Improvements in project design can be made through government training and extension assistance. Industrial extension services in India, Japan and Korea provide prospective entrepreneurs and owners of small enterprises with advice on production alternatives, plant layout and machinery installation and operation. Demonstrations of efficient technical processes are conducted by extension service centres in India, reaching rural areas with small mobile workshops mounted on trucks.[18]

18. See K. Balachandran, "Small Scale Industries in India—Policies, Programme and Progress," *Small Industry Bulletin for Asia and the Far East*, No. 7 (1970), pp 119-126. More general discussions of design needs can be found in Wayne Weiss, Albert Waterston and John Wilson, "The Design of Agricultural and Rural Development Projects" in Rondinelli (ed.) *Planning Development Projects* pp. 95-139.

Some Asian governments also provide potential entrepreneurs with industrial profiles that outline capital investment, infrastructure, power, equipment and facilities requirements, and the size and type of community most likely to have sufficient population and infrastructure to support efficient operation of a plant to produce those products. In Korea and other countries, the government has leasing or hire-purchase options to provide factories to smaller industrialists, especially those who are capable of producing exportable goods but do not have the capital to purchase adequate facilities.[19]

The inability of most small-scale producers to find adequate facilities has made constructions of industrial estates an essential part of promotion programmes in most Asian countries. Generally, the government acquires and prepares suitable sites for industrial sheds, provides basic infrastructure such as roads, power, water, waste disposal and service facilities, builds and modifies plants and, in some cases, provides warehousing, common service facilities, repair shops and financial services at the site.

Finally, small-scale industrialists need direct assistance at the design stage in overcoming problems of small size. In some cases, proposed ventures are simply too small to be viable and advice should be available on the possibility or desirability of establishing or joining industrial production and marketing cooperatives, the opportunities for becoming ancillary industries, establishing subcontracting relationships with larger industries, or simply merging with medium-size or larger establishments.[20]

4. Appraisal, Selection, Negotiation and Approval

If a project requires funding by either government agency or institutional lender, it must usually be financially appraised and approved after technical feasibility studies are completed. The organisation making the appraisal takes into consideration a variety of factors including

19. Medium Industry Bank, "Small Industries Policies : Republic of Korea," *Small Industry Bulletin for Asia and the Far East*, No. 8 (1971), pp. 84-86.

20. See, for instance, H. Ansari, "A Brief Discussion on the Merging of Small Industries in Iran," *Small Industry Bulletin for Asia and the Far East*, Vol. 10 (1973), pp. 2-5.

the need and justification for the project, the potential for generating sufficient profits to repay loans and the overall credit-worthiness of the borrower.[21]

Once the project is approved, final arrangements must be made to obtain whatever government licenses, permits or sanctions are necessary and the borrower must be prepared to negotiate loan conditions, establish agreements on amounts, rates of interest, pay-back arrangements, default penalties and other matters, and to complete the final loan documents.

Perhaps the most serious problems reported by small-scale industrialists in Asia are the lack of access to adequate credit from commercial lending institutions, general shortages of capital and high rates of interest. New entrepreneurs and rural industrialists, especially are considered poor credit risks. With small amounts of personal savings, meagre assets to offer as collateral, and scant backgrounds in business, small entrepreneurs are often excluded from serious consideration for loans by organised credit institutions and most depend on family savings, small profits from other businesses, or high-interest, short-term loans from money-lenders. Once they go into debt, they are often caught in a nearly inescapable cycle of borrowing in order to survive, and sometimes are exploited by lenders who impound their inventories or machinery as security.

The poor credit ratings of small-scale industrialists is often compounded by their lack of accounting and financial analysis skills, their limited knowledge of banking and credit procedures, and the complexity of requirements imposed by lending institutions. They easily become frustrated with complicated loan application processes. Moreover, in most countries, commercial banks and government agencies prefer to lend to larger, more established industries that offer less risk, greater security and fewer problems. Small projects, therefore, are often appraised entirely on the basis of the credit-worthiness of the borrower rather than on the merits and potential profitability of the proposal. Moreover, the cultural gaps between bank loan officers and rural busi-

21. A deteiled discussion of this stage of the cycle can be found in J P. Gittinger "Economic Analysis of Agricultural Projects" in Rondinelli (ed) *Planning Development Projects*, pp. 140-155, and R.P. Sinha, "Project Evaluation : Measuring the Immeasurable" in Rondinelli (ed.) *Planning Development Projects*, pp. 156-160.

nessmen, makes the process of appraisal and negotiation of loans for small enterprises even more difficult.

All these factors combine to restrict severely the access of small enterprises to capital and credit. But, if participation in productive activity is to be expanded in Asia, new means must be found to assist small-scale entrepreneurs financially to initiate and operate new ventures and to expand and diversify existing operations. They must be trained in accounting, financial analysis, borrowing procedures and loan negotiation. A wide variety of policies and programmes must be established to increase their access to capital. Basic to any serious rural development effort is a programme for mobilising savings in rural areas and small cities. A number of countries have been successful in increasing rural savings through intensive campaigns and by increasing the number and distribution of savings institutions.[22]

Substantial changes must also be made in credit programmes and appraisal procedures. Loan guarantee funds must be established or strengthened to protect the assets of government and commercial banks lending to small industrialists, the amount of credit available to the small-scale industrial sector must be expanded drastically, and lending institutions must expand the number of low-interest, medium and long-term loans on a concessionary basis. In most countries it is necessary for national development banks to provide re-financing and re-discounting facilities, and special concessionary loan departments must be established within commercial banks. The skills of small-industry loan officers must be improved for appropriately appraising projects submitted by small-scale entrepreneurs.

At the same time, "integrated lending packages," should be created by government agencies and commercial lenders for specific industries and rural regions to combine credit, technical assistance, design and

22. See the report of the ESCAP Seminar on the Modernisation of Private Savings by B. Maithreyan, "Savings In a Developing Economy—Certain Suggestions for Reform and National Coordination," *Economic Bulletin for Asia and the Pacific*, Vol. 26, No. 1 (1975), pp. 188-201; and Sang Chan Kim, "Incentives to Save and An Appraisal of their Effectiveness in the Republic of Korea," *Ibid.*

23. A number of suggestions are made by David Kochan *et. al.*, *Financing the Development of Small-Scale Industries*, Bank Staff Working Paper No. 191. (Washington : The World Bank, 1974), mimeographed, pp. 11-41.

marketing advice and managerial training for small-scale borrowers. In most Asian countries appraisal and lending procedures must be liberalised; more simplified appraisal criteria, flexible loan conditions, streamlined application and processing procedures, lower collateral requirements, provision of credit insurance at nominal cost, and single credit screenings on the basis of the proposal's merit rather than the credit rating of the borrower, would all be essential to such a programme. Projects should be appraised by an estimation of the proposal's soundness in generating sufficient income to repay the loan.[24]

Much of Japan's success in generating small-scale industrialisation can be attributed to the fact that an "impressive array of private and government financial institutions are engaged in financing small industries." As one observer notes, "...no other Asian country has such a vast network of lending institutions to help small industries."[25] Where small-scale industrialisation programmes have been even moderately successful, as in Japan, Korea, Malaysia and India, it has generally been due to the attitude among government and private bankers that this sector represents vast opportunities for expanding productive activity, income, savings and investment, and that extensive efforts should be made to extend credit more widely to smaller entrepreneurs and industrialists.

5. Activation and Organisation

Actual start-up planning and operations can begin seriously when project funding is approved. At this stage, it is necessary to make any changes in the size, scope or nature of the project and redesign production and operations arrangements in conformance with negotiated loan agreements. The management and production plans should be formalised, the organisational structure of the project put into place, and operation plans activated. Bids must be requested and contracts tendered for construction, renovations or leasing of facilities, and procurement arrangements made for equipment, materials and supplies. Workers must be recruited and trained. Management and production procedures

24. See United Nations Economic Commission for Asia and the Far East; "Seminar on Financing Small Scale Industry in Asia and the Far East; Conclusions and Summary," *Small Industry Bulletin for Asia and the Far East*, No. 9 (1972).

25. See Oomen, *op. cit.*, p. 113.

are now established, import and export licenses cleared and marketing and distribution channels opened.

Here again, small enterprises face serious problems. Poor technical and supervisory skills and the difficuity of hiring skilled manpower often make some form of training for small-scale industrialists in "start-up operations" necessary to prevent serious delays and cost overruns. Technical and management training is often necessary for both the owner and his foremen, and supervised on-the-job or apprenticeship training should be available through regional industrial extension centres. The difficulty of hiring workers in some Asian countries is due to minimum wage requirements that set salaries beyond levels that small, marginal profit industries can afford to pay. Exemptions from laws for small-scale enterprises may be needed to generate employment. Lack of trust and excessive fear of competition among some small-scale industrialists make them hesitant to seek external assistance or to delegate responsibility within their own estabishments; they often attempt to do too many things themselves and inefficiently disperse their energy and entrepreneurial talent. Technical, managerial and supervisory training should be given as a part of every government or commercial bank loan to small-scale borrowers; follow-up assistance in activation and organisation of the project should be part of industrial extension services.

6. Implementation, Operation and Control

Operation of the project can begin when activation and organisation tasks are completed. Resources, raw materials and other inputs are acquired, technology is tested and adapted and production processes are then set in motion. Production and distribution processes are modified, if necessary, after an initial period of testing. Accounting and disbursement procedures are established and arrangements made for paying contractors, suppliers and workers. The work of contractors and subcontractors must be supervised and monitored; basic inventory and supply control arrangements should be established, and arrangements made for maintenance of facilities and equipment.

It is at this stage of the project cycle that most of the problems plaguing small-scale indutrialists become apparent. Limited space for plant and

equipment often makes small scale manufacturing or agricultural processing inefficient. Obsolescent or inappropriate technology and equipment leads to sporadic production of poor quality goods. The difficulty of obtaining raw materials or their high prices drives up costs, keep machinery equipment, and manpower underutilised and lowers profit margins. Small enterprises generally cannot afford to stockpile large inventories of raw materials or finished goods, and products cannot be stored for sale when market prices are most advantageous. The nature of the product may mean that it can only be produced seasonally or when sufficient orders accumulate. The complexities of gaining access to export markets, and their limited knowledge of domestic markets, keep small-scale industries producing relatively small volumes. When machines break down, the scarcity of replacement part either disrupts operations for long periods of time or forces workers to improvise repairs, which if done improperly causes further damage to machinery.

Internal management and control practices are notoriously poor among small-scale industrialists. Inadequate accounting and record-keeping system, informal procurement and inventory methods, and lack of production and distribution scheduling, further contribute to inefficiency. Again, a wide variety of assistance efforts are needed during the implementation and operation stages. Training of small-scale industrialists should include information about where appropriate technical and managerial assistance can be found when problems arise. Some coordinating body such as a government industrial promotion agency or private development organisation can play an important role in helping larger industries to identify parts or inputs currently imported from abroad that could be produced through domestic subcontracting. Providing technical assistance in organising and supervising production processes, controlling the quality of products and managing smaller enterprises might be a means for larger firms to encourage higher quality production in domestic small-scale industries. The lack of competition and active cooperation between large and small firms in Japan demonstrate the feasibility of linking the two in the process of expanding participation in economic activity.

Expansion of export potential for small scale industrial products would also help to overcome some problems related to low demand and small volume of production. India and Nepal provide market profiles for

several industries, assist entrepreneurs to conduct market studies and provide trend and forecasting analysis on market demand for various exportable products.[26] Those countries that have achieved some progress in promoting small-scale industrial exports have used a variety of assistance methods. Korea and Japan have comprehensive programmes which include export advance incentives, loans against export usance bills and long-term export financing. India and Japan have drastically simplified export and customs procedures for some types of small enterprises. They have established export advisory services on marketing and given transport and shipping concessions. Extensive marketing promotion schemes include dissemination of information about local products abroad, exhibitions and trade fairs, and coordination of export production activities.[27] Korea provides tax concessions and exemptions from customs duties, inspection and quality control services, technical advice, and industrial estates for small enterprises capable of producing export goods.[28]

Similar programmes are needed to assist in improving production for the domestic market. The Japanese government has set up a large number of open laboratories, for instance, to test, analyse and inspect raw materials for small industrialists to help them improve product quality and overall productivity. Under the "travelling technical guidance" programmes, university professors and technicians from private firms tour smaller factories throughout the country identifying and analysing operational problems, offering recommendations for improvement and holding guidance classes in various cities. Small enterprises are given access to the services of research and experimental institute free of charge. Modernisation promotion councils at the national and prefectural levels help small enterprises to expand operations and modernise their plants.[29] Malaysia has been able to promote indigenous small-scale industries and attract foreign investment by providing a strong network

26. See S.S.S.J.B. Rana, "The Place of Marketing in Programmes for Promotion, Modernisation and Development of Small-Scale Industries," *Small Industry Bulletin for Asia and the Pacific*, No. 13 (1976), pp. 48-53.

27. See P. Narasiah, "Export Promotion of Small Industry Productions," *Small Industry Bulletin for Asia and the Far East*, No. 7 (1970), pp. 33-44.

28. Kok Chong Yu, "Measures for Promoting Exports of Small Industry Products in the Republic of Korea," *Small Industry Bulletin for Asia and the Far East*, No. 7 (1970), pp. 26-30.

29. Oomen, *op. cit.*, pp. 115-117.

of public facilities and physical infrastructure in parts of the country, including well-maintained road systems in West Malaysia and electrification, water supply and local telecommunications on the western side of the Malay peninsula.[30] To overcome problems with inadequate equipment and facilities small enterprises also need special hire-purchase arrangements or subsidies to acquire new technology.

7. Termination or Completion, Transition to Normal Operations and Output Diffusion

If, projects are temporary activities designed to achieve specific objectives within limited costs and periods of time, plans must be made for their completion or, (in cases of failure) termination. Transition to normal administration or regular operations, and the diffusion of outputs from the project are elements of the project's phase out. This is often the most neglected stage of project management, either because in small projects the same individual or organisation will continue operating the venture after production processes are established or because in larger projects attention is totally absorbed in implementation. Either managers do not realise that long-term operations require somewhat different management techniques than projects, or do not begin to consider transition problems until the project is almost completed. Small-scale entrepreneurs need help, moreover, in assessing the potential for success after a project is under way. If intransigent problems appear, they need advice on the desirability of terminating the project prior to completion.

8. Evaluation and Follow-up

Project evaluation includes both financial auditing to ensure that funds were used efficiently and economically, and post-assessment of the project's results. Most projects that use borrowed funds are evaluated by the lending agency through audits, but internal evaluations should also be made in order for small-scale industrialists to identify factors that contributed to success or failure and to learn a lesson that might be

30. See Wolfgang Kasper, *Malaysia : A Study in Successful Economic Development*, (Washington : American Enterprise Institute for Public Policy Research, 1974) pp. 62-64.

useful in subsequent projects. Systematic evaluation by government agencies and promotion organisations are one means of identifying recurring problems and of tailoring training, extension, and research to the needs of small enterprise.

An inherent part of post-evaluation should be analysis of follow-up opportunities for expansion or replication of successful operations, or for investment in related projects. Through experience with one project, entrepreneurs often discover opportunities for new locations or new products. Follow-up investment analysis provides the project sponsor with information needed to initiate the project cycle again. Assistance with this phase of the cycle should be provided by regional small-scale industrial assistance centres, industrial extension officers or government and private lending institutions.

CONCLUSION

The complexity of managing even small-scale projects should be obvious from the foregoing description of the project cycle. Successful management requires an understanding of the nature of projects as complex activities as well as knowledge of the technical and managerial conditions in particular industries. Project management is both a way of thinking—an approach to organising and implementing tasks designed to achieve well-defined objectives—and a set of skills for performing those tasks efficiently and effectively. When they are well-managed, projects are primary means of mobilising resources and investing them in productive ventures. In Asian societies seeking to expand participation in the economy, projects play a crucial role in the development process. Increased investment in small-scale agricultural and manufacturing industries, especially within rural areas and smaller cities, can increase employment, income and entrepreneurship in nearly every Asian country.

The success of such a strategy, however, depends heavily on the willingness of the government and private enterprise to establish policies and programmes that increase the access of those now unaffected by economic and social progress to opportunities for investment, production, trade and employment. The integrated project management cycle provides a framework for research into the needs

and problems of small enterprises, and offers a conceptual and operational structure for training government officials and private entrepreneurs and managers in the processes and techniques of projects planning and implementation. With further modification and adaptation to condition in individual countries, it can also provide a framework for diagnostic consultancy and extension activities, and for programme and policy analysis in the promotion of small-scale industrialisation. □

FORM IV

(as per Rule 8)

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Integrated Development Programmes : A Skeptical Perspective

Vernon W. Ruttan*

The concern today with integrated rural development in the developing world represents, in part, a reaction against the distortions produced by the production-oriented ("Green Revolution") rural development efforts of the 1960s, which were, in turn, a reaction against the economic failures of rural development programmes of an even earlier vintage.

These earlier aid-supported community development efforts, initiated in many countries in the early 1950s (in India, Pakistan, and the Philippines, for example), were in serious trouble by the mid-1960s.[1] They had been based on the assumption that the mobilisation and development of community resources—human and physical—motivated by the multipurpose village worker and supplemented by credit and limited grants of materials would lead to the modernisation of rural society. True, the programmes did result, in some areas, in highly visible symbols of development—roads, schools, water supply, community centres. However, where resistance to change by the traditional leadership was most strongly entrenched, the independence of the village-level worker was weakened and the reform objectives of self-determination at the village level were emasculated.

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1. For the background on the origins of community development in India, see Albert Mayer, McKim Marriot and Richard L. Park, *Pilot Project, India* (Berkeley: University of California Press, 1959). For evaluations of India's community development experience, see John P. Lewis, *Quiet Crisis in India* (Washington: The Brookings Institution, 1962), pp. 155-162; John W. Mellor, Thomas F. Weaver, Uma J. Lele and Sheldon R. Simon, *Developing Rural India: Plan and Practice* (Ithaca: Cornell University Press, 1968), pp. 33-41, 75-81; Guy Hunter, *The Administration of Agricultural Development: Lessons from India* (London: Oxford University Press, 1970(; Edgar Owens and Robert Shaw, *Development Reconsidered* (Lexington, Mass.: D. C. Heath, 1972), pp. 21-25.

Programme Failures, Project Successes

The community development programmes of the 1950s were least successful in efforts designed to expand the economic base needed to support rural development—efforts to introduce changes in farming practicss that were capable of increasing agricultural productivity, or to generate employment and income through expansion of village indutries. Neither the communities themselves nor the village-level worker had access to the materials necessary for high-productivity technologies, or the knowledge and authority to realise more efficient institutional performance.[2]

In some countries the establishment of new communities was viewed as a more promising route to rural development than the reform or modernisation of old communities. This was particularly true in many Latin American countries where development of new lands on the frontier was technically feasible.[3] It also seemed a promising alternative in some areas of South-east Asia—in Malaysia, the outer islands of Indonesia, and the Cagayan Valley and Mindanao in the Philippines. But here too the recored has typically been one of limited accomplishment or outright failure.

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2. The Gezira Scheme In Sudan represents a major exception to the generally disappointing rural development programme experience. During the initial stages of the scheme, economic and technical objectives were given a high priority relative to other objectives. In spite of its success the Gezira Scheme has not, perhaps because of its colonialist origins, received wide attention as a model for other rural development efforts. For an excelent discussion of the strengths and weaknesses of the Gezira Scheme, see Arthur Gaitskell, *Gezira: A Story of Development in the Sudan* (London: Faber and Faber, 1959).

3. Michael Nelson, *The Development of Tropical Lands: Policy Issues in Latin America* (Baltimore: The Johns Hopkins University Press, 1973). In his review of the experience of 24 tropical land development projects in Latin America, Nelson concluded that, "few spheres of economic development have a history of, or reputation for, failure to match that of government-sponsored colonisation in humid tropical zones" (p. 265). He found that the probability of failure was directly related to the level of government participation in the organisation and management of the project. Spontaneous colonisation was uniformly more successful than directed or semi-directed colonisation. The government was much more effective in the role of organising specific services or tranportation facilities to service spontaneous settlement. Morever, access to markets, including highway development, appeared to be the most pervasive factor characterising successful settlement projects.

Despite the widespread disillusionment with the comprehensive rural development programmes of the 1950s, there are a number of individual rural development projects which have made effective contributions to the income and welfare of rural people.[4] Many of these have been patterned after the Comilla project established by the Pakistan (new Bangladesh) Academy for Rural Development.[5] The Comilla project—and others like it—was clearly successful in generating and diffusing technical and institutional change and in improving the welfare of rural villages.

The question thus arises: *why is it possible to identify a number of relatively successful small-scale or pilot rural development projects but so difficult to find examples of successful rural development progirammes?* Where does one go for the insight needed to understand the reasons for the discrepancy?

There are three bodies of literature which seem to me to give insight into the morphology of rural development projects, programmes, and processes. These are the literature on (a) the urban-industrial impact hypothesis: (b) the theory of induced technical change; and (3) the new models of institutional change (dealing with institution building and the economics of bureaucratic behaviour).

The urban-industrial impact hypothesis helps to clarify the relationships between the development of rural areas and the development of the total society of which rural areas are a part. It is particularly

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4. There are several useful annotated bibliographies and literature reviews on rural development: United Nations Department of Economic and Social Affairs, *Popular Participation in Development: Emerging Trends in Community Development* (New York: United Nations, 1971); Tekola Dejene and Scott E. Smith, *Experience in Rural Development* (Washington: American Council on Education, Overseas Liaison Committee, August 1973).
5. For the history of the Comilla Project, see Arthur F. Raper, *Rural Development in Action* (Ithaca : Cornell University Press, 1970); M. Nural Haq, *Village Development in Bangladesh* (Bangladesh Academy for Rural Development, Comilla, 1973); Akhter Hameed Khan, "The Comilla Projects – A Personal Acount," *International Development Review*, Vol. 14, No. 3 (1974), pp 2-7; Robert D. Stevens, "Three Rural Development Models for Small-Farm Agricultural Areas in Low Income Nations," *The Journal of Developing Areas* Vol. 8 No. 3, (April 1974), pp. 409-420. For an example of a project patterned after the Comilla project, see John M. Cohen," Rural Change in Ethiopia: The Chilalo Agricultural Development Unit," *Economic Development and Cultural Change*, Vol. 22 (July 1974), pp 580-614.

useful in understanding the spatial dimensions of rural development—*where* rural development efforts are likely to be most successful.

The induced technical change theory provides a guide to *what* must be done to gain access to efficient sources of economic growth—the new resources and incomes that are needed to sustain rural development. And the models of institutional change offer insights on *how* to organise rural institutions which will take the best advantage of the human and physical resources available to rural communities.

The Urban-Industrial Impact Hypothesis

The literature on the relationship between urban-industrial and rural development has its origins in Europe in the early efforts of Von Thunen to determine both the optimal intensity of cultivation and the optimal organisation of farm enterprises.[6] In the United States the implications of urban-industrial development for agricultural development were outlined by T. W. Schultz in the early 1950s. His perspective can be stated in a series of three hypotheses:

(1) Economic development occurs in a specific locational matrix . ...(2) These locational matrices are primarily industrial-urban in composition .....(3) The existing economic organisation works best at or near the centre of particular matrix of economic development and it also works best in those parts of agriculture which are situated favourably in relation to the centre.[7]

Schultz was particularly concerned with the development of a hypothesis that would explain the failure of agricultural production and price policies to remove the substantial regional disparities in the rate and level of development of rural areas in the United States. The rationale for the urban-industrial impact hypothesis was developed in terms of

6. See Joosep Nou, *Studies in the Development of Agricultural Economics in Europe* (Uppsala: Almquist and Wiksells, 1967), pp. 184-230, for a history of the impact of Von Thunen's work on economic thought. Also, H.D. Dickson, "Von Thunen's Economics," *Economic Journal*, Vol. 79 (December 1969), pp. 894, 902.
7. T.W. Schultz, "A Framework for Land Economics—The Long View," *Journal of Farm Economics*, Vol. 33 (May 1951), pp. 204-215; T.W. Schultz, *The Economic Organisation of Agriculture* (New York: McGraw-Hill, 1953) p. 147.

more efficient functioning of factor and product markets in areas of rapid urban-industrial development.

Formulation of the hypothesis generated a series of empirical studies designed to test its validity.[8] The effect of these studies has been the development of a model of rural development in which the rural community is linked to the urban-industrial economy through a series of market relationships:[9]

(a) the *product market* through which the commodities produced in the rural sector are transmitted to the urban sector and through which incomes are generated in rural areas;

(b) the *markets for purchased inputs* through which the capital and operating inputs move (new technologies are included in the inputs which the rural economy obtains from the industrial sector);

(c) the *labour market* through which labour is allocated between the rural and urban sectors and among economic and household activities in each sector;

(d) the *credit and land markets* through which both land and nonland assets are reallocated both between and within the urban and rural sectors; and

(e) the *market for consumer goods and services* through which rural families achieve access to, or are excluded from, the patterns of consumption which characterise urban families. In developing countries the markets for consumer goods and services represent an

8. Vernon W. Ruttan, "The Impact of Urban-Industrial Development on Agriculture in the Tennessee Valley and the Southeast," *Journal of Farm Economics*, Vol. 37 (February 1955), pp. 38-56; Anthony M. Tang, *Economic Development in Southern Piedmont, 1860-1950: Its Impact on Agriculture* (Chapel Hill: University of North Carolina Press, 1958); William H. Nicholls, "Industrialisation, Factor Markets, and Agricultural Development," *Journal of Political Economy*, Vol. 69 (August 1961), pp. 319-340; Dale E. Hathaway, J. Allen Beegle and W. Keith Bryant, *People of Rural America*, 1960 Census Monograph (Washington: U.S. Government Printing Office, 1968); Martin T. Katzman, "The Von Thunen Paradigm, the Industrial-Urban Hypothesis, and the Spatial Structure of Agriculture," *American Journal of Agricultural Economics*, Vol. 56, No. 4 (November 1974).
9. Vernon W. Ruttan, "Agricuitural Policy in an Affluent Society," *Journal of Farm Economics*, Vol. 48 (December 1966), pp. 1110-1120.

important source of change in the transition from subsistence to market agriculture.[10]

Both the rate of growth of the urban economy and the efficiency of the inter-sector product and factor markets place important constraints on the possibilities of development in rural areas. Rural development in France was inhibited for a century by the stagnation in demand associated with slow growth of both population and per capita income. Neither the product market nor the labour market functioned as dynamic sources of rural development. In contrast, the availability of an expanding market for livestock products in the United Kingdom was an important factor in Denmark's successful rural development experience.[11] The rapid economic growth in rural areas in Taiwan and the Indian Punjab affected by the new cereals-fertiliser technology reflects the capacity of the factor markets to deliver to rural areas the high-payoff technical inputs suited to local factor endowments. The urban-industrial impact hypothesis is also consistent with the results reported by Nelson on the sources of success and failure of colonisation efforts in Latin America.[12] It represents the implicit theoretical foundation for a number of proposals to organise rural development efforts around new towns, urban-industrial growth centres or growth poles.[13]

Development processes in the contemporary rural community in a developing society cannot be isolated from development process in the

10. Stephen Hymer and Stephen Resnick, "A Model of an Agrarian Economy with Non-Agricultural Activities," *American Economic Review*, Vol. 59 (September 1969), pp. 493-506.

11. William W. Wade, Institutional Determinants of Technical Change *and Agricultural Productivity Growth: Denmark, France and Great Britain, 1970-1965* (Ph.D. Thesis, Graduate School, University of Minnesota, 1973).

12. Nelson, *The Development of Tropical Lands: Policy Issues in Latin America.*

13 See, for example, S.M. Shah, ' Growth Centre as a Strategy for Rural Development: India Experience," *Economic Development and Cultural Change*, Vol. 22 (January 1974), pp. 215-228; Frank C. Miller, *Old Villages and a New Town: Industrialisation in Mexico* (Menlo Park, California: Cummings Publishing Company, 1973); Christopher Salter, "Chinese Experiments in Urban Space: The Quest for an Agrapolitan China," paper presented to the Colloquium no "New Concepts and Technologies in Third World Urbanisation," University of California (Los Angeles), May 17-18, 1974; Frank G. Mittlebach, "New Towns: Prospects for Innovation," paper presented to the Colloquium on "New Concepts and Technologies in Third World Urbanisation," University of California (Los Angeles), May 17-18, 1974.

larger society. Even the most intensive rural development efforts are unlikely to succeed if rural development is viewed as an alternative, rather than a complement, to urban-industrial developments. Yet, acceptance of an urban-industrial impact or "growth pole" strategy implies differential rates of development among areas. This may be consistent with efficient use of development budgets, but it may also be accompanied by intensification of social and political stress.

Induced Technical Change[14]

The design of a successful rural development strategy involves a unique combination of technical and institutional change. The ability of rural areas, to respond to the opportunities for economic growth generated by local urban-industrial development, or by the expansion of national and international markets, depends on the capacity for adaptive responses on the part of cultural, political and economic institutions. It also depends on technical innovations which are capable of generating substantial new income flows in response to the new economic opportunities.

During the early stages of economic development, the capacity of rural areas to successfully respond to opportunities for growth depends critically on the achievement of rapid technical change leading to productivity growth in agriculture. Significant growth in agricultural productivity can rarely be realised by the reallocation of resources within traditional agricultural systems. Technical changes embodied in new and more efficient inputs are essential—better crop varieties, cheaper plant nutrients, and more efficient sources power.

A critical limitation on the capacity of rural areas in most developing countries, and in many of the backward rural areas in the highly developed countries, is the location-specific character of much of agricultural technology. This limits the gains that can be realised by the simple transfer of agricultural technology from areas of high to areas of low productivity. A necessary condition for sustained productivity growth in agriculture is the institutionalisation of experiment

14. For an elaboration of the "induced technical change" model see Hayami and Ruttan, *Agricultural Development: An International Perspective* (Baltimore. The Johns Hopkins Press, 1971).

stations capable of producing a continuous stream of ecologically adapted and economically efficient technology—consistent with resource endowments and relative factor prices—for each commodity of economic significance in each agricultural region.

Alternative paths of technical change in agriculture can be made available. Technology can be developed to facilitate the substitution of relatively abundant (hence cheap) factors for relatively scarce (hence expensive) factors. The constraints imposed on agricultural development by an inelastic supply of land, for instance, may be offset by advances in biological and chemical technology (as in Japan). The constraints imposed by an inelastic supply of labour may be offset by advances in mechanical technology (as in the United States).

Failure to invest in experiment stations necessary to loosen the constraints imposed by resource endowments can effectively limit a region's capacity to respond to new economic opportunities. The effect of such failure during the initial stages of development is that the agricultural sector will not be able to generate the new income streams needed for growth in rural communities and in the regional economy. During the later stages of development the effect is a widening of the economic gap between urban and rural areas and among rural areas themselves. The result is the emergence of stranded populations—people left behind in the Appalachias, the Mezzogiorno, north-east Brazil, the Deccan Plateau, and other lagging regions.

Models of Institutional Innovation

The emphasis in the last two sections on the role of inter-sector factor and product markets, and on the role of technical change induced by market forces which reflect regional resource endowments, should not be taken to imply that rural development can be left to an "invisible hand" that directs needed technical and institutional changes.

Improvements in the welfare of rural people in poor regions, will require institutional innovations which effectively link urban and rural areas through a series of non market, as well as market, relationships. These nonmarket relationships focus primarily on (a) the investment in rural pople and in the amenities—particularly in the areas of education

and health—that are necessary to improve both productivity and the quality of life in poor communities, and (b) modifications in the institutional infrastructure necessary to enable rural people to mobilise both economic and political resources.

The returns of the investment in rural people are shaped by development.[15] Almost all rural people in poor countries enter the development process with very little formal schooling—most are illiterate. As development proceeds, the capacity to respond to new inputs in production and better possibilities in consumption increase the value of the abilities acquired from schooling. As the economic and social environment becomes more complex, education augments the capacity to decode, interpret, and make decisions based on new technical and economic information.

The institutional organisation and the educational and health standards employed in developing countries have typically been borrowed from countries with quite different human resource endowments and economic opportunities. The effect has been the adoption of educational and health system characterised by fiscal burdens that are beyond the capacity of the family, the community, or the state. There is an urgent need for institutional innovations that sharply increase the efficiency of resources devoted to schooling and health.[16]

There is also a need for institutional innovations to make the markets more efficient through which rural people obtain access to credit, land, and new technologies. There has been much discussion in the development literature on biases and imperfections in factor and product markets–

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15. Theodore W. Schultz, "The Education of Farm People: An Economic Perspective," (Department of Economics, University of Chicago [mimeo], 1973); Arnold C. Harberger, 'Investment in Men Versus Investment in Machines, The Case of India"in C. Ar nold Anderson and Mary Jean Bowman, eds., *Education and Economic Development* (Chicago Aldine Publishing Company, 1965), pp. 4-50.

16. For two studies which explore the possibility of achieving greater efficiency in the organisation and delivery of education and health services, see Philp H. Coombs and Manzoor Ahmed, *Attacking Rural Poverty: How Nonformal Education Can Help* (Baltimore: The Johns Hopkins University Press,1974); John Bryant, *Health and the Developing World* (Ithaca: Cornell University Press, 1969).

on middleman monopoly and monopsony.[17] The markets through which political resources are brought to bear on institutional performance in rural areas are often even more imperfect—more biased against rural people—than the credit and product markets. The lack of access by the poor majority in rural communities to the instruments of local government that would enable them to provide either economic or political rewards for effective performance—by the extension, irrigation, education and health bureaucracies—reduces the incentive for efficient bureaucratic performance.

With few exceptions, the literature on institutional change does not seem particularly useful as a guide to the design of institutional innovations capable of sharply increasing the returns of investment. However, the literature on ,'institution building" does seem to me most helpful. This literature has evolved out of an effort, primarily in the field of public administration, to provide technical assistance agencies with methodology for external intervention which would induce more effective institutional performance.[18]

A major inference from this literature is that it has been easier to institutionalise an organisation whose operations are primarly concerned with the use of a well-developed technology. Where relatively "closed-system" technologies are available, the behaviour they require for successful introduction and management are particular to their operations—and not to the socio-cultural system at large. The Gezira Scheme, built around the technologies of irrigation and cotton production, represents an example. Where no closed-system technology is available, effective institutionalisation has been exceedingly difficult to achieve.

A basic weakness of the integrated rural development approach is that

17. C.R. Wharton, Jr., "Marketing, Merchandising and Moneylending : A Note on Middleman Monopsony in Malaysia," *Malayan Economic Review*, Vol. 7(October 1962), pp. 24-44; Kurt R. Anschel, Russell H. Brannon, and Eldon D. Smith, eds., *Agricultural Cooperatives and Markets in Developing Countries* (New York: Praeger, 1969).

18. William J. Siffin, "The Institution Building Perspective: Properties, Problems and Promise, "*Institution Building: A Model of Applied Social Change*, D. Woods Thomas, et al. (eds.) (Cambridge: Schenkman, 1972), pp. 113-148. For an annotated bibliography of the Institution building literature, see Melvin G. Blase, *Institution Building: A Source Book* (Michigan State University, East Lansing: Midwest Universities Consortium for International Activities, Inc., 1973).

policy or programme objectives are adopted for which no readily available closed-system technology or programme methodologies are available. Integrated rural development can be described, perhaps not too inaccurately as an ideology in search of a methodology[19] or a technology.

Bureaucratic Behaviour

An additional body of literature on which it is useful to draw in attempting to understand the proces of institutional innovation is the emerging literature on the economics of bureaucratic behaviour. It attempts to extend the micro-economic theory of the firm and the consumer for the purpose of (a) defining the relationships between the public or semi-public organisation (or bureau) and its environment, and (b) analysing the consequences of these relationships for public choice, for the generation of budgets, and for the supply of bureaucratic services or other outputs. As a result an "economic" or "rational" theory of bureaucratic behaviour has been developed as an alternative to an "organic" or "altruistic" model.[20]

A major implication of the models developed thus far is that, given the "markets" in which they operate, bureaucracies will be successful in capturing a relatively large share of the economic gains generated by their activities.[21] This ability, manifested by staff expansion or official corruption, may be relatively low where the demand for their

19. The ideology of rural development has been described by Dr. Y. C. James L. Yen in terms of four goals of rural reconstruction: (a) livelihood, (b) education, (c) health, and (d) group activities. Y. C. James Yen, "International Institute of Rural Reconstruction and Philippine Rural Reconstruction Movement," in Harry Bayard Price, ed., *Rural Reconstruction and Development* (New York: Praeger, 1967), pp. 19-32. For an examination of the interplay between ideology and technology in rural development, see David J. Vail, "Technology for Ujamaa Village Development in Tanzania," (Program in East African Studies, Maxwell School of Citizenship and Public Affairs, Syracuse University, forthcoming, 1975).

20 The seminal work in this body of literature is Anthony Downs, *An Economic Theory of Democracy* (New York: Harper 1957), pp. 3-85 See also, James M. Buchanan and Gordon Tullock, *The Calculus of Consent* (Ann Arbor; University of Michigan Press, 1962); Mancur Olson, Jr., *The Logic of Collective Action: Public Goods and the Theory of Groups* (New York: Schocken Books, 1968); Anthony Downs, *Inside Bureaucracy* (Boston: Little, Brown & Co., 1966); William A. Niskanen, Jr. *Bureaucracy and Representative Government* (Chicago Aldine-Atherton, 1971).

21. William A. Niskanen, "The Peculiar Economics of Bureaucracy," *American Economic Review*, Vol. 58 (May 1968), pp. 293-305.

services is relatively elastic, or relatively high where the demand for their services is relatively inelastic.[22]

A further implication of this literature is that the efficient delivery of bureaucratic services to rural communities must depend on effective organisation at the community level. Rural communities must be sufficiently well organised to interact effectively with the delivery agencies in the establishment of priorities. Moreover, they must be able to mobilise sufficient political resources to be able to provide incentives for efficient bureaucratic performance. Yet it has been demonstrated by Olson's theoretical analysis as well as by the history of present movements that such organisation is extremely difficult to achieve.[23]

A less obvious implication of the literature, but one that is consistent with my own experience, is that efficiency in the delivery of bureaucratic services will depend on innovations which enable the market and non-market systems to utilise relatively unskilled human resources. And I would add that the sharp disparity in educational opportunities available to girls and the limited use of women in agricultural programmes and rural services represent a particularly heavy restraint on rural development in many countries.[24]

The Difficulties, the Possibilities

The insights opened up by these three bodies of literature—the urban-industrial impact hypothesis, the theory of induced technical change, and the models of institutional innovation—do constitute a modest

22. For a test of the Niskanen model, see W. Keith Bryant,"An Analysis of the Market for Food Stamps,"*American Journal of Agricultural Economics*. Vol. 54 (May 1972) pp. 305-325; "An Analysis of the Market for Food Stamps: Correction and Extension," *American Journal of Agricultural Economics*, Vol. 54 (November 1972) pp. 689-693

23. See Mancur Olson, Jr., *The Logic of Collective Action*, p. 48; James M. Buchanan and Gordon Tullock, *The Calculus of Consent*, pp. 43-62; Solon Barraclough, "Farmers Organizations in Planning and Implementing Rural Development" in Raanon Weitz, *Rural Development in a Changing World* (Cambridge: The MIT Press, 1971), pp. 364-390; John F. Speight, "Community Development Theory and Practice: A Machiavellian Perspective" *Rural Sociology*, Vol. 38, No. 4 (Winter 1974), pp. 477-490. The difficulties of achieving effective organization for change at the local level led Speight to conclude that "directed change must come from outside the community" (p. 479).

24. Ester Boserup, *Women's Role in Economic Development* (New York: St. Martins Press, London: George Allen and Unwin, 1970),

advance in both the capacity (a) to understand the rural development programme failures and the rural development project successes noted earlier in this article, and (b) to design more successful rural development programmes in the future. Examination of contemporary rural development experience within the framework of these three bodies of literature leads, moreover, to a number of fundamental conclusions regarding the factors which condition the success of rural development efforts.

The success of many of the rural development pilot projects has been due to the relative intensity of the human resources devoted to organisation, management, and technical assistance.[25] When an attempt was made to generalise a pilot project on a national or regional scale, the intensity of human resource input could not be maintained. Furthermore, access to the higher decision-making levels of government and the administrative freedem to tailor programmes precisely to local conditions are frequently sacrificed to administrative convenience when projects are generalised. Highly centralised administration of national programmes makes it difficult to carry out the experiments with programme content and delivery methods that are essential if rural development programmes are to meet the diverse needs of rural areas.[26]

There is a useful analogy to earlier attempts with agricultural development programmes designed to increase crop yields by applying higher levels of fertiliser inputs to traditional crop varieties. Under a high level of management it was possible to obtain modest yield increases. But the rate of return that the average farmer could achieve was low, and acceptance of technical change was slow. When new varieties characterised by more efficient response curves became available, the rate of return from "improved practices" rose dramatically and exten-

25. I am indebted to conversations with Uma Lele and John Mellor for turning my attention to the issue of intensity of the human resource input in rural development. This perspective is outlined more fully in Uma Lele, *African Rural Development Study* (Washington: IBRD, forthcoming).

26. Arthur T. Mosher, "Administrative Experimentation as a 'Way of Life' for Development Projects," *International Development Review*, Vol. 9, No. 2 (June 1967), pp. 39-41; Inayatullah, "An Analysis of the Emergence of a Rural Development Innovation In Comilla, Bangladesh," (Kuala Lumpur: Asian Centre for Development Administration, February 1975). For a useful case study of the effect of administrative rigidity on program development, see Orlin J. Scoville, "Rural Development in Thailand: The ARD Program," *The Journal of Developing Areas*, Vol. 9, No. 1 (October 1974), pp. 53-68.

sion workers no longer had to try to persuade farmers to use fertiliser. Thus, it seems apparent that the gains from even the pilot "integrated" rural development projects will remain low, until technical and institutional innovations that permit much greater efficiency in the use of human resources become available.

A second inference that emerges from this review is that the resources devoted to integrating the development and management of physical and institutional infrastructures are likely to have a relatively low return. The absence of any well-defined rural or community development technologies around which professional capacity or resources can be organised or institutionalised casts considerable doubt on the viability of integrated rural development efforts. Moreover, great disparity in the distribution of economic and political resources in many rural areas —e.g., land ownership—makes it difficult to design rural development programme activities which can command a broad basis of community support.

That does not mean, however, that it is impossible to organise efforts which expand the resources available to rural people and which contribute to the efficiency of production and consumption activities in rural areas. It is possibie to provide farmers with more productive seeds and fertilisers. It is possible to improve transportation and communication between rural and urban areas. It is possible to organise schooling in such a way that it contributes to the efficiency of rural people as both producers and consumers. It is possible to train even poorly educated health and extension workers in the skills that enable them to deliver productive technologies and services to rural areas. And it is possible to make these services available by locating them in the communities where rural people live and work.

Five Generalisations

This attempt to interpret recent development experience has led to a series of five generalisations with respect to programme ideology and design of any large-scale rural development effort :

First, rural development programme activities must be organised around activities and services that have relatively well-defined technologies or methodologies and objectives. It is importamt to rural communities that

such activities and services be simultaneously available, but not necessarily administratively integrated.[27]

Second, rural development programme activities must be organised to utilise the relatively unskilled (and inexperienced) human resources that are available in rural areas. It follows that they must be extensive rather than intensive in their use of high-cost human capital, at both the planning and implementation stages.

Third, effective implementation of rural development programmes is, to a substantial degree, dependent on the development of the institutional capacity to mobilise the limited political and economic resources available to the disadvantaged in rural communities. In societies where rural administration is organised according to economic policies which are primarily directed toward the extraction of a surplus from rural areas, the political and economic conditions necessary for rural development will rarely be met.

Fourth, the problem of welfare in the rural areas of most developing countries remains more a problem of the level of output per person than of distribution. The search for new sources of income growth must continue to be sought in both technical and institutional change.

Finally, the structural characteristics of most rural communities, and of the societies of which they are a part, will continue to prevent them from obtaining access to many of the available development opportunities. Yet rural development pragrammes will rarely be able to mobilise the political and economic resources necessary for massive structural reform. Therefore, we can expect that the development of rural areas will continue to be characterised by unequal rates of development between rural and urban areas, among rural areas, and among classes within rural areas. □

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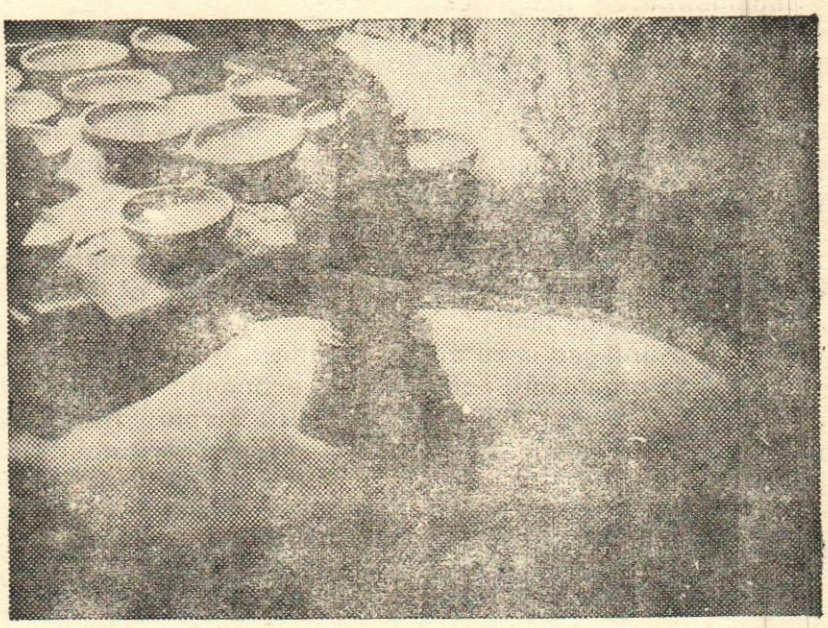
27. Shoaib Sultan Khan, "Daudzai Project: A Case Study" (Peshawar: Paksitan Academy for Rural Development, January 1975), pp. 16-18; A.T. Mosher, 1972, p. 2.

the art of good management...



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Rural Development Efforts In India : An Assessment

Sarathi Acharya* & Satish Jha**

The concept of development has often been interpreted differently by different authorities and the definition itself has undergone changes over the years. Since development involves both tangible and intangible factors, a lack of unique measurement method has further led to multiple strategies of development based on alternative assumptions. In some quarters economic development is frequently identified with economic growth,[1] and at the earlier stages of planning in India, the efforts were totally devoted to enhancing the growth rate of the national output.[2] Even when the distinction between growth and development became sharper, the perusal of the same policy continued with the pretext that growth is the necssary pre-requisite for development. Only when the cleavage between the two became so deep that growth itself was hampered because of complete lack of a supportive design, a debate on development emerged. Rural Development has, thereafter, become the principal focus of the Development Debate in India, especially, under the Sixth Plan.

"Development", according to the latest concepts afloat, involves 'humans' as distinct from 'material produce'. It is defined as a process which involves improvement in the quality of life of the weaker sections and a larger participation and involvement of the masses in the process of decision making in the economic, social, political and cultural life of a society.[3] In economic terms, therefore, the concept of development involves 'distribution' in a big way. Accordingly, Rural Development in India is now understood as one which would promote a larger participation and involvement of the rural poor on the one hand and a provision for a better quality of life for the rural poor on the other.

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1. See for instance, Dorner P, Land Reform and Economic Development, Penguin, 1972, as a covering reference.
2. The II Plan strategies make this quite explicit.
3. This is the definition followed by the ILO.

Strategies in the past 25 years of planning implicitly identified rural areas with agricultural and allied activities and urban areas with industrial and trade activities. The strategy of industrialisation, which was the spear-head of Indian planning during the first 20 years led to islands of large industrial concentration in the cities and towns with the bulk of the rural population submerged in utter poverty and backwardness. Even in the urban areas, there was excessive concentration of wealth and productive power, with a large urban concentration of the poor, both from the cities originally and those migrated from the rural areas. With the expanding base of the factory manufacturing sector in the economy, the economic activity and employment base in the traditional activities in the rural sector (based on *inferior* out-moded technologies) declined and there was a swelling in the ranks of the landless labourers. In view of the inoperative land reforms and the failure of other sectors of the economy to provide employment to persons from the extinct sectors, the inevitable outcome was the destitution of the rural poor. Even though after 1965 the terms of trade between agriculture and industry shifted somewhat in favour of the former,[4] the living conditions of the majority of the rural poor either continued to be unchanged or deteriorated.

Even as the identification of the rural sector with agricultural and allied activities was continued, resource allocation and mobilisation priorities continued towards higher growth of output alone. Thus, given the land and asset holding pattern, capitalisation of agriculture occurred over large areas leading to a denial of all what has been listed under 'development' due to the wide gap between the social and private rates of return.

A survey of the economic history of the last 25 years shows a total lack of priority and integrated strategy of development of the rural India. There have been, what at best can be termed as half-hearted efforts from time to time for rural development, and these programmes too were often distorted due to lack of the very

4. Mishra, S.N., Alternatives in Agricutlure, IEG, 1978. has shown this by comparing the price movements of Agricultural and non-agricultural goods, since rural poor are not the ones which benefit directly from a better deal for agriculture.

definition of development. Some of these programmes are examined in some detail below.

Rural Development Strategies

One of the first efforts towards rural development was the Community Development Programme which emerged from the Gandhian framework to which the then national leadership was committed. The Community Development Programme was concieved in 1952 and the agency through which the social and economic life of villages could be changed was termed as rural extension. Through this Community Development Programme various agencies working for rural development were to be integrated within the framework of the district administration. One important point to remember here is that the CD as a method came only after successful abolition of intermediaries between the state and the farmer; this was to broaden the base of the administrative machinery in coming years. It led to the establishment of what was supposed to be the viable administrative unit termed as the block. By the end of 1974 about 5100 CD blocks were established in the country, and one front on which CD programme succeeded was the creation of these blocks.

The approach underlying the CD ideology for rural development was a comprehensive one aiming at on overall improvement of the life of rural people but did not have a pointed thrust. Also, as an officially sponsored agency attempting to involve the life of the rural people at large in its activities, it had certain inherent contradictions which came to the fore at the very beginning of the programme itself. In an effort to bring in the role and participation of the rural inhabitants, the institution of *Panchayati Raj* was established in 1957. This institution of *Panchayati Raj* as such and a formal accountability of the block administration to this elected body made the *Panchayati Raj* bodies a strong tool in the hands of local elite who used it to their benefit.

The grim food situation in the subsequent years, despite expansion in area under cultivation as well as irrigation (aggravated by the faster population growth than predicted and also a rise in the per capita disposable income in certain areas), subsequently leading to large imports of food, led to search for schemes that could promote agricul-

tural production rapidly within the country. The document on "Problems of the Third Plan"[5] observed : the CD movement has now placed before itself the objectives of achieving increased agricultural production as one of its main aims and it has decided that about 80 percent of time and energy of the rural extension works should be devoted to the attainment of this *basic* aim. This led to the formulation of a number of programmes, important among them being the Integrated Agricultural District Programme (IADP) which was launched in 15 districts all over the country.

The heart of the concept of IADP was one of using the district as the focus of the agricultural development programme and the districts were selected on the basis of quality of land and water resource situation. The effort of this intensive programme did reveal that with intensive efforts through extension, supervision and the provision of new technology the agricultural production could be increased to a substantial level provided a suitable coordinating machinery was established for agricultural development which cut across the vertical hierarchy of district administration. However, as it occurred, given the socio-economic organisation, such a development led to a differentiation among the peasantry besides augmenting regional disparities.

These realisations led to initiation of two types of approaches in the subsequent years : one, the area approach and the second, a target group approach to development of rural areas in general and rural poor in particular. These schemes took shape through the Fourth Plan. Some of the important programmes in this series were the Small Farmers Development Agency, Tribal Area Development, Hill Area Development, Drought Prone Areas Programme, etc. In certain regions, "growth centre" approach was emphasised but that was in the context of creating infrastructure for the industrialisation of these areas. In that way the latter programmes were distinct from the programmes mentioned earlier as the former emphasised on the development of agricultural and allied activities alone.

The schemes of Small Farmers Development Agencies (SFDA) and Marginal Farmers and Agricultural Labourers Development (MFAL) were introduced on a pilot experiment basis in 87 project areas during

5. Problems of Third Plan—Planning Commission, 1961.

the Fourth Plan in order to find some institutional solution for potentially viable and non-viable cultivators. These programmes started functioning from 1971-72 onwards. By 1978 these agencies had identified about 2 million, small farmers, another 2 million marginal farmers and about 50,000 agricultural labourers. Of these, about 2.3 million were enrolled as members of cooperatives. However, the programmes could not continue at the targetted pace and they could utilise only about half of their outlay during first five years of their operation (only about Rs. 540 million was utilised by these agencies as against a total outlay of Rs. 1030 million). These programmes, however, did help in putting up more than 200,000 minor irrigation units, more than 100,000 dairy units and a number of other units of subsidiary oocupations. The whole scheme is intended to be intensified though the Sixth Plan.

The objective of the effort through Tribal Area Development (TAD) has been to bring tribals—about 40 million in number—within the mainstream of economic development. However, a number of difficulties in the implementation of this programme are being faced. The types of difficulties range from being that of social and political to administrative and managerial. It has been observed that unless more rigorous efforts through adequate measures and effective implementation of requisite legislations are made, it may not be possible to even intervene, let alone stop the exploitation of tribals. Hill Area Developmeni Schemes are based on Gadgil's *Mandi* approach which was found to be relevant for the hill areas. The main philosophy and the objective of these projects is the removal of inter-regional and intra-regional disparities by way of an integrated approach combining in itself the major economic development programmes involving agriculture and allied economic activities and creating infrastructural facilities in the field of communication, irrigation, land development, processing, marketing, etc. The agencies for such development are again within the CD pattern.

These programmes are all constrained in achieving their objective due to the slow progress made in land-reforms due to the reinforcement of traditional social structure of the land-holding classes, inability of planning at local level through the involvement of larger masses and lack of skills at the level of the extension agency which operates through the CD blocks to meet challenges arising from the new technology in agriculture and allied activities. Though irrigation potential under major and medium irrigation plans has risen to a little above 22

million hectares, it has not been possible for the farmers in these irrigated areas under the command of the irrigation projects to maximise advantages due to the non-availability of assured and regular water supplies. The non-construction of waterways and field channels; the need for land levelling, land shaping and other on-farm work; the non-existence of proper drainage system leading to the problems of water logging, salinity and alkalinity; the non-adoption of rostering system of irrigation and inadequacy of infrastructure and imports etc., are some such aspects which have led to the under-utilisation of the irrigation potential in case of a large number of projects. Also, it was observed that majority of farmers who have benefitted from these projects have been the big farmers. Because of their resource position they were able to overcome most of the problems stated above. Though an integrated area development approach has been adopted to overcome these problems, its emphasis has been more on technical and managerial aspects. In other words, there has again been a concentration on physical productivity, at least implicitly.

Drought Prone Areas Programme (DPAP), conceived on the understanding that rural works *in situ*, in areas which are recurringly affected by drought would not result in the development of these areas. The concept of DPAP lays emphasis on an optimum utilisation of land and water resources of such water-scarce areas. The programme has two objectives explicitly stated—the development of the area and special emphasis on the weaker sections of the areas. The Fifth Plan, which emphasised on the Integrated Rural Development of the areas, had put the DPAP within that perspective However, the major changes in the organisation which were considered to be the back-bone of this programme, have not been possible and the evaluation studies made of some DPAP programmes show[6] that they have not made any headway in attaining their objectives.

At present, out of a total of 390 districts in the country, 331 are under at least one area of special programme. Each district has a central programme around which other special programmes are based. The break-up of these programmes is given below :

6. See for instance, Report on DPAP Jhabua, Economic Times, Oct. 12, 1978.

Programme	*No. of Districts Covered*
SFDA/MFAL	198
Drought Prone Areas Programme (DPAP)	74
Integrated Rural Development (IRD)	20
Command Area Development (CAD)	124
Tribal Area Development (TAD)	5
Integrated Tribal Development (ITD)	64
Hill Area Development (HAD)	3
Coverage Overlapping of Programmes	*No. of districts*
Districts having more than one programme	89
DPAP, SFDA & CAD	40
DPAP but not SFDA & CAD	129
SFDA but not DPAP & CAD	36
Total No. of districts under SFDA/DPAP/CAD	294
No. of districts without SFDA/DPAP/CAD	96
No. of districts without any special programme of DPAP/SFDA/CAD/IRD/TAD/HAD	59

However, asfar as the attainment of the objective of improving the quality of life of rural poor is concerned, these programmes have presented a poor result as can be seen from the growing proportion of population below the poverty line. These programmes have not been successful in achieving the two objectives implicit in the very definition and also explicitly stated as the objective—that of removing inter-regional and intra-regional imbalances. The schemes have benefitted a certain section of the population which is negligible and the achievements are too meagre for eradicating poverty from the rural areas of the country.

The changes in the concept of rural development programmes which have occurred from time to time ranging from a comprehensive approach in 1950 to productivity approach up to the sixties to area and target group approach since then, can be said to be a movement from the comprehensive or general to the particular. It has been emphasised

all along that this movement towards the particular is within the overall comprehensive framework but the contradiction between the two, conceptually as well as orgnisationally, remains unresolved. From a managerial perspective this movement to specificity has brought a pointed thrust in the planning and implementation of development programmes but has led to a process of sub-optimisation as well. The multiplication of various programmes, projects, agencies, etc., has made the task of intregation further difficult and the last of these have tended to become a world into itself.

Land Reforms

Independent India inherited a land system from the colonial regime that was characterised by a high degree of concentration of land, both under the *Zamindari* and the *Ryotwari* tenure systems. These systems were a result of various land reforms measures taken up by the British to safeguard their political influence in the rural areas and save the rural market from being completely pauperised. This generally followed either economic disasters like famines or political upheavals like peasant uprisings and rebellion, etc.[7]

By the time of independence a strong public opinion had crystallised to the effect that the existing agrarian relations were an impediment to the path of national economic regeneration, as they restricted the rural market by keeping a large mass of producers under accute poverty. The Indian National Congress which championed this cause since 1931 appointed various committees to probe into the matter and when it came to power, its task, it claimed was to concretise these ideas. In 1948 the Congress approved that all the intermediaries between the tiller and the state should be eliminated as early as possible.

In December 1947 the Congress Agrarian Reforms Committee (known as Kumarappa Committee) was appointed to survey the agrarian relations in the country and make recommendations covering all the major issues concerning land. Recommendations of this Committee

7. Census of India 1951, Vol. 4, Govt. of India.
8. Resolution on Economic and Allied Matters : 1924-69, New Delhi, Indian National Congress.

were to shape the nature of land reforms policy in the coming years. Its main recommendations were : The main principles which should govern the agrarian policy of the country are : (a) the agrarian economy should provide an opportunity for the development of the farmer's personality ; (b) there should be no scope of exploitation of one class by another ; (c) there should be maximum efficiency of production; and (d) the scheme of reforms should be within the realm of particibility.[9] In this light it suggested (i) abolition of intermediaries between the state and the tiller (ii) land to the tiller (iii) differentiated approach towards land holding on the basis of given differentials.

All these recommendations were accepted by the government and the pace of abolition of intermediary right was phenomenal in different parts of the country. This brought about 20 million cultivators directly in contact with the state. However, the question of ceiling on land holdings had not been brought in very sharply though the Kumarappa Committee had made an effort to classify holdings into three categories, basic, family and optimum, which was too general a classification to be implemented. Even the first five year plan document was rather ambiguous on the issue of ceiling.

It would not be out of place to quote the observation made by the National Commision on Agriculture. It observed that the question of ceiling on land holdings was pushed into the background during the first six years of independence by measures relating to *Zamindari* abolition. The Indian agrarian policy was very much influenced at that time by the belief that agricultural production could be increased only by larger farms using modern techniques and that small scale farming was the main cause of backwardness of Indian agriculture.[10] However, the contradiction between the avowed ideal of social justice and the highly skewed land distribution was too obvious and became a point of controversy among the political circles as well as the inteligentsia of the country. As a result, the Nanda Committee was appointed in 1955 by the Planning Commission. The Committee stressed the desirability of land reforms from the point of view of (a) inducing capital investment in land, (b) ending uncertainty, (c) providing work and security for

9. Report of the National Commission on Agriculture, Vol. XV p. 22, Govt. of India, New Delhi, 1976.

10. *Ibid.*, p. 27.

the landless, and, (d) encouraging personal cultivation. It also prescribed a ceiling limit of three times the family holding which could be raised up to a maximum of six times the family holding if the number of family members exceeded five. Exemption in case of large farms under various categories using technical inputs and plantations etc., was also recommended. It found abolition of tenancy altogether impracticable. Land reform measures during the Second plan were based heavily on the observations made by the Nanda Panel for removing structural impediments to agricultural growth and to create conditions for evolving high efficiency-based agrarian economy. The policy remained static along the same lines during the Third Plan. The Fourth Plan document observed many gaps between the objectives, the legislation and their implementation in case of land reforms. It noted that the progress in conferring ownership to the tiller had been to the tune of 16 percent only and insecure tanancies according to 1961 census accounted for 82 percent of total tenancies. However, its observation remained to the extent of pointing out loop-holes in the legislation to implement land reforms. In the same vein, the Fifth plan also emphasised the need for removal of gaps between policy, legislation and implementation. It maintained that the laws for the abolition of intermediary tenures have been implemented fairly inefficiently, which, in the field of tenancy reform and ceiling on holding legislation has fallen short of the desired objectives and implementation of the enacted laws has been inadequate.[11]

An assesment of land reform policies pursued was made by the Appu Committee in 1973 which placed on record that "programmes of land reform adopted since independence have failed to bring about the required changes in the agrarian structure.[12]

The reasons for such a poor performance on these two points of tenancy reforms and consolidation of land holdings as advanced by the Appu Committee were lack of political will, absence of pressure from below, administrative inadequacies, absence of updated land records, absence of supporting service and the absence of integrated approach to consolidation of holdings. These causes by themselves are quite exhaustive in nature and most of the debate on the question of failure of land reforms in India has been to prove the primacy of one over the

11. Draft Fifth Five Year Plan, Vol. II, p. 43

12. Appu. P.S., Note on Land Policy, Planning Commission, 1973.

rest. However, the objective of land reforms can become a possibility only, if, either there is sufficient political will on the part of the state or the affected classes have to assert themselves through their own political organisation.

Conclusion

From the foregone discussion, two main points emerge which are critical for consideration. The first, all efforts for rural development have centred around increasing agricultural production. Even in the tribal area development programmes or the programmes of the small and marginal farmers, the effort has continued towards increasing the agricultural production, productivity and there has been no fundamental effort for either diversifying the occupational base in the rural areas, or, providing alternative, viable employment base to the rural population. Second, even after understanding the problem in great detail, the policy attempts have remained "soft" and "peripheral". The typical example is that of land reforms. It is well known that rural transformation is not possible untill the land question is fully settled, but still plans after plans have given it a lukewarm emphasis.

Development is a process of change where at times there are conflicting interests between groups of the population—between those who benefit from the changes and the ones who lose from it.

In a country where the development question is pivoted on such a conflict, it is necessary that hard decisions be taken in larger interests. □



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Rural Development : People-Centered Approach

B. C. Muthayya*

Development is a process of change from the exisiting level to the planned new level. It implies that the level aimed at is better (physical, economic, social and so on) than what it was. It has no satiation point and, therefore, is a continuous process which is positive and purposive. In view of this, it is necessary to limit the goals of development periodically in terms of what to achieve, or, in what direction a particular action must be taken. For example, one may think of objectives of development in terms of improving the standards of living of people by certain points measured in economic and social units such as increasing the production, improving the productivity of the workers, fulfilling the targets fixed, improving the educational, health and nutritional standards, etc. In short, the goal of development is achievement of a task prescribed which may vary from time to time.

The other objectives of development that could be delineated are maintenance of group harmony and involving the people in the achievement of tasks in order to foster self-reliance. It is assumed that achievement of the task alone by external intervention will not bring about development of the community, as people do not get the feeling that they are participants in the endeavour. Therefore, it is necessary to involve people or their representatives effectively in the process of development or in the achievement of the task. While achieving the tasks with the involvement of the people, it is also necessary to see that these achievements do not bring about disparity among people in terms of possessions and profits resulting in disquiet in the rural areas. Therefore, while achieving the first two objectives, care should also be taken to ensure the effective participation of all sections of the community in order to maintain the social equilibrium and the required morale.

If we assume that rural development, by and large, is aimed at not only bringing about improvements in the levels of living of the people by providing them various inputs, but also to make them capable of, and

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responsible for sustaining the programmes and bring about further improvements in whatever that has been done for their betterment, then it calls for an approach which is oriented towards an understanding of the existing situations and taking actions to remove the lacunae osbserved.

Programmes of rural development are intended to bring about change in the existing levels of living of the people in terms of improving their conditions in regard to food, clothing, shelter, health and nutrition, education, family size, communication, and so on. However, before implementing such programmes, it is necessary to find out the existing conditions in order to discover avenues for innovations, factors of resistance and methods of bringing about such improvements. It has been found that the reactions of the people to the various programmes vary, depending upon the socio-economic levels to which they belong at the given moment of time in terms of their present *possessions*, *activities* and *behaviours* (socio-phychological). The possessions can be house, land, irrigation facilities, modern agricultural implements, material possession, cattle wealth, income, educational level and caste. As for activities, it may be conceived in terms of family size, health and nutritional status, mass media contact, mobility rate, leisure-time activities and membership in social organisations. The behaviours are to be assessed in terms of perceptions, cognitions, effects and attitudes.

Past Studies

Most of the studies which have attempted to understand the existing conditions have drawn heavily on these factors in order not only to find out the differential reactions of the people to the various programmes implemented but also to discover the benefits derived by them. It is everybody's knowledge that the so-called (now) green revolution was possible only because of the upper and middle-level farmers than the lower-level farmers in terms of size of landholding. In view of this, the possessions in terms of personal resources, and activities in terms of what they do and behaviours in terms of the socio-psychological dimensions, by and large, serve as indicators of rural level of living.

In case it is possible to bring about a relationship between possessions, activities and behaviours, then the factors contributing to this relationship in each of these dimensions could lead to an understanding of

the indicators of levels of living, Usually, we restrict our knowledge of the indicators to the possessions as revealed in the studies done on these lines but do not have consistent and adequate data on behavioural dimensions validating the indicators emerging from possessions. In other words, the satisfaction of one's needs need not necessarily be the result of certain possessions alone, but may be the result of positve feelings that are associated with them. The latter is very difficult to achieve, leave alone to assess and, hence, studies depend on the former.

One of the objectives of the community development movement was to raise the expectations of the rural masses which was considered necessary under the assumption that increased expectations would lead to putting in increased productive efforts. But the basic factor that expectations in vacuum would not bring about increased effort but increased dissatisfaction seems to have not been taken into account One should have certain basic requirements to base one's future expectations as otherwise they will remain unrealistic. A study [Muthayya, 1971 b] conducted in some villages in Lucknow District in 1966, revealed that people were still clamouring for statisfaction of their basic needs like food, clothing, shelter, leave alone a piece of land to call as their own. In this context, the expectations that were raised by the Comunity Development Programmes could not be fulfilled as the people did not have the basic resources to alleviate their existing conditions, not to talk of fulfilling the expectation cherished. Naturally, therefore, the yawning gap between expectations and attainment has led, to some extent, to disquiet in rural areas. Another study that was conducted in some villages in Allahabad [Sinha, 1969] also revealed that the range of needs expressed by the villagers, while highly restricted, were largely confined to items of immediate necessities and subsistence. Yet, another study [Muthayya, 1972] conducted in Andhra Pradesh also brought forth information suggesting that people, by and large want to produce more to meet the immediate basic and family needs. In a similar study [NPC, 1967 c] conducted in some of the villages of Uttar Pardesh, Haryana and Rajasthan, it was reported that ownership of land, irrigation facilities, corp insurance, guaranteed minimum price for the produce, social rewards, and other titles were powerful motivators to the farmers. In a small-scale study conducted in Andhra Pardesh [Muthayya, 1971 a], it was found that the farmer-cultivators maintained a progressive outlook aspiring for some increase

in most of their personal assets, but their aspirations were cautious in respect of items like material possessions, livestock, furniture, house, agricultural implements, landholding, etc., which involved expenditure. Their aspirations were very realistic probably because of caution and/or a defence against failure as they did not want to aspire for something which they think they might not achieve, judged from their present frame of reference.

Motivation, the Key Factor

These few studies, in a way, suggest that people, by and large, are restricted in their wants and they do not visualise the possibility of improving their present levels of living. In a nationwide study conducted by the NICD in 1966, an assessment was made of the obstacles which hinder economic motivation. It was found in this analysis that the villagers would not accept any highly remunerative job elsewhere in case it endangered their health, involved selling their land, and disobeying their parents, in that order. These studies also revealed that farmers, by and large, were not motivated in spite of the expectations that were raised.

Of all the variables in agriculture, the farmer is the most crucial and the least predictable. Therefore, there is a need to understand the nature and level of motivation of the farmers and also the incentives which would be meaningful to them in order to encourage their productive efforts. In this context, one of the aspects of paramount importance in community development is motivating the people. Motivating the villagers to participate in the community affairs or to improve their presonal assets is a prerequisite for bringing about their involvement either in community efforts or in the personal productive efforts. Therefore, for effective motivation for community development, it is essential to know the goal that is to be achieved. the energy that is to be released and the tool or method that is to be used to direct or control their energy.

The programmes that are implemented for development in the community in terms of providing technical skills from external source or amenities for better living, may not generate the local impulses to improve as it may give rise to a tendency to depend upon external source for such assistance. In case the community development, as envisaged

in its conceptual framework, has to be achieved, then it is necessary to understand the level of motivation of the people in terms of their present deprivations, prepotent need areas and then by using proper methods attempts should be made to motivate them through an emphasis on such of those deprived need areas. Any satisfied need would cease to be a motivator of behaviour and hence our effort should be to find out those needs which are deprived and use them as incentives for furthering the motivation of the people. So motivating people for community development is of primary importance for any change or improvement that is envisaged in the community.

People's Participation

Another factor which is of importance is in terms of bringing about "peoples' participation". Participation in the real sense of the word should involve people in any programme based on mutual respect. It involves a capacity to identify oneself with other persons in the community without being conscious of any of the socio-economic barriers. Unfortunately, in spite of the people's 'institutions like the *Panchayati Raj*, it has been pointed out time and again that people are not coming forward and involving themselves in the functions of the local institutions except perhaps at the time of voting.

It has also been found in one of the studies [Muthayya, 1972] that villager's sense of effectiveness, sense of political efficacy and sense of duty as citizens are, by and large, at a low ebb. It may be said that the people do not participate because of lack of potentiality to participate. Most of the people (about 50 percent) are below the poverty line and, therefore, are not in a position to participate in the real sense of the word by virtue of the dependent relationship on those who belong to the higher echelons of the community. It is likely that, as the dependent relationship decreases by virtue of the various economic and welfare measures undertaken for their benefit, there may be a possibility of improvement in the level of their participation.

People's participation either in the implementation of the programme or in developing plans for the improvement of a village or area or a community very much depends upon their ascribed or achieved role in the community. If they occupy roles in a community which are vulnerable, the chances of their participation will be very much less.

In any kind of social group, the hierarchy of relationship patterns are similar to the hierarchy of relationship in a family and, therefore, the chances of participation in the real sense of the word will be too much of an ideal. Whatever may be the ascribed position of an individual in a particular community, his position as an individual member of the community must be recognised regardless of his personal resources. Until and unless this is done, the chances of people's involvement and participation in the programmes of community development will remain bleak.

The attitude that some people maintain that the villagers are illiterate, ignorant, indifferent, etc., may certainly influence their style of handling them, as it is believed that one's reaction to people is very much dependent upon what assumptions one makes about them and what expectations one has about their behaviour. Therefore, when we aim at involving the people, whatever be the nature of the people, we must make an accurate assessment of their needs, attitudes, values and past experiences to guide our thinking for ascribing roles in the process of involving them to achieve community development.

Self-reliance

Another important factor that has been talked about in the recent times is to bring about self-reliance among the people. One of the major objectives of our economic planning is achievement of self-reliance. So, when we think of self-reliance in an individual in rural areas, we expect it to be, to a large extent, the result of the developmental process. The question, therefore, arises, how can majority of the rural folk become self-reliant when their "self" itself is in need of some status. We will not be in a position to talk about self-reliance unless we are sure that adequate opportunities for the growth of the individual self have been created in rural community.

In this context, the land reform measures that are so vigourously thought to be implemented in the recent times may be a good augury in the direction of providing a self-status to the majority of the rural folk. It has also been found in various studies that landholding, whatever may be the degree, has certain bearing on one's level of living, participation in social organisation, general productivity and social attitudes. In

view of this, it may be said that there may be a possibility in the future that the majority of the rural people may achieve some self-status in terms of certain possessions and, therefore, efforts should made to encourage them to make use of these assets to further their development.

Evolution of Appropriate Leadership

Another important variable which is of psychological significance is *leadership* available in the community. We have to identify such of the leaders who, by and large, think of the existing structure as something which could be changed and modified. They should not only serve as participants in the community development but also orient their behaviour in a positive way to improve the community structure. Therefore, leadership in this context involves behaviour relating to the existing social process which has a meaning in a shared context of the participants.

The results of some studies on leadership may be of interest to get an idea of the nature of the elected leaders. A psychological analysis of the elected leaders [Muthayya, 1971 c] revealed that a higher percentage of the elected village leaders had faith in the people but were autocratic in their attitude. A study [Muthayya and Raju, 1973] of personal-social aspects of elected village leaders revealed that these leaders, to a great extent, were young in age (31 to 40 years), educated cultivators, and belonged to higher-caste group, had higher landholding and had relatively higher income. These studies suggest that though leaders younger in age seem to emerge, traditional attitudes and personal resources have still an important role for their election to leadership positions.

The study in Tamil Nadu [Muthayya—study in progress] on 112 panchayat leaders, showed that leaders compared with non-leaders (N=82) were less pessimistic, less in ego ideal, more emotionally unstable, less in need achievement, less self-confident, more dogmatic and more dominant. In studies of this type, one can only identify these qualities after these leaders are elected in order to predict the type of leader behaviour that could be expected rather than use them for selection of future leaders, as it will go against the basic principles of democracy.

In one of the studies [Muthayya 1972], when villagers were asked to name the functions of the village panchayat leaders, the functions mentioned were, "plan development works for the village", "attend meetings of the panchayat", "provide facilities for the village" and "settle village disputes". In the opinion of the BDOs, the panchayat leaders should serve in an advisory capacity and guide in policy matters and not interfere with the day-to-day administration or in the execution of any of the programmes [Muthaya, 1973]. Therefore, if one looks at the functions of the panchayat leaders from the people's and also the official points of view, it settles down, by and large, to a thinking that they should not only initiate and direct action, but also serve as providers of whatever the village requires.

The value orientations of the village panchayat leaders studied in Tamil Nadu [Muthayya—study in progress] were examined and the results revealed that the leaders compared with the non-leaders, had a better commitment to principled conduct in public life, national commitment, and commitment to people's participation in decision-making. However, their commitment to change was not very much different from that of the non-leaders as it was almost equal, but their commitment for economic equality was less than that of non-leaders. The last two findings are, by and large, incongruent with the expectations of the leaders as it is necessary in the present juncture that leaders must be more committed to change than others, as they are the primary agents of change and, secondly, leaders must be more concerned or committed to bringing about economic equality than the non-leaders, as it is through these leaders that economic justice is expected to be achieved in the rural area.

Developmental Personnel

It is said, time and again, that the biggest contribution that the Government can make to the community development movement is by providing competent and efficient officials. Unfortunately, not much of a caution seems to have been exercised in choosing the right men, as it was thought that any person with certain administrative experience could manage these functions. This thinking did not recognise the change required in the general attitudes of these officials from procedure or rule-centered behaviour to one of people-oriented behaviour. The problem here is to locate the right type of officials who have the required

psychological attributes to cope up with the changing demands of the developmental administration. A study [Muthayya and Gnanakannan, 1973] among the block personnel like the block development officer, *mukhyasevika, gramsevak* and *gramsevika* in three southern states of India revealed that those personnel who were relatively more extrovert, emotionally stable, self-cofident, socially intelligent and optimistic were more satisfied in their jobs. If job satisfaction could be taken as an index of one's job performance, then, the officials with these attributes are bound to remain not only satisfied in their job but also contribute to their work performance. Therefore, there is a need for an objective selection procedure for finding the right type of men to man the developmental administration in order to make it an effective machinery for community development.

A study [Muthayya, 1972] on perceived need satisfaction on the job among Administrative Officers revealed that need for self-actualisation and autonomy were perceived to be of a lesser degree in their occupations. The needs in which greater dissatisfaction was expressed among introverts were self-actualisation and autonomy whereas among extroverts, it was self-actualisation and social need. Those who were emotionally unstable had expressed dissatisfaction in security, esteem and self-actualisation need, whereas those who were emotionally stable had expressed dissatisfaction in social and autonomy needs. A study on perceived need satisfaction on the job among the command area development officers [Muthayya, 1975] revealed that the most deprived needs in their jobs were, *self-actualisation* and *autonomy*. Task orientation, followed by self-orientation was the most predominant personality orientation. Those high in self-orientation were deprived in the need for autonomy whereas those high in task and interaction, were deprived of the need of *self-actualisation*. The question, therefore, arises what, possibilities are open to bring about changes in the present administrative set up to make it developmets-oriented and also to find incumbents who would further the goals of this administrative process.

Conclusion

Therefore, in any rural development programme, attempt must be made to understand the motivational level, potentiality of the people to participate, the status of their selves, the leadership available and nature of the developmental personnel, as these are important in not only fur-

thering the objectives of development but also in bringing about the development of the people. In case the attempt is to bring about development in the community, it is an easy process as improvements are brought about by forces which are external to the community, resulting in negating the above factors. In such a situation, the sustenance of the programmes, implemented by the external source, by the local community will be very remote. In any community development programme, therefore, it is necessary to give cognisance to the peoples' motivations and to bring about change in the areas of their discontent as it will have credence and chances of survival. If at all people have to involve themselves in social organisations as envisaged, it is important that they should have adequate personal resources or, in other words, their potentiality to participate should improve. Therefore, it is necessary to bring about certain improvements through the avocations so that their resource may have a chance to build up, giving them a status in the village community. Unless and until this happens, participation of the people through their own initiative will remain a sales gimmick to make people believe that they are important though, at the same time, their involvement in the total social process will be negligible.

It is also necessary to generalise the leadership in the particular community in terms of functions. This way the leadership becomes distributed based on the number of functions a particular community would like to sustain or is capable of sustaining. So, each one of the leaders, by virtue of his functions, contributes to the total growth of the community. It also should ensure healthy inter-relationships among these functional leaders through a general leader of the community as this would result in the distribution of power to a greater number of leaders and may bring about involvement and participation of the people as envisaged.

All these ideas drive at the fact that the people must be given a chance to decide what they want regardless of what they are, as it is believed that what people tend to create, they certainly would help to sustain. □

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in its conceptual framework, has to be achieved, then it is necessary to understand the level of motivation of the people in terms of their present deprivations, prepotent need areas and then by using proper methods attempts should be made to motivate them through an emphasis on such of those deprived need areas. Any satisfied need would cease to be a motivator of behaviour and hence our effort should be to find out those needs which are deprived and use them as incentives for furthering the motivation of the people. So motivating people for community development is of primary importance for any change or improvement that is envisaged in the community.

People's Participation

Another factor which is of importance is in terms of bringing about "peoples' participation". Participation in the real sense of the word should involve people in any programme based on mutual respect. It involves a capacity to identify oneself with other persons in the community without being conscious of any of the socio-economic barriers. Unfortunately, in spite of the people's 'institutions like the *Panchayati Raj*, it has been pointed out time and again that people are not coming forward and involving themselves in the functions of the local institutions except perhaps at the time of voting.

It has also been found in one of the studies [Muthayya, 1972] that villager's sense of effectiveness, sense of political efficacy and sense of duty as citizens are, by and large, at a low ebb. It may be said that the people do not participate because of lack of potentiality to participate. Most of the people (about 50 percent) are below the poverty line and, therefore, are not in a position to participate in the real sense of the word by virtue of the dependent relationship on those who belong to the higher echelons of the community. It is likely that, as the dependent relationship decreases by virtue of the various economic and welfare measures undertaken for their benefit, there may be a possibility of improvement in the level of their participation.

People's participation either in the implementation of the programme or in developing plans for the improvement of a village or area or a community very much depends upon their ascribed or achieved role in the community. If they occupy roles in a community which are vulnerable, the chances of their participation will be very much less.

In any kind of social group, the hierarchy of relationship patterns are similar to the hierarchy of relationship in a family and, therefore, the chances of participation in the real sense of the word will be too much of an ideal. Whatever may be the ascribed position of an individual in a particular community, his position as an individual member of the community must be recognised regardless of his personal resources. Until and unless this is done, the chances of people's involvement and participation in the programmes of community development will remain bleak.

The attitude that some people maintain that the villagers are illiterate, ignorant, indifferent, etc., may certainly influence their style of handling them, as it is believed that one's reaction to people is very much dependent upon what assumptions one makes about them and what expectations one has about their behaviour. Therefore, when we aim at involving the people, whatever be the nature of the people, we must make an accurate assessment of their needs, attitudes, values and past experiences to guide our thinking for ascribing roles in the process of involving them to achieve community development.

Self-reliance

Another important factor that has been talked about in the recent times is to bring about self-reliance among the people. One of the major objectives of our economic planning is achievement of self-reliance. So, when we think of self-reliance in an individual in rural areas, we expect it to be, to a large extent, the result of the developmental process. The question, therefore, arises, how can majority of the rural folk become self-reliant when their "self" itself is in need of some status. We will not be in a position to talk about self-reliance unless we are sure that adequate opportunities for the growth of the individual self have been created in rural community.

In this context, the land reform measures that are so vigourously thought to be implemented in the recent times may be a good augury in the direction of providing a self-status to the majority of the rural folk. It has also been found in various studies that landholding, whatever may be the degree, has certain bearing on one's level of living, participation in social organisation, general productivity and social attitudes. In

view of this, it may be said that there may be a possibility in the future that the majority of the rural people may achieve some self-status in terms of certain possessions and, therefore, efforts should made to encourage them to make use of these assets to further their development.

Evolution of Appropriate Leadership

Another important variable which is of psychological significance is *leadership* available in the community. We have to identify such of the leaders who, by and large, think of the existing structure as something which could be changed and modified. They should not only serve as participants in the community development but also orient their behaviour in a positive way to improve the community structure. Therefore, leadership in this context involves behaviour relating to the existing social process which has a meaning in a shared context of the participants.

The results of some studies on leadership may be of interest to get an idea of the nature of the elected leaders. A psychological analysis of the elected leaders [Muthayya, 1971 c] revealed that a higher percentage of the elected village leaders had faith in the people but were autocratic in their attitude. A study [Muthayya and Raju, 1973] of personal-social aspects of elected village leaders revealed that these leaders, to a great extent, were young in age (31 to 40 years), educated cultivators, and belonged to higher-caste group, had higher landholding and had relatively higher income. These studies suggest that though leaders younger in age seem to emerge, traditional attitudes and personal resources have still an important role for their election to leadership positions.

The study in Tamil Nadu [Muthayya—study in progress] on 112 panchayat leaders, showed that leaders compared with non-leaders (N=82) were less pessimistic, less in ego ideal, more emotionally unstable, less in need achievement, less self-confident, more dogmatic and more dominant, In studies of this type, one can only identify these qualities after these leaders are elected in order to predict the type of leader behaviour that could be expected rather than use them for selection of future leaders, as it will go against the basic principles of democracy.

In one of the studies [Muthayya 1972], when villagers were asked to name the functions of the village panchayat leaders, the functions mentioned were, "plan development works for the village", "attend meetings of the panchayat", "provide facilities for the village" and "settle village disputes". In the opinion of the BDOs, the panchayat leaders should serve in an advisory capacity and guide in policy matters and not interfere with the day-to-day administration or in the execution of any of the programmes [Muthaya, 1973]. Therefore, if one looks at the functions of the panchayat leaders from the people's and also the official points of view, it settles down, by and large, to a thinking that they should not only initiate and direct action, but also serve as providers of whatever the village requires.

The value orientations of the village panchayat leaders studied in Tamil Nadu [Muthayya—study in progress] were examined and the results revealed that the leaders compared with the non-leaders, had a better commitment to principled conduct in public life, national commitment, and commitment to people's participation in decision-making. However, their commitment to change was not very much different from that of the non-leaders as it was almost equal, but their commitment for economic equality was less than that of non-leaders. The last two findings are, by and large, incongruent with the expectations of the leaders as it is necessary in the present juncture that leaders must be more committed to change than others, as they are the primary agents of change and, secondly, leaders must be more concerned or committed to bringing about economic equality than the non-leaders, as it is through these leaders that economic justice is expected to be achieved in the rural area.

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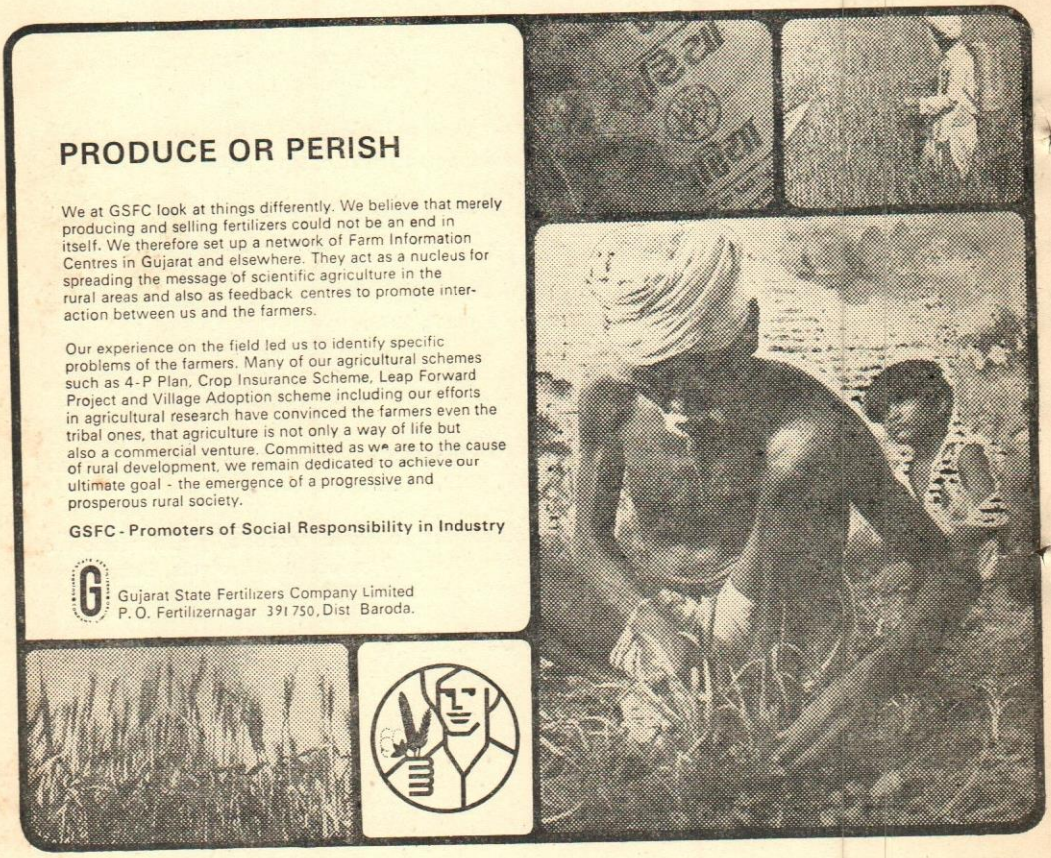

Rural Development : Problems and Prospects

Rajesh Tandon*

In a country like India, rural development is a critical element in the overall development of the economy. Various concepts, approaches and strategies of rural development have been tried in India over the past three decades. Some of these have emphasised agricultural growth while others have focussed on developing the infrastructure. Educating the rural population has been one of the strategies of rural development. Development of the entire community has been the strategy in some others. There has been no dearth of ideas and approaches in the field of rural development in India. Many of these approaches have attempted to build on the historical Indian experience (like cooperatives), and many others have been borrowed from the experience of other countries (like integrated area development or "green revolution").

Yet, many studies have increasingly shown an uneven impact of these approaches on the development of the countryside. Between 1961 and 1971, the number of landless agricultural labourers increased from 30 million to 47 million. The number of people below the poverty line (Rs. 30 per capita per month) has increased by 25 percent over this period. (The Hindustan Times, May 11, 1977).

This situation presents a strange paradox. While governmental expenditure and developmental programmes have substantially increased over the last 20 years, the gains of development have not reached bulk of the rural population. In order to understand the problems experienced in these approaches of rural development, it is important to examine the context of these efforts in India. The most dominant characteristic of the rural situation in India today is extreme socio-economic inequality. A small minority of rural population consisting of large land-owners, money-lenders and capitalist farmers have most of the economic resources. This small minority also possesses higher social status. By and large, this minority belongs to superior castes and has, therefore, acquired high social status in the context of the prevailing

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caste system in the rural areas. The socio-economic advantage is also associated with political leverage. It has been shown that this socio-economically well-off minority has acquired significant political influence at the local and state levels (Thorner, 1976; Rudra, 1978).

The bulk of the rural population consists of small and marginal farmers and landless agricultural labourers. This group lacks economic resources and is primarily below the poverty line. The social status of the members of this group in the context of caste system is low. Their socio-economic disadvantage is associated with the lack of political leverage. By and large, this large majority is socially, economically and politically exploited and oppressed.

It is against this background of two distinct classes that the approaches of rural development need to be examined. One of the consistent findings of studies assessing the impact of rural development in India has been that the gains of development have primarily reached the small minority which possesses social, economic and political leverage. It is the large majority of rural poor which has been unable to benefit from the rural development programmes.

Problems of Rural Development

Two characteristics appear to be common in most of the strategies of rural development in India.

1. Most developmental programmes have been designed and implemented on the basis of a target area. The Community Development Programme viewed the village as a community; the cooperative institutions are primarily area-based; the 'Green Revolution' used some selected districts as the target; and tribal development blocks have been created on the basis of target area. To the extent that all these programmes are meant for rural population in the target area, the small minority which possesses social, economic and political leverages has been able to make use of these developmental programmes. They were able to not only utilise the available resources but also influence them in a manner that the resources continue to flow to this small minority. The bulk of the rural population, lacking social, economic and political leverage has thus failed to utilise these programmes based on the target-area approach.

2. Most strategies of rural development in India have emphasised the creation of new delivery mechanisms. Rural development has been primarily designed for providing a range of goods and services for the rural population. Administrative structures have been created to cater to this end. These delivery systems include agricultural inputs, credit, irrigation, electricity, education, etc. The block development machinery, created during the community development programmes, was further strengthened during the Panchayati Raj. Various cooperative institutions were created for the extension of credit and other facilities. Primary schools were established for providing education. These services were made avialable to facilitate rural development. However, no effort was made to enhance the capacity of the rural population to utilise these services. Thus, those who already possessed such capacity benefitted from these services and the rest could not make use of them.

Existing evidence supports the above contentions. Etienne (1968) argues that the limited success of community development programmes was due to the lack of mobilisation of the local population. The small minority with social, economic and political leverage used Panchayati Raj institutions to gain substantial economic and political benefits for themselves (Etienne, 1968; Desai, 1969). It is now a well-established fact that the weaker sections of the rural population did not make use of the educational facilities (Vyas and Choudhary, 1971; Sharma, 1972).

The failures of the cooperative institutions as instruments of change in the rural situation have been well documented. Myrdal (1968 : 1338) shows that "credit cooperatives have become mainly the preserves of the upper strata in the villages including the money lenders who often acquire money from them." The control of this small minority over the cooperative institutions in furthering their own interests has been further documented by Nilakant, *et. al.* (1977). The impact of 'Green Revolution' has been limited to the small minority of big land-owners. They were able to get substantial benefit from the facilities made available during this programme (Bardhan, 1970; Ladejinsky, 1970; Frankel, 1971). The technological improvements in agriculture ushered in during 'Green Revolution' have further enhanced the social, economic and political leverage of this small minority; the poorer section of rural population have continued in their poverty (Rao, 1976). Similar dynamics has taken place in the case of irrigation facilities. Analysing the impact

of the Kosi Command Area Project in Bihar, Appu (1973) shows the limited utilisation of irrigation facilities. Only big land-owners who possess political leverage and connections in the delivery system obtain irrigation facilities for their benefit (Wade, 1975).

It is now clear that our strategy of rural development which does not emphasise the development of the capacity of the weaker sections of the rural population to utilise the resources of development will lead only to partial success in India. What can then be the process of developing this capacity? What models of developing this capacity are available in the Indian context? Two illustrations are presented here to indicate the process through which this capacity for utilising developmental resources can be developed among the rural poor. One of this illustrations is the *Bhoomi Sena* movement in Maharashtra; the other is Peer Group experiment in Rajasthan.

'BHOOMI SENA'

The Bhoomi Sena movement was initiated in Palgarh *taluka*, Thana district in 1970. The *Sawkars* were the money lenders, landlords and traders in Junglepatti in Palgarh *taluka*. They were a small minority with large land holdings, merchants and traders having linkages with external mercantile groups. *Adivasis*, as poor peasants and landless labourers, were in majority. A group of young *Adivasis* investigated the land records to identify the details of illegal usurpation of land belonging to the *Adivasis* by the *Sawkars*. They created an organisation called *Bhoomi Sena* to fight such injustices against *Adivasis*. Their first action was to take the crop from the land belonging to *Adivasis* but illegally usurped by the *Sawkars*. After getting the crop they collectively threshed it and stored it in grain banks formed in the villages.

From this initial effort the *Bhoomi Sena* formed a *Shetkari Mandal* as a registered society. The activities of this association were to provide credit facilities to the *Adivasis* by acting as a mediator between banks and small farmers. This association gradually started to dig wells and entered the grass trade.

The next phase in this movement was to organise a *Shibir* (a camp) for collective reflection. As an outcome of this camp, *Tarun Mandals* were

started which took up campaigns against alcohol and bonded labour. These *Tarun Mandals* also attempted to reduce expenditure on cultural rituals and social practices, like marriage ceremony. Over a period of time, the issues of minimum wage, Panchayat elections, schools, etc., were taken up by *Bhoomi Sena* (De Silva, 1978).

PEER GROUP

An interesting approach to rural development was started in Kherwara block of Udaipur district in 1975. This Peer Group project was aimed at the involvement of local population in their own development. One poor farmer from each of the initial set of 25 villages was identified by a voluntary agency as the rural change agent. The majority of the individuals in the area are *Adivasis*. They were assisted by a team of field staff in various methods of improving agriculture, cooperatives and rural engineering. Equipped with such new ideas and information, these individuals started developing Peer Groups in their villages. Gradually members of these groups started practising some of the new ideas that were brought in by the peer leaders. New methods of cultivation were adopted; cooperative institutions were utilised and informal credit societies were formed; and adult education was stimulated.

After a period of time, it was realised that some effort was needed to organise these peer groups as they were primarily a collection of individuals acting in their self-interest and not organised entities taking initiative in common interest. Educational interventions were used with some of these peer groups to facilitate their process of organising. This intervention consisted of awareness raising through a process of dialogue and skill-building in group functioning and learning through experience. The groups planned their strategies of action during these training interventions. After this intervention, the groups were able to take initiative in reducing expenditure on marriages and eliminating alcohol consumption, in contesting elections for Panchayats and in obtaining facilities like primary schools, post office and irrigation canals (Tandon, 1978).

The Alternatives

An examination of the above mentioned cases highlights alternative strategy used for rural development. Three distinct characteristics

emerge from these two case studies :

1. *Conscientisation* or awareness-raising is the process utilised in both the above cases. The target population of rural poor became conscientised through systematic efforts at collective examination and reflection. The *Shibir* organised by *Bhoomi Sena* was such an effort. The training intervention for peer group had a major component of awareness-raising. In both these cases, systematic efforts were made to examine the socio-economic reality of their contexts and to verbalise their experiences through a process of collective dialogue. The process helped in developing a heightened awareness among the people and acted as a major stimulant for future action. The process of conscientisation, therefore, is a critical ingredient of developing the necessary capacity among the rural poor. Freire (1972) has argued for conscientisation as a 'pedagogy of the oppressed'.

2. Mobilisation and organisation of the rural poor was another important characteristic of these two cases. Individual initiatives by the rural poor in their own interests are difficult. As an individual, a poor farmer or a landless labourer is impotent against the vested interests and the forces of *status-quo*. As an individual, he is being exploited by rural elite and neglected by the delivery systems. It is through the process of collective mobilisation and organisation of such individuals that they can acquire a sense of empowerment to act in their common interests. This organised effort can help them in breaking the cycle of exploitation and impoverishment. Organised effort, therefore, acts as a vehicle for increasing the power of the otherwise powerless majority. It is this organisation which brings in a sense of individual confidence and potency to act in one's own interest. To the extent that this majority has many common interests, the organisation facilitates collective efforts in meeting those interests. It was possible for the *Tarun Mandals* of *Bhoomi Sena* to confront the issues of expenditure on weddings and alcohol and encourage education for the children only through their organised efforts. Similarly, Peer Groups were able to obtain facilities of schools and post office and participate in Panchayats throught their organised action.

In this context of mobilisation and organisation, two things need to be elaborated further. The initial impetus for mobilisation and organisation can either come from within the community or from outside. In case

of *Bhoomi Sena*, there was an internal stimulation for mobilisation in the initial stages. During the middle of the movement, some external assistance was also provided. However, the movement progressed largely through the internal stimulus. In case of Peer Groups, initial catalysis was triggered by an external agency. Further reinforcement was also provided through external interventions. However, internal momentum developed after these external impetus. Secondly, the issue of skills in mobilisation and organisation are critical for any success of these strategies. Certain skills in mobilising people, planning collective action, taking collective decisions and organising groups are necessary for such organisations to become viable. These skills may be internally available among the people or may be learned initially through outside assistance. In case of *Bhoomi Sena*, the initial catalysts possessed such skills to some extent because of their prior experience in other mass movements. However, they were also able to improve upon these skills as they learnt from their experience in the initial stages of *Bhoomi Sena*. The concept of *Shibir* was developed as an outcome of these results. In case of Peer Groups, initial assistance in developing these skills was provided by outside agents. The training intervention was aimed at enhancing such skills among the members of the Peer Groups.

Whatever may be the source of initial stimulation, it is clear that some such catalytic agents are necessary to trigger the process of mobilisation and organisation (De, 1978). What is important is the issue of skills in mobilisation and organisation. Both the case studies underscore this point.

3. These two case studies show that rural development efforts cannot be limited to economic spheres alone. In the context of present rural reality, social, cultural and political aspects are intricately linked with economic aspects. Poverty in the Indian countryside is reinforced by cultural rituals and social practices. Both these case studies highlight the socio-cultural changes that took place as an outcome of conscientisation, mobilisation and organisation. Curtailment of expenditure on marriages and alcohol were two common illustrations from these two case studies. To that extent, the limited focus of rural development efforts at increased agricultural production or education, or abolition of untouchability will necessarily lead to partial results.

Many other case studies have begun to appear which demonstrate the effectiveness of the alternative strategies in rural development (Sethi, 1978). The common element in most of these cases are the processes of conscientisation, mobilisation and organisation. It is through the organisation of the majority of rural population that their capacity to utilise developmental resources can be augmented. Unless the capacity of the rural poor to utilise these developmental resources is enhanced, it is doubtful that rural development could be achieved on a national scale.

Conclusion

In the context of these alternative strategies some questions remain to be addressed :

1. Who is going to initiate the process of conscientisation and organisation among the rural poor ? Many voluntary agencies, groups and individuals have been trying to catalyse such process in their limited area of operation. How can one move from a limited experiment to a national movement ? How can these sporadic and fragmented efforts be channelised into a planned strategy of rural development ?

2. To the extent that this alternative strategy focuses on the empowerment of rural poor through their organisations, how can the conflicts arising out of these be managed ? In the initial stages of the organisation-building process, the effort needs to be protected from the assaults of those who are in power and whose interests will be challenged by the organisations. How can this protection be provided in the initial stages ? How can external support for such organisations be developed ?

3. What can be the role of government agencies and officials in this strategy ? To what extent can they be motivated for such organisations ? What will be the role of delivery systems in the face of these organisations ?

4. To the extent that these processes are political in nature, what is the consequence of such strategies on the national polity ? How can political parties, Trade Unions, activists and social scientists contribute towards the escalation of such strategies ?

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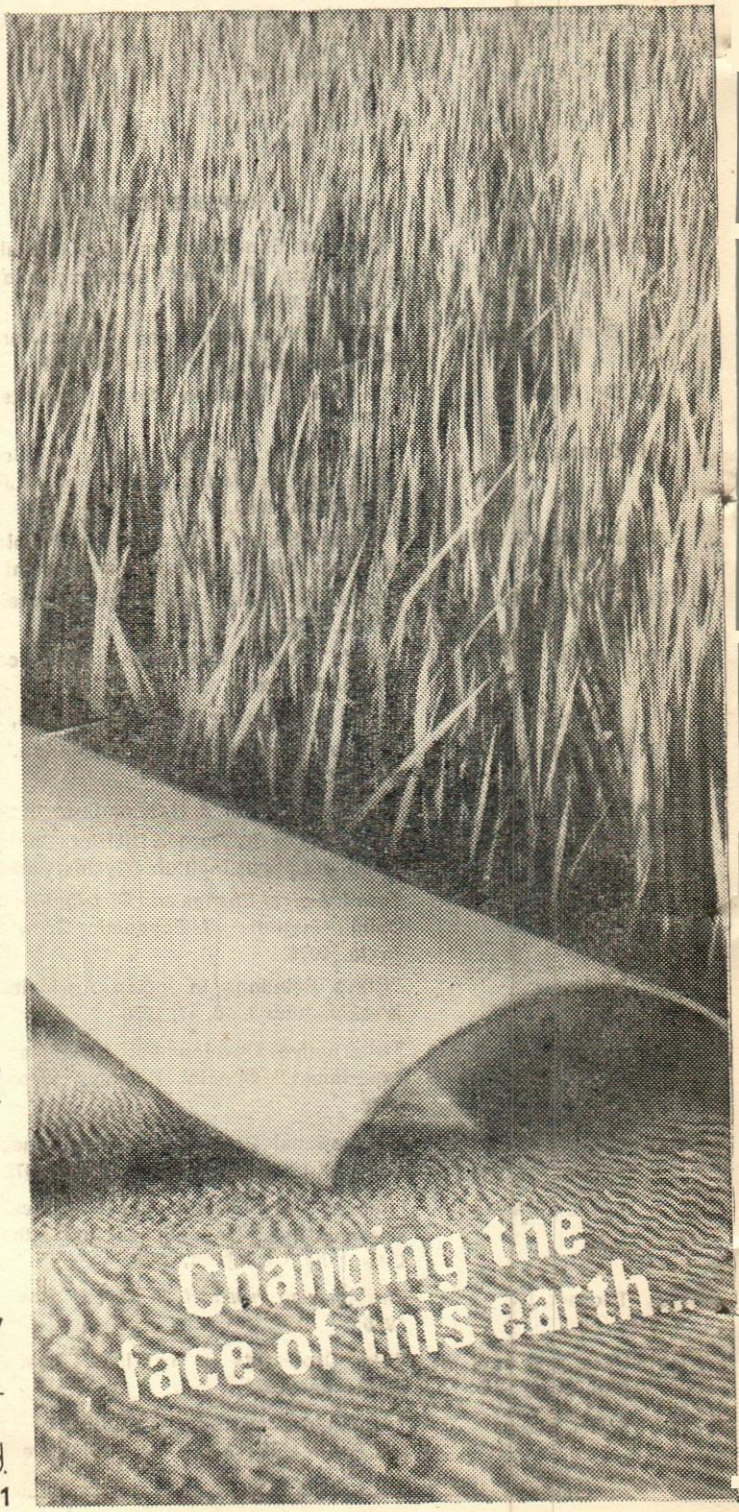

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Rural Poverty : A Historical Perspective

R. Radhakrishna* S. A. R. Sastry*

The present mass poverty is not a recent phenomenon, but had deep roots in the severe stagnation that gripped the Indian society for centuries. The living standards in the pre-colonial period were quite low. The colonisation strengthened the forces underlying poverty by creating barriers to the absorption of the fruits of industrial revolution. The development programmes initiated in the post-Independence period made no substantial improvement on the poverty front, although economic aggregates reflected progress.[1]

This paper attempts to view the present mass poverty and economic disparities in the back drop of the evolution of institutions and economic classes. Section 1 depicts the economic society in the pre-colonial perid. Section 2 traces out the evolution of colonial institutions designed for exploitation and the emergence of mass poverty. Section 3 briefly traces the post-Independence scene.

1. INDIAN SOCIETY IN THE PRE-COLONIAL ERA

Self-Sufficient Village Economy

In spite of the upheavals and various vicissitudes it had undergone in its long course of history, Indian society, before the advent of British power presented a picture of stability. Its soul lay in its innumerable villages where people lived in the same simple ways; the social institutions remained unchanged in their essentials. The predominant feature of the Indian economy was the existence of isolated self-sufficient village economies.[2] The village itself consumed a major

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portion of the foodstuffs and other raw materials it produced.[3] A part of the produce was appropriated in the form of land rent by the feudal ruling class.[4] Its requirements of handicrafts were satisfied by the families of craftsmen associated with the village. It was this tight union of agriculture and hand industry which made the village economically independent of the outside world.[5] The social make up through its caste structure provided the basis for the unalterable division of labour.[6] This was reinforced by the comparative isolation in which the villages were held by the virtual absence of a network of communications.[7]

The urban structure of life was sustained by the rural produce, which it extracted in the form of rent. It was mainly a one-way flow of wage goods from the rural sector as the cities had nothing to offer in return.[8] Thus, exchange did not play a decisive role in the economy as a whole. The local artisans in the urban centres produced the basic necessities and luxuries needed by the ruling class.

Economic Classes

While there are divergent views regarding the growth or stagnation of the economy during pre-colonial period, there seems to be a greater degree of unanimity on the class formation and structure of Indian society.

The method of appropriating the peasants' surplus for the ruling hierarchy and the existence of caste system laid the foundation for economic classes.[9] The big feudal lords (*Jagirdars*), as a rule Muslims, were

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The lowest and largest stratum of the feudal class were peasants, drawn chiefly from the higher Hindu castes. They enjoyed security of occupancy in general but not the right to abandon it. They were forced by officials to cultivate and were not allowed to leave villages. Considerable economic differentiation existed even among this class. At one end of this spectrum were the headman and the top peasants while small peasants generally sunk in debt in meeting the expenses of cultivation existed at the other.[11]

The landless workers were mostly drawn from menial castes such as *Chamars, Dhanuks, Thoris* or *Batahars.* They were prohibited from cultivating the soil on their own. Besides following their prescribed professions, such as shoe-making, tanning and scavenging, they formed a rural reserve force to work on the field of peasants. Among the artisans there existed a close association between caste and occupation. The merchant and the money-lender, drawn mainly from the upper Hindu caste, formed the other dominant class and carried on trade both internal as well as external. The large export of grain and other produce extracted from the peasants in the form of revenue maintained a class of grain merchants. They financed wars among kings and supplied loans to petty feudal lords and craftsmen.[12]

2. ECONOMIC TRANSITION DURING COLONIAL PERIOD

The penetration of British imperialism played an important part in the disintegration of India's economy; on the one hand, it undermined the

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12. Levkovsky, A. I. *op. cit.* p. 8.

foundations of self-sufficient village economy and wrecked the handicraft industries, on the other, it hastened the growth of commodity economy. By controlling trade and administration, the colonialists designed institutions for extracting surplus. As a first step they devised land revenue systems which shook the old structure of village life in India.[1]

Land Revenue Systems

The initial assessments of land revenue levied by the British were very heavy.[14] "Under the Zamindar's Settlement, former tax gatherers (known as zamindars), who were no more than mere agents of the former governments appointed for the collection of land revenue, were by the Act of 1993 declared full proprietors of the areas over which their rights of land revenue collection extended. Thus by the force of authority of the British Government in India millions of cultivators were transformed, almost overnight, from peasant proprietors into tenants at will. In the whole history of mankind, ancient or modern, one would look in vain for a parallel to this classic example wherein so many were sacrificed in such a short time that a few *Prosper and Rule*."[15] As the Government limited "its own demand to a certain fixed ratio, the zamindars were rendered secure against any further encroachment upon their profits, while the poor labourer is still left in a precarious position with regard to his rights which are wholly dependent upon the arbitrary will of his superiors.[16] In the hands of "unscrupulous zamindars.....the refinements of rent law have become fresh and powerful engines of oppression and consequent on of oppressions and exactions, have driven ryots in Eastern Bengal to such a pitch of desperation that agrarian disturbances seem to have become chronic there, while from North Bihar we hear of thousands of ground-down tenantry flying from the cruel mercies of the court of wards management into Nepal."[17]

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17. Panchanan Saha, *ibid*. pp. 50-51.

better. The cultivator was required to pay to his government twice a year a fixed sum of money, crop or no crop. If the cultivator failed to pay the revenue in time, his land was made subject to forefeiture.[18] Thus the exploitation of the tiller grew in sharpness with the introduction of a host of parasitic intermediaries and the methods pursued in the collection of land revenue. "There is no parallel in the history where a whole people was thus converted by the exercise of sovereignty into a nation of estate coolies with their own natural aristocracy reduced to the position of foremen and superintendents through the work exacted and oppression carried out'."[19]

Legal System

By bringing in sophisticated legal institutions through the apparatus of law courts, lawyers and formal procedures "the British legal system made land transfer a matter of extreme, almost fearful, simplicity. Ignoring Indian custom, the civil courts rigorously enforced the English contract law which made a man's entire property liable for the satisfaction of his debts. Upon the production of a bond from the money-lender, the courts would automatically decree sale of a defaulting cultivator's landholding Pitched high and rigidly collected during the early years of British rule, it (land revenue) drove the peasant to the money-lender to meet its claims ..Once in debt a peasant was usually unable to extricate himself...Interest rates ranged upwards of 25 percent, so that even small debts rapidly mounted up to enormous proportions. The money lender was adept at fraudulent practices in the keeping of accounts, and did not in any case want to be paid off. His aim was to make the peasant into a perpetual bond servant by a mortgage which gave him control of the crop or by a forced sale in which he would take title to the land while retaining the former proprietor as his tenant. In either case the money-lender had the upper hand and the courts—restrained by their belief in freedom of contract and *laissiz faire*—were little more than instruments of his will."[20]

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18. Patel S. J., *op. cit.*, p. 12.
19. Panikkar K.M. : *Asia and Western Dominance*, Allen and Unwin, 1953, p. 113.
20. Thomas R. Metcalf: *The Aftermath of Revolt : India 1857-1970*, Princeton University Press, 1964; pp. 205-207.

Polarisation

With the mounting indebtedness of the peasant in an atmosphere of insecurity and tension, agriculture stagnated. Polarisation advanced with the landlord and the money-lender at one pole and the mass of enslaved and poverty-stricken peasants at the other.[21] Foundation had thus been laid for the emergence of an immiserised segment of landless poor on a vast scale from the rural landscape of India.

British Industrialisation and its Backwash

Deterioration of Artisans: Introduction of another institution underlined by commercial agriculture and a monetary form of rent marked the beginning of another stage in the exploitation of rural India. They undermined the cohesion and the self-sustaining nature of the Indian village by bringing in distortions in the patterns of division of labour. The rapid spread of plantations and commercial agriculture, the foremost forms of capitalist enterprise in India, was a welcome development to the British, as they served their trading interests and met the rising tempo of demand for raw materials thrown up by the industrial development. As the pace of her industrial expansion accelerated, the British manufacturers' clamour for markets reached a crescendo. "East India offered a market for the manufactures of Europe, greater and more extensive than both Europe and America put together."[22] Eric Stoke's characterisation of India as "a military empire...a vast commitment, dubiously balanced by its actual commercial value to English industry"[23] came true.

Indian coastal towns were linked with Britain in the 1840's by steamships and the interior of India was covered after the 1850's by the most elaborate railway network in Asia.[24] The location of the railways was determined by strategic considerations and by the desire to secure the best markets and raw materials. These developments were detrimental to the Indian society in many ways. "The same railways which carried away

21. Levkovsky A. I.: *op. cit.* p. 16
22. Reported to have been quoted by Adam Smith in Parliamentary Debates, Levkovsky, *Ibid* p. 19.
23. Joseph J. Spengler: *Indian Economic Thought: A Preface to its History*, p. 129.
24. Daniel and Alice Thorner, *op. cit.*, pp. 54-55.

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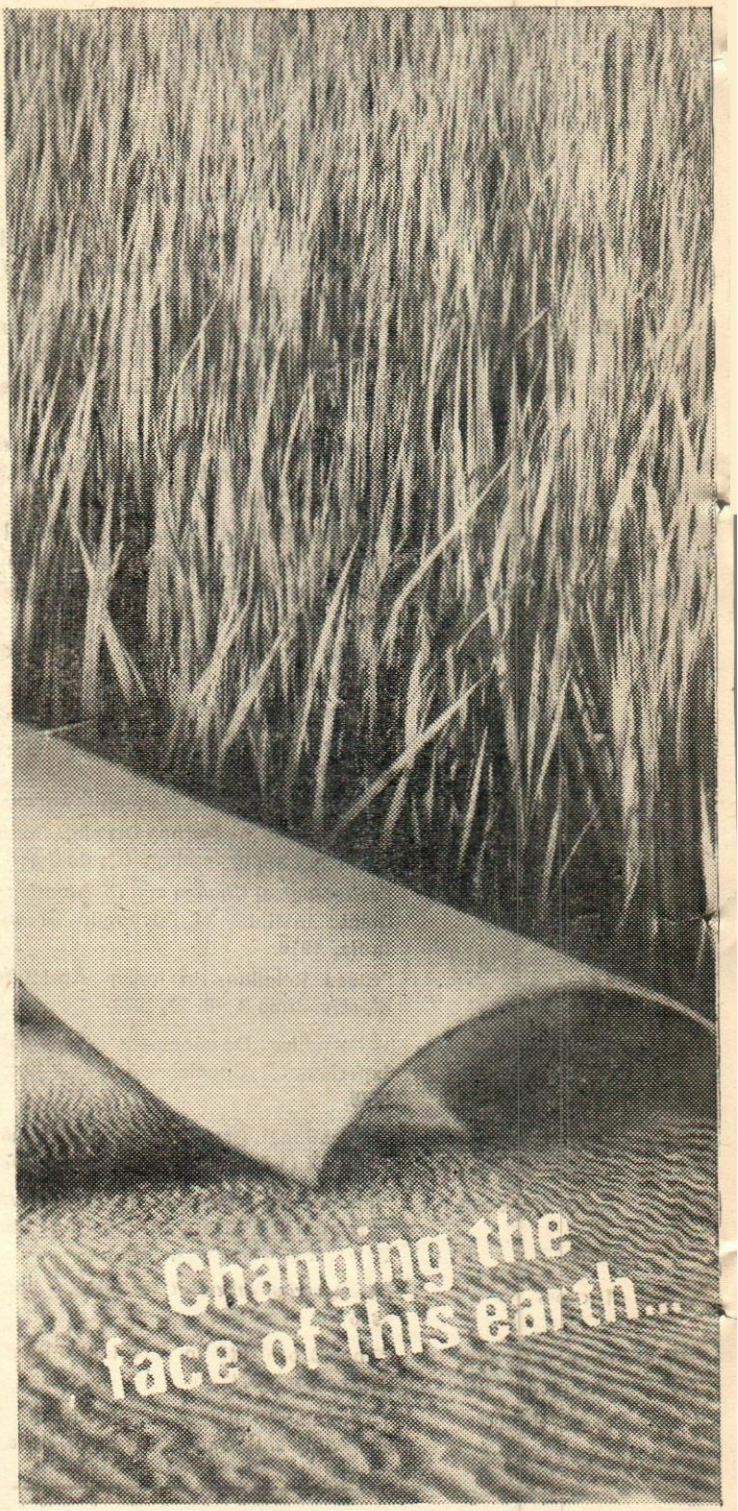

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16. Panchanan Saha : *Emigration of Indian Labour 1834-1900;* People's Publishing House, 1973, footnote p. 60, quoted from Radical Bengali Journal "*Gyananneshan*", May 1838.
17. Panchanan Saha, *ibid.* pp. 50-51.

better. The cultivator was required to pay to his government twice a year a fixed sum of money, crop or no crop. If the cultivator failed to pay the revenue in time, his land was made subject to forefeiture.[18] Thus the exploitation of the tiller grew in sharpness with the introduction of a host of parasitic intermediaries and the methods pursued in the collection of land revenue. "There is no parallel in the history where a whole people was thus converted by the exercise of sovereignty into a nation of estate coolies with their own natural aristocracy reduced to the position of foremen and superintendents through the work exacted and oppression carried out'.'[19]

Legal System

By bringing in sophisticated legal institutions through the apparatus of law courts, lawyers and formal procedures "the British legal system made land transfer a matter of extreme, almost fearful, simplicity. Ignoring Indian custom, the civii courts rigorously enforced the English contract law which made a man's entire property liable for the satisfaction of his debts. Upon the production of a bond from the money-lender, the courts would automatically decree sale of a defaulting cultivator's landholding Pitched high and rigidly collected during the early years of British rule, it (land revenue) drove the peasant to the money-lender to meet its claims ..Once in debt a peasant was usually unable to extricate himself...Interest rates ranged upwards of 25 percent, so that even small debts rapidly mounted up to enormous proportions. The money lender was adept at fraudulent practices in the keeping of accounts, and did not in any case want to be paid off. His aim was to make the peasant into a perpetual bond servant by a mortgage which gave him control of the crop or by a forced sale in which he would take title to the land while retaining the former proprietor as his tenant. In either case the money-lender had the upper hand and the courts—restrained by their belief in freedom of contract and *laissiz faire*—were little more than instruments of his will."[20]

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18. Patel S. J., *op. cit.*, p. 12.
19. Panikkar K.M. : *Asia and Western Dominance*, Allen and Unwin, 1953, p. 113.
20. Thomas R. Metcalf: *The Aftermath of Revolt : India 1857-1970*, Princeton University Press, 1964; pp. 205-207.

Polarisation

With the mounting indebtedness of the peasant in an atmosphere of insecurity and tension, agriculture stagnated. Polarisation advanced with the landlord and the money-lender at one pole and the mass of enslaved and poverty-stricken peasants at the other.[21] Foundation had thus been laid for the emergence of an immiserised segment of landless poor on a vast scale from the rural landscape of India.

British Industrialisation and its Backwash

Deterioration of Artisans: Introduction of another institution underlined by commercial agriculture and a monetary form of rent marked the beginning of another stage in the exploitation of rural India. They undermined the cohesion and the self-sustaining nature of the Indian village by bringing in distortions in the patterns of division of labour. The rapid spread of plantations and commercial agriculture, the foremost forms of capitalist enterprise in India, was a welcome development to the British, as they served their trading interests and met the rising tempo of demand for raw materials thrown up by the industrial development. As the pace of her industrial expansion accelerated, the British manufacturers' clamour for markets reached a crescendo. "East India offered a market for the manufactures of Europe, greater and more extensive than both Europe and America put together."[22] Eric Stoke's characterisation of India as "a military empire...a vast commitment, dubiously balanced by its actual commercial value to English industry"[23] came true.

Indian coastal towns were linked with Britain in the 1840's by steamships and the interior of India was covered after the 1850's by the most elaborate railway network in Asia.[24] The location of the railways was determined by strategic considerations and by the desire to secure the best markets and raw materials. These developments were detrimental to the Indian society in many ways. "The same railways which carried away

21. Levkovsky A. I.: *op. cit.* p. 16
22. Reported to have been quoted by Adam Smith in Parliamentary Debates, Levkovsky, *Ibid* p. 19.
23. Joseph J. Spengler: *Indian Economic Thought: A Preface to its History*, p. 129.
24. Daniel and Alice Thorner, *op. cit.*, pp. 54-55.

the commercial crops brought back machine-made industrial products to the villages. The village weavers and traditional handicraft servants had to compete in the second half of the nineteenth century with products like Lancashire cloth, which was then overrunning world markets. The village artisans no longer were sheltered by the friendly backwardness of the older village commune. Furthermore, the union of agriculture and hand industry which had been the basis of village could no longer remain the compact social and economic unit that it had been. The growing tendency was for each family to make ends meet as best as it could...in the coastal zones and in the regions lying along the new railroads the ancient village handicrafts declined. The village potter, tanner, dyer, oilman, the jeweller, all faced strong competition from machine products—since 1850 a dwindling proportion of the village artisans of the subcontinent have been able to subsist on what they have received for their services from the village. Millions of them have had to find other ways to gain a livelihood or to supplement their scanty earnings from the village. In most cases the only avenue open to them has been agriculture, and they have added steadily to the great pressure on land—"[25]. This army of dispossessed craftsmen went only to swell the segment of landless labour. This crowding into agricultural pursuits resulted in sharing the poverty of the already impoverished peasant. Misery multiplied and the distress was so acute that the Governor-General reported in 1834-35 : "The misery hardly finds a parallel in the history of commerce. The bones of the cotton weavers were bleaching the plains of India[26]

This transfer of working force from the secondary to the primary sector was a unique characteristic of the development policies pursued by the British colonialism while the reverse was taking place at home in her economic expansion. The transformation of these "self sustaining communities into mere farms producing opium, cotton, indigo, hemp and other raw materials in exchange for "British Stuff"[27] not only provided a handle for increased seizure of surplus product through the innocuous looking commodity-money relations but also exposed the Indian economy to the threat of severe famines in years of successive drought. The heavy exports of grain draining away the surplus on the eve of the 1896-97 famine, the most severe in India during the nineteenth

25. Daniel and Alice Thorner, *ibid.*, pp. 55-56.
26. Dutt R. C. : *The Economic History of India Under Victorian Age*, London, 1950, pp. 539-44.
27. Marx. K: " Trade with China", *New York Daily Tribune*, Dec. 3, 1859, p. 8.

century, is a standing testimony to the colonial statesmanship of Britain.[28] The series of famines which occurred in India in the last century since the sixties aggravated rural poverty and enslaved the peasant further to the landlord and the money-lender. Large masses of peasantry began to roll down the social ladder as tenants-at-will and landless labourers.[29] The upshot of all these changes was the progressive *impoverisation* of the peasant and the heightening of inequalities of wealth and income among the social classes in the society.

Regional Inequalities: The other consequence of transsforming India into an agrarian and raw material adjunct of capitalist Britain was the aggravation of regional inequalities. In facilitating the flow of raw materials and finished products, centres of trade and transport grew in size and importance. It was through these 'parasitic cities'—to borrow a phrase from Hoselitz—that the basic resources were drained off from the hinterland in greasing the wheels of British *industry;* at the same time they acted as funnels through which the finished products of Britain filtered back to reach the Indian masses. A network of financial institutions cropped up at these centres in support of the trading operations. The growth of a small segment of processing industries was the concomitant outcome of the parasitic operations of the British capital. All these developments helped in creating a climate in which the pressure of externalities, both social and economic, exerted a strong pull on the upper strata of the village community. They shifted to these urban centres and forged links with the British capital in their eagerness to share the spoils of exploitation. The logic of accumulation with all the institutions and paraphernalia transmitted debilitating impulses to the rural economy through its fiscal, monetary and administrative instruments and widened the inequalities across social classes and geographical regions in the country.

3. DEVELOPMENT AND POVERTY IN POST-INDEPENDENCE

On the eve of Independence, India acquired an economy with a colonial heritage characterised by parasitic agglomerations and structural stagnation. The end of political subjugation on the advent of Independence marked the beginning of an era of transition from stagnation to growth).

28. Bhatia B.M. : *Famines in India 1866-1965* Asia Publishing House, 1968.
29. Patel S.J. : *op. cit.*, p. 15.

Attempts were made to correct some of the inherited imbalances and distortions to achieve a breakthrough in the legacy of low level equilibrium at which the economy had been operating. Planning was initiated to promote rapid industrialisation with particular emphasis on the development of basic and heavy industries to make the growth self-sustaining. At the same time, promotion of social justice through the equitable distribution of income and wealth and eradication of poverty through special programmes were emphasised. Attempts were made to bring about institutional changes through land reforms, tenurial reforms and cooperative movement.

Despite these well-meaning efforts, the benefits of development failed to percolate to the majority at the bottom of the socio-economic hierarchy.[30] Polices and programmes designed to ameliorate the conditions of the poor had little effect on their levels of living. This view has been emphatically documented in the writings of Gadgil and Dandekar and empirically sustained in the writings of the latter and further studies stimulated by their works.[31]

Eliminating Exploitation

The initial measures focussing on the abolition of anachronistic institutions like the princely states and zamindari did not lead to any radical change in the colonial structure of agrarian relations. The economic power probably shifted from one layer to the other at the top; this shift confined only to forward caste groups. The development schemes initiated in the rural areas in the post-independence period strengthened the position of large and medium sized holders who are generally the land working as well as the land owning castes. This layer of the rural hierarchy has the political manoeuvrability as an additional asset at the state and local levels and dominated the local institutions through which the

30. For the details of how India's development though impressive did not benefit the weaker sections, see Mahalanobis, P. C. : "The Asian Drama: An Indian View," *Sankhya*, Series B, Vol. 31, Parts 3 & 4, 1969.

31. In a recent study it has been shown that the absolute levels of living of the poorest have been falling since 1963-64. See Radhakrishna R. and Atul Sarma : *Inflation and Disparities in the Level of Living*" (mimeo), Sardar Patel Institute of Economic and Social Research, 1974; a shorter version appeared in *Indian Economic Journal*, Vol. 23, No. 4, 1976.

inputs of development flowed into the region.[32] The introduction of land reforms in the form of land ceilings and tenancy regulations had little impact as these measures remained mostly on paper; attempts at their implementation were sabotaged by a host of *benami* transactions in collusion with local bureaucracy.[33] By virtue of their political linkages and socio-economic status, this minority carried home the harvest of benefits resulting from the developmental schemes at the expense of the powerless majority whose position deteriorated.[34] Nothing would have been more naive to expect than that something radical would occur when development activities have been channelised through the age-old and exploitative socio-economic institutions with attempts at marginal tampering. Further "A decade of favourable terms of trade to agriculturists... have led to possibilities of accumulation of surplus with the top strata of rural societies for which investment outlets were not adequate within the traditional framework of agriculture. These were diverted to money-lending activities and towards purchase of land. The ceiling and tenancy acts acted as detergents to the flow of urban investment in land... There has been a gradual transfer of land to the resident land lords in the village who are less deterred by ceiling and tenancy acts since they are well entrenched in power in the village to resist both administration and the tenant class. The result is the transformation of non-owning cultivating peasants into landless and of reduction of the cultivating unit of the small owner-cum-tenant cultivator."[35]

Technological Changes

The advent of green revolution during the late sixties raised hopes regarding its salutary effects on the levels of living of rural poor. While the green revolution has made some dent on the growth rates of cereal output in selected developed rural pockets, simultaneously, a

32. See Parthasarathy, G. : "Rural Power Structure" *Seminar*, April, 1971.
33. Planning Commission *Implementation of Land Reforms*, August, 1965.
34. Reviewing the progress made in the first and second five-year plans, Prof. Gadgil observed . "Agricultural labour has distinctly deteriorated in its position and this most probably, is also what has happened in the case of rural artisans and casual labour, and labour employed in unorganised industry, trade and transport." See for an exhaustive account, Gadgil D. R., *Planning and Economic Policy In India*, Gokhale Institute of Politics and Economics, 1972.
35. Parthasarathy, G.: *Green Revolution and the Weaker Sections*, Andhra University, Waltair, Sept., 1973., p. 9.

large number of studies revealed its perverse distributional effects.[36] In some areas, it was found to have limited attraction for small farmers though the gains per acre were observed to be relatively more for small farmers.[37] There were found to be many institutional hurdles in its adoption by the small farmers.[38] "Given the much higher cultivation costs of the new varieties, and an even greater premium on timely agricultural operations—including a rigid schedule for the application of fixed amounts of water to achieve maximum potential yields—the economic disparities between the minority of cultivators who can finace land improvements and the majority who cannot are bound to widen further.[39] Also the employment implications of new technology seem to be mixed. In the first round it entailed more instensive cultivation of land and consequently greater use of farm labour. But the growing investible surplus of the big farmer was being channeled into the adoption of capital-insentive techiques with resulting displacement of labour.[40] Restrictions on caste mobility had an influence on the social categories of labour displaced.[41] The green revolution had also altered

36. M. L. Dantwala : "Who has Gained from New Farm Technology" *Economic and Political Weekly*, April 23, 1977; Zubeida Manzoor Ahmed;" The Social and Economic Implications of Green Revolution In Asia", *International Labour Review*, Jan. '72, pp. 9-34; Wolf Ladejiusky: " Ironics of India's Green Revolution" *Foreign Affairs*, July '70, and Ladejiusky's series of articles on Green Revolution in the various issues of *Economic and Political Weekly* 1969; Parthasarathy, G. *op. cit;* Indira Rajaraman : "Poverty, Inequality and Economic Growth : Rural Punjab, *The Journal of Development Studies*, July, 1975.
37. See Bhalla G. S., *Changing Structure of Agriculture in Haryana*, Dept. of Economics, Punjab University, 1972.
38. While summarising the results of a few studies on the problems of small farmers sponsored by the Planning Commission, Minhas observes "Notwithstanding the fact that technology may be neutral to scale, the credit and inputs required for cultivation are rarely available to the small farmers from the established financing institutions. The difficulty is accentuated in areas where implementation of agrarian reforms is tardy. Even when financing institutions are in a position to help the small farmers, the procedures are cumbersome. "B. S. Minhas: *Planning and the Poor*, S. Chand & Co., 1974, p. 106.
39. Francine R. Frankel: *India's Green Revolution* : *Economic Gains and Political Costs*, Princeton University Press, 1971, p. 194.
40. One cannot say conclusively the overall effect of Green Revolution on employment. Nevertheless, whatever monetary gains they have received are no match to the current inflation. Comparing the incomes of agricultural labour in 63-64 and 73-71 from the NSS data, Parthasarathy and Rama Rao observed that except in three States, viz., Punjab, U. P. and Orissa, in all other States there was a decline in real income of agricultural labour. Parthasarathy G. and Dasaratha Rama Rao: "Minimum Wages Legislation for Agricultural Labour: A Review" *Economic & Political* Weekly, Sept. 27, 1975, A 76—A 88.
41. Hanumantha Rao G: *Caste and Poverty*, Ph. D. Thesis, Andhra University, Waltair, 1975.

in certain areas the nature of tenancy. The land owners stopped leasing out and the big peasant started leasing in land from small owner cultivators who could not withstand the sweep of competition in the altered set up.[42]

Target Group Schemes

A number schemes[43] launched by the government for the benefit of the rural poor also did not make any substantial impact on their low levels of living. Reviewing the evaluation studies carried out by social scientists, Dantwala showed how the schemes were mismanaged and had little impact on the poverty of the masses. "As far as I can see, the Socialism of the New Congress will have little impact on the poverty of the masses. Its main beneficiaries will be the "gate keepers", the Parvence Politician and his proteges, the not-so-small entrepreneur in industry, the upper-middle farmers, organised industrial labour, the civil servant in strategic positions and perhaps economic advisers and consultants.[44] Thus the impact of developmental policies had been iniquitous and unjust in helping the lot of the underprivileged groups in society.

4. CONCLUSION

The above analysis shows that the present poverty has deep roots in the historical past. The institutions created for colonial exploitation had direct bearing on the intensification of poverty by disintegrating India's self-sufficient village economy and wrecking the handicraft industries. The land revenue and legislative institutions advanced polarisation with the landlord and the money-lender at one pole and the mass of enslaved and poverty-stricken peasant at the other. The backwash effects of British industralisation led to deterioration of handicraft industries and the displaced artisans had swollen the ranks of agricultural landless labour. The transfer of working force from the secondary to the primary sector was a chief characteristic feature of

42. Parthasarathy G. *op. cit.*

43. The Schemes include Rural Works Programme, Development of Khadi and Village Industries, Small Farmers Development Agency, Scheme for Marginal Farmers and Agricultural Labourers and other crash programmes.

44. Dantwala M. L., *Poverty in India: Then and Now 1870-1970*, Macmillan, 1973, p. 56.

the arrested development policies pursued by the British colonialism.

In the post-Independence era, attempts were made to stimulate growth through planning. Some institutional reforms were also undertaken. While there was no dispute that India made progress in terms of economic aggregates as compared to her colonial past, but the distributive content of her performance was dismal. The half-hearted institutional changes possibly proved counter productive. In other words, the past development failed to release millions of people from poverty, lethargy and inhibitions created over the colonial era spanned over centuries. □

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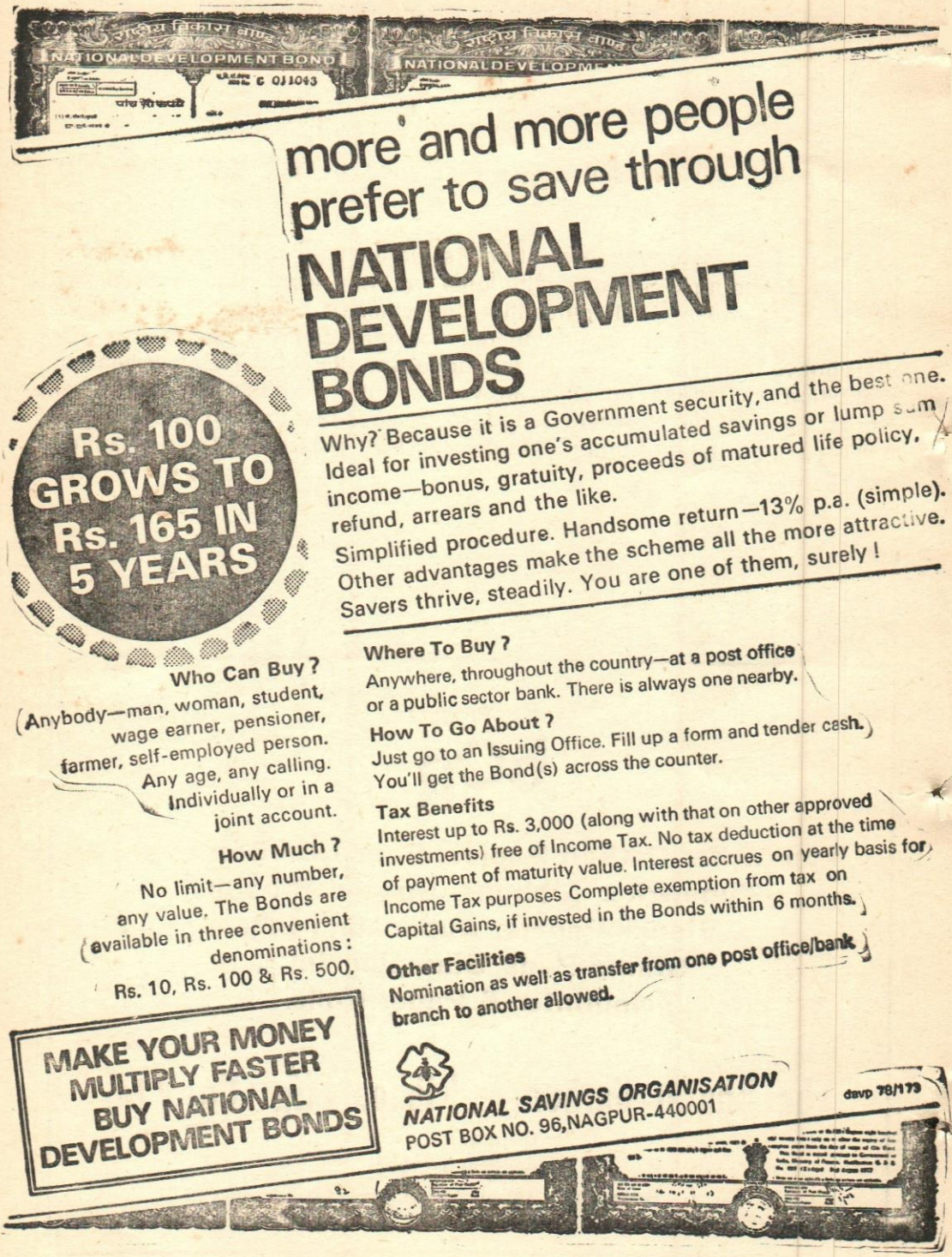
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District Industries Centres : A Leap Forward

Ram K. Vepa*

A Survey recently made by the United News of India of the progress made to establish District Industries Centres has highlighted the fact that in as many as 18 states, the District Industries Centres have been established while in four states (Bihar, Kerala, Meghalaya and Nagaland) a start is yet to be made.

The Development Commissioner, Small Scale Industries (who is the National Coordinator of the programme) has also undertaken a quick evaluation of the DIC progrmme and the progress made so far. According to his assessment, out of the 223 District Industries Centres sanctioned, more than 150 have become operational of which many have started to make significant progress.

Of the 223 Districts now brought under the DIC programme, 112 were covered earlier by the Rural Industries Project Programme (or the Rural Artisan Programme). Out of the 101 Districts declared as backward and eligible for Central capital subsidy, 75 Districts have now been brought under the DIC programme; similarly out of 247 backward Districts eligible for concessional finance, 166 Districts have been covered under the DIC programme.

In regard to the staffing pattern, general managers have been sanctioned for all the DICs of which 158 have been recruited. Similarly, in regard to the functional managers (of which there are 4 to 7 for each DIC), 750 have been recruited so far. Most of these personnel have also undergone at designated training centres, a programme carefully devised by established national institutions like the Indian Institute of Management, Ahemdabad; Small Industries Extension Training Institute, Hyderabad; National Productivity Council; National Industrial Development Corporation; State Bank of India and private sector establishments, such as Hindustan Lever, etc. An attempt was made to imbue the personnel who are to work in the DICs with a sense

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of perspective of their jobs to enable them to interact meaningfully with the other fucntionaries engaged in the same task as also with rural entrepreneurs.

Modus Operandi of DICs

On an overview of the entire programme, it is seen that significant progress has been made for the establishment of the DICs even in the relatively backward states, such as Orissa, Rajasthan, Madhya Pradesh and Bihar. In the more advanced states, such as Gujarat, Karnataka, Maharashtra, West Bengal, etc., District Industries Centres have already begun to formulate programmes of action to be implemented in the current year. A programme drawn up by the DIC established in the 24-Parganas of West Bengal has been circulated to all the District Industries Centres for their information. In the North-Eastern Region, the progress has been slow largely due to lack of suitable personnel to man the Centres.

Admittedly, the progress achieved so far is not spectacular but nor is it unimpressive. For the first time, an institutional framework has been provided at the District level to look into the problem of Rural Industrialisation which earlier was being catered to by a single officer variously known as District Industries Officer or Assistant Director of Industries. The District Industries Office with its five to eight core functionaries headed by General Manager of the rank of a Joint Director of Industries, will bring to each area a capability, both administrative and technical, far exceeding what was available in the past. Besides, it will act as a nodal agency to draw together the various personnel working under different organisations so as to weave a coherent pattern of economic development. In the districts, where the DICs have become fully operational, they form a bridge-head to make a dent on the intractable problem of carrying forward the process of industrialisation into the semi-urban and rural areas.

The DIC is not just an administrative gimmick as its critics contend nor is it, perhaps, a 'revolution' as some of its enthusiasts described it. It is basically an attempt to decentralise industrial administration and to provide a milieu in which entrepreneurs from the rural areas can set up new industries based on local raw materials and catering largely to local demand. Where as in the past, the potential entrepreneur had to interact with a multiplicity of agencies for obtaining various

necessary approvals, he can now get them from one single institution — the District Industries Centre. It will also provide to the widely-dispersed decentralised craftsmen a systematic programme of support in terms of raw materials, finance and technology. On this account the DIC represents an imaginative and meaningful attempt made for the first time to take the process of industrialisation to the rural and semi-urban areas particularly in regard to towns with a population of less than 50,000 and with investments below Rs. 100,000.

The approach to be adopted by the DICs is not fragmented nor conventional as in the past. The DICs have been advised to look at the total resource picture of the District, both in terms of material as well as human resources. In fact, even material resources are ultimately as important as the use to which they are put to by men; the human factor, as Gandhiji used to emphasise constantly, is the supreme consideration. In every area of the country, there are skills, some of them handed down from centuries, which could be capitalised and used as a base for further development. Similarly, various occupations have provided livelihood to large number of people but they need to be encouraged and organised. The basic approach of the DIC is not to disrupt the exisiting occupational patterns at the rural level but to help those who are already engaged in traditional occupations to do them better so as to provide better livelihood for themselves and a greater service to the community.

Similarly, the DICs will identify possible 'growth centres' in each District, which could emerge as focal points for growth in their respective regions. These could be the centres of Community Development blocks or *taluka* headquarters or market towns which have traditionally been recognised as centres of economic activity. The DIC will formulate programmes for the establishment of new industries at such growth centres so as to process the raw materials that are available in that area. The work programme of each DIC will, therefore, have a distinctive flavour of its own and there is no one 'model' plan of action they are required to follow.

To enable this job to be done effectively, a great degree of flexibility has been provided to the state governments to establish the DICs in the most suitable manner. The staffing pattern has also been made flexible although it has been emphasised that a certain 'critical mass'

of capabilities would need to be provided so as to set off a momentum for growth. State governments have been advised—and they are in most cases responding favourably—to delegate a wide spectrum of powers to the DIC so that it can perform its nodal function effectively. Suitable linkages with existing institutions have also been provided so that the DIC can emerge as the hub of economic growth in each District.

Problem Areas and their Solutions

Quite obviously, there are many problem areas ahead for the successful functioning of the DICs.. One such is the availabilty of credit to the new units that will be set up under the programme. Administratively, it has been provided that a functionary of the Lead Bank of the District will operate as a member of the team of the DIC so that his appraisal and advice will be available to the new entrepreneurs. It is expected that with this linkage to the banking system, a greater flow of credit will be made available to the new entrepreneurs. It is expected that with this linkage to the banking system, a greater flow of credit will be made available to the 'tiny' sector which has hitherto not figured prominently in the advances made by the commercial banks. A proposal to set up an apex financial organisation to support this sector is also under consideration of the government.

Another key area on which considerable thought is being given is to provide a mechanism for the successful marketing of the products made in the units set up by the District Industries Centres. Various suggestions are being considered and a high-level marketing advisory group has been constituted to formulate suitable product-wise strategies. One suggestion under consideration is to establish Rural Marketing Centres which will draw upon the expertise already available in organisations such as Handloom, Handicrafts and the Khadi and Village Industries Commission. It is also proposed to identify entrepreneurs who can undertake commercial activities on a professional basis and to provide them with incentives so as to be able to do this job effectively.

A third area is technology for continuous upgradation of skills that are already available. A Production-cum-Training workshop is proposed

to be established in the each District Industries Centre which will offer facilities for training of rural artisans and other skilled workers. It is also under consideration to link the DICs with the national R&D network through suitable institutions at the state level. It is recognised that the development of appropriate technology for rural areas would be a vital factor in the successful implementation of the DIC programme.

Ultimately, the success of the programme would critically depend upon the human factor on two counts : firstly, on the personnel who will man these centres and secondly, on the type of entrepreneurs that it will be able to attract and stimulate. Care has been taken in the recruitment of personnel for the DIC to draw upon those who are well motivated and this has been further accentuated by suitable training programmes given to them. In regard to entrepreneurs, the District Industries Centres will undoubtedly play an important role in identifying the entrepreneurship that exists but is dormant in the rural areas so that it can, in, course of time, provide a corps of entrepreneurs who will act as 'agents of change' in the countryside.

Conclusion

The DIC concept is basically to bring administration to the people at the grass-roots level. In that sense, it is a logical culmination of the programmes that have been undertaken in the past but the success of the programme will undoubtedly depend upon the support it receives from the state governments as well as the enthusiasm it can generate among potential entrepreneurs. There is no reason to be unduly pessimistic or cynical about the success of the programme since the experience of past five months (of which three were spent in the modalities for the establishment, recruitment and training of personnel) has shown that given a sound institutional framework, there is a great potential both in human and material terms, which can be mobilised to establish a network of industries in rural areas. □

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Industry and Rural Development

Pravinchandra V. Gandhi*

The role of rural development in the total economic health of the nation cannot be overemphasised. This is particularly so in respect of India where more than 70 percent of the population lives in rural areas and about 50 percent of the national income is derived from agriculture.

Industry, however much well organised, cannot achieve and sustain lasting prosperity without commensurate development in the rural areas. The close nexus between industry and agriculture, the size of rural population, the significant contribution of the rural sector to national income and the immense potential the very process of rural development itself throws up for industrial growth, make rural development imperative as well as unequivocal. An improvement in the style and standard of living of the rural people has a definite answer for many of our current problems.

The Federation of Indian Chambers of Commerce and Industry, (FICCI), as early as in April 1976, set up a special Sub-Committee on Rural Development with a view to motivating business houses and units to undertake rural development programmes.

The Federation has :

— formulated plan of action indicating the types of welfare and development activities that could be undertaken by companies ;

— organised Seminars at Bangalore, New Delhi, Bombay, Madras and Calcutta, to discuss the issues and problems involved ;

— brought out a brochure on 'Rural Technology' giving broad outlines of some of the mini-technologies developed that could be used with advantage in rural areas;

* President, Federation of Indian Chambers of Commerce & Industry, New Delhi.

— established contacts with some of the Universities and Institutions that impart training in village development work as well as with voluntary organisations that are active in rural areas with a view to enlisting their cooperation in securing motivated personnel and also in formulating and carrying out these programmes;

— published a brief report of rural development activities launched by different business houses and companies; and

— tried to persuade Chambers of Commerce in different regions to set up rural development cells in their own organisations to guide and help their members in these activities.

Three model schemes, one each on dairying, irrigation and textiles are being prepared and would be ready shortly.

The FICCI also proposes to organise training programmes in rural development for industrial executives.

Generally speaking, agro–industries like sugar, jute, oil, dairy etc., have their own extensive rural development programmes. Manufactures of agricultural inputs like tractors, fertilisers, banks (credit) and pharmaceuticals also have their rural extension programmes. The challenge before these extension programmes is to reach to the rural poor and build in social dimensions. For example, a cooperative society aiming mainly at the landless and small farmers could be organised. The organisation of a cooperative would itself be of great educational value and will foster self-reliance among the poor. Similarly, if banks provided loans to groups of small farmers and helped them organise procurement of inputs and marketing of their produce, then they too would become agents of development. The Marianad Community Development Project, Trivandrum, provides an excellent example in rural development. While organising the fisher-men in a marketing cooperative, the organisers have worked in the fields of education, health, housing and have gradually built up the confidence of the fishermen so that they could manage their own affairs. Impressed by the gains, fishermen in surrounding areas have themselves formed their marketing cooperatives. Now, their effort is to enforce a scientific exploitation of sea resources.

That apart, Rural Development has to be supported by scientific institutions, voluntary agencies and the business houses. Scientific institutions have the responsibility of developing appropriate technologies. The voluntary agencies have to implement them in the villages, and the business houses have to coordinate and support the two.

As in industry, the technologies developed in the laboratories have to be modified and developed to make them operational. The business houses have the necessary expertise for this. The focus being on organisation of production in rural areas, the industry is in a singular position to coordinate. This organisational ability or managerial input is an imprtant contribution that the industry can make.

So far, 64 projects have been approved by the prescribed authority. About Rs. 13 million would be spent on these projects.

With a view to encouraging companies and cooperative societies to involve themselves in the task of rural development, the Finance (No. 2) Act, 1977 introduced a new section 35CCA in the Income-Tax Act, under which companies and cooperative societies are entitled to a deduction in the computation of the taxable profits on expenditure incurred by them on any approved programme of rural development.

Also, to give further impetus to the programme of rural development, Section 35CCA has been inserted in the Income-Tax Act, 1961, through the Finance Act 1978. Section 35CCA provides for the deduction in the computation of the taxable profits, on expenditure incurred by a tax-payer engaged in a business or profession by way of payment of any sum, to an association or institution having the object of undertaking any programme of rural development, to be used for the purposes of carrying out such programme. The deduction will, however, be admissible only in cases where the association or institution, as also the programme of rural development for which such sums are paid, have been approved by the "prescribed authority" notified by the Central Board of Direct Taxes.

While taking up rural development schemes, the following guidelines broadly hold good :

— rural-based industrial units should takeup schemes in areas situated

near their factories;

— urban industrial units which draw their raw materials from rural areas or get a significant proportion of their workers from particular rural areas should carry out the schemes in those rural areas;

— purely urban-based units which do not draw their raw materials from rural areas should select areas where active cooperation of suitable social organisations, already engaged in rural development activities, could be secured. They can also secure consultancy services by appointing some of these social organisations as their consultants in this work.

Industrial units that are engaged in research and development or manufacturing activity which could be useful in the development of rural areas, could take up these activities in a few selected areas. For example, if a unit has expertise in water purification processes, it can take up the project of making pure drinking water available to the people in some selected areas; a unit engaged in manufacturing equipment useful for small irrigation could take up the work of establishing small irrigation facilities in rural areas; or an engineering unit can take up the programme of erecting *gobar gas* plants or of setting up small ancillary units in rural areas.

In conclusion, it may be stated that business houses and industrial units should take up rural development work as an integral part of their normal functioning. Rural Development work has to be regarded not as charitable activity, but as an expansion of the role and function of business and it has to be evaluated on the basis of fixed criteria and pre-determined goals. □

Planning Process for Integrated Rural Development: A Simplistic Approach†

R. N. Azad*

Integrated Rural Development has been a subject of much discussion at various forums—national and international—during the last few years and much has been said on this subject by academicians, planners, administrators and practitioners connected with or operating through various governmental organisations, voluntary agencies and professional institutions, etc. This paper attempts to present a simplistic methodology for a field operator which can be the starting point of the process of planning and implementation of Integrated Rural Development.

The objective of achieving full employment, eradication of poverty and creation of an egalitarian society has always been implicit in the development strategies adopted in the past. An assessment of India's economic development over a quarter of century of planning would, however, indicate that although our economy has made significant progress in different sectors, the problem of unemployment and under-employment still remains unresolved. For instance, the food production has more than doubled, industrial production has quadrupled as compared to the base year of the planning era and the national income has grown at an overall rate of 3.5% a year over this long period which is quite significant considering the size and very diverse condition of natural endowments coupled with extreme demographic pressure. Despite these achievements, even the backlog of unemployment has not been contained from one Plan period to another and the number of persons living below the poverty line has not diminished.

The Draft Five-Year Plan (1978-83) has, therefore, defined removal of unemployment as one of the principal objectives of planning to be achieved within a period of ten years[1]. The Plan Document also

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† Based on a paper presented at a Seminar on IRD, organised by Punjab Agricultural University, Ludhiana, 17-19 October 1978.

1. Draft Five-Year Plan 1978-83, Planning Commission, Govt. of India.

(c) Labour mobilisation—training in skills and organised mobility to tie-up labour with opportunity.

As stated earlier, the strategy under the IRD programme is based on decentralised micro-level block planning. The programme is mainly focussed on the target groups comprising small and marginal farmers, tenants and share croppers, landless agricultural labourers, artisans, Scheduled Castes & Scheduled Tribes and other disadvantaged groups like nomads, rural women, etc. The objective is to raise the income levels of the target groups and bring them above the poverty line. This can be achieved by taking up productive programmes specially designed for each family. The schemes that can be taken up under the programme have, therefore, to be beneficiary-oriented. The programme is being taken up during 1978-79 in 2,300 blocks out of about 5,004 blocks in the country. The 2,000 blocks are such as are covered under one or more of the 3 special on-going programmes of Small and Marginal Farmers Development Agencies, (SFDA), Drought Prone Areas Programme (DPAP) and Command Areas Development

2. Azad, R.N., Integrated Rural Development, published in *Dynamics of Development*, Vol. II, pp. 419-436, Concept Publishing Company, New Delhi, 1977.

3. Sivaraman, B. in his various addresses and meetings.

recognises that the achievement of the 'employment objective' depends crucially on increased labour absorption in agriculture and allied activities. This is because the growth of employment in large and medium industries is incapable of absorbing more than a fraction of the labour force. Assuming the person-day unemployment rate to be at least as much as in 1973, the present unemployment estimates in the Draft Plan 1978-83 have been placed at 20.6 million person-years : 16.5 million in the rural areas and 4.1 million in the urban areas.

The employment strategy set forth in the Plan is :

i) to adopt an employment-intensive sectoral planning;

ii) to regulate technological change to protect and enhance employment ; and

iii) to promote area planning for full employment.

Programme (CAD). Further, it is proposed to add 300 new blocks every year for comprehensive area planning for full employment. It has been decided to bring about integration in approach and methodology of these special on-going programmes. Depending upon the requirements of area, any new scheme or programme which may be of direct benefit to the target groups by way of giving them additional income and employment opportunities can be taken up in any block covered under the IRD programme.

Planning Process

There have been some sporadic attempts in the past to have grass-root planning. However, the fact remains that neither any sizeable effort seems to have been made nor any significant success appears to have been achieved in this direction. Also, though some states have made some efforts in the past to have planning at the district level, the planning at the block level has almost been non-existent. The planning processes involved under the new approach of decentralised planning at the block levelwill require much preparatory work to plan area and target group specific programmes. In order to have a comprehensive block plan, the following processes would be involved :

i) Compilation of Basic Data and Preparation of Resource Inventory :

The resource inventory will indicate the availability of local resources and give a base to the planner to plan suitable programmes for the optimum utilisation of these resources, using appropriate technologies while meeting the objective of optimum utilisation of resources which are labour intensive to achieve the employment objective. The science and technology input can make significant contribution in this regard. The inventory will clearly indicate the various on-going programmes including those in the Central, State, Cooperative and Corporate sectors. The fiscal resources for block planning will include State Plan outlays, Central outlays that may flow from Central funds for various special programmes, and special Central assistance for block Planning and institutional finance. The resources inventory will not end with its mere compilation. More important from the planning point of view will be its meaningful analysis. This analysis should bring out the gaps and constraints in

development of the area and the people inhabiting it, particularly those in the target groups. Obviously, the institutional and structural aspects and management problems will not be precluded from the purview of the analysis.

ii) Household Survey :

The household survey has to be conducted to identify the families living below the poverty line in the block and should be confined only to such data which are considered essential to plan suitable schemes to raise their income levels. In the first phase, the household survey should be specifically confined to the target groups which can be selected empirically. In subsequent phases, more comprehensive household surveys and bench mark surveys can be planned to bring mid-term refinements in the plans.

iii) Manpower Budgeting :

The household survey of the area and the information already available through various sources like Census Reports, N. S. S. data, Revenue Records, Lead Bank Survey Reports, Agricultural Census, Cattle Census, Techno-economic Surveys, empirical estimates on seasonal migration of labour from the area, etc., will give an indication of the existing unemployment and underemployment problem in the block. Detailed manpower budgeting will be required for placement of unemployed and underemployed members of the labour force.

iv) Formulation and Implementation of Block Plans :

As already stated, little experience presently exists at the block level, and for that matter elsewhere, in the formulation of block plans of types as are envisaged. Under the IRD programme, it is proposed to involve the voluntary organisations of standing and repute, both in the formulation as well as implementation of block plans. Before assigning the job of block plan preparation, it has to be ensured that concerned voluntary organisation has the adequate rapport with the area of operation and also has the experience of working in the rural areas. Some voluntary organisations have already done excellent work and possess valuable experience in this regard and must be usefully associated in the preparation of block plans and their implementation. Some professional and academic institutions may also be

associated with the preparation of block plans. However, the institution selected should be such as have 'soiled their hands' in such work so that the Block Plan does not remain an academic exercise.

v) People's Involvement in the Plan Formulation and Implementation :

The planning process at the block level will have to ensure active participation and involvement of the people for whom the programmes are intended, both in the formulation and implementation of block plans. The extension machinery at the block level will have to be suitably strengthened and activated to create an awareness among the target groups about the programmes and the benefits it seeks to provide in terms of raising their income levels and taking them above the poverty line. In this connection, author's experience in different parts of the country with a fairly large and representative sample of target groups who were to derive benefits from some of the important on-going programmes has revealed that the target groups in many cases were not even aware of the existence of the programme. While on the one hand this calls for an intensive effort on the part of the extension machinery and the implementing agency to create necessary awareness, on the other hand it brings to focus the utmost need for associating the people in plan formulation. Again, the author's personal experience in seeking people's suggestions for undertaking schemes suitable for the area in Nittur village in Tumkur District of Karnataka, Haripur Village in Puri District of Orissa and Bhure and Bigharwal villages in District Sangrur of Punjab has confirmed that the so-called local illiterate or semi-literate are quite capable in suggesting technically feasible and economically viable schemes. Same was the experience of consultation with the educated and semi-educated, unemployed rural youth in these villages. This has belied the general impression that planning is a highly academic, technical and sophisticated exercise and the common people cannot make relevant suggestions in plan formulation. The emphasis under the new strategy of planning having shifted to the block level, it should now be easier to actively involve the people in the whole process of planning and its implementation. However, it is not intended to minimise the importance of the role which the professional experts and scientists have to play in the process of plan formulation and its implementation. The experts have to find solutions thrown up during the surveys of the area, analysis of the resources inventory and dialogues

with the local people. They will have to work out various alternatives indicating the cost-benefit analysis including social costs and benefits, at the same time keeping in view the resources available and confront the people with these alternatives. Only through such a process the final choice should be made.

Pitfalls of a 'Single Model' Approach

One bane of various past programmes has been a 'single model' approach for the entire country. The programmes have necessarily to be location-specific and a single model will not suit the entire country of such diversities as ours. Decentralised micro-level planning gives an opportunity of making a significant departure from the past practice of a 'single model' approach and, therefore, needs to be fully exploited. Further, the planning process has to avoid a rigid pattern and leave sufficient flexibility to give full expression to the local genius of the people in formulation and implementation of the block plans. In this context, it will be significant to mention that apart from the programmes of the Central Government., some of the State Governments have also initiated interesting programmes in the area of rural development. For instance, the *Antyodaya* programme of Rajasthan and the Central Village scheme of Punjab based on the Growth Centre concept will be worth citing. Under its *Antyodaya* scheme, the Rajasthan government are selecting 5 poorest families in each village and providing them with means of gainful employment so that they cross the poverty line. The Punjab government have taken up a massive programme of developing a focal point in a cluster of 5 villages to cater to most of the needs of the farmers. To start with, one such focal point in a cluster of 5 villages is being set up in every block during the current year. The programme will be gradually expanded to cover the entire area. Both these schemes suit the local conditions and the stage of development in the two states and have made a good start. Similar experiments are being made by some other states. Experiences gained from all such schemes will be of immense value in future planning. A synthesis of such local programmes within the national programme of Integrated Rural Development will be a desirable step.

Monitoring and Concurrent Evaluation

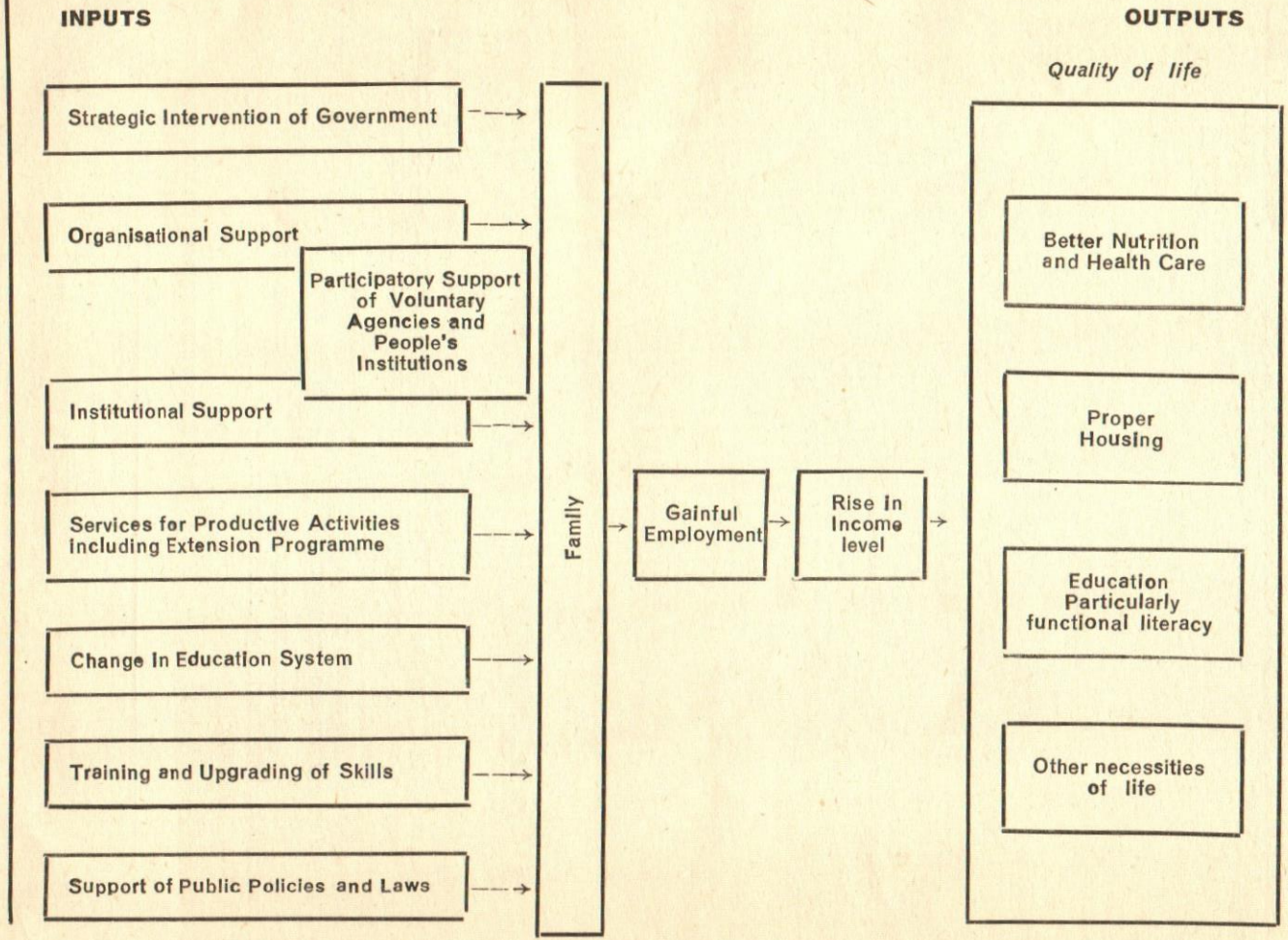
The main objective of the Integrated Rural Development programme

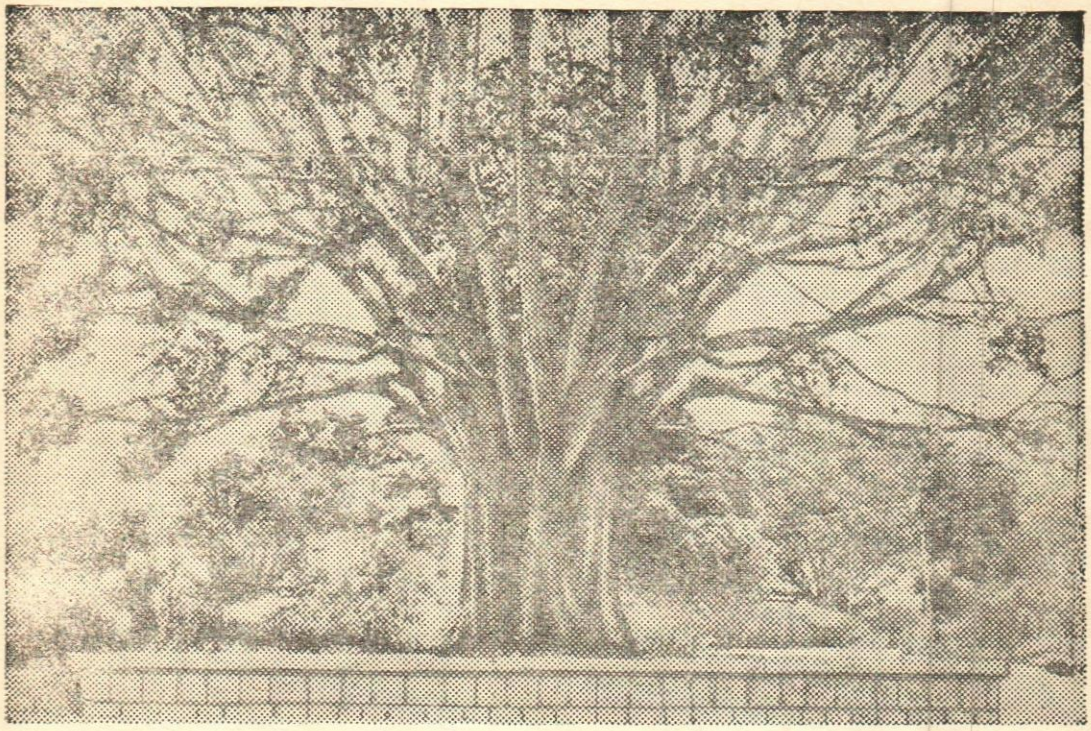
is on reaching the benefits of development to specific target groups and to enable them to get over the poverty line by raising their income levels. It would, therefore, be essential to have an efficient monitoring system where it is possible to estimate in measurable terms the benefits actually reaching the target groups at any point of time. The emphasis on monitoring the achievements of physical and financial targets alone under the rural development programmes is not likely to serve the purpose. Monitoring under the new programme will have to be done specifically to indicate what number of families, whose employment and development is the basic objective, have been made viable at a certain point of time and how are they going ahead further. The monitoring system should also enable the planner and implementor to make mid-term corrections so that planning does not remain a one-time exercise but a continuous operation. A model based on systems approach of socio-economic development of a rural family in the target groups has been given on page 563.

Conclusion

To sum up, the country has embarked upon a very bold experiment in decentralised micro-level planning at the grass-root level on a size which may not find a parallel elsewhere. In this policy decision, the experience gained through earlier programmes of rural development has been taken note of. All the same, it will require a massive effort and collaborative endeavour of all those concerned with rural development in various capacities to make a meaningful headway. Also, temptation will have to be resisted to create 'show pieces' which may not be easy to replicate in terms of financial investment and manpower resources. □

Systems Approach to Socio-Economic Development of a Rural Family in the Poverty Group





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Planning for Rural Development : Evaluation of the 1978-83 Plan

Brahm Prakash*

Introduction

This paper attempts to evaluate the rural development aspect of the *Draft Five Year Plan — 1978-83* (hereafter known as the Plan or, the Plan-78, as different from the Plan-79 which will have 1979-84 perspective, and so on). It may not be possible to do a comprehensive and a thorough evaluation of the plan provisions for so many reasons.[1] First of all, most of the background technical papers which provide the necessary under-pinning to the plan are not accessible, and secondly, the constraints of size and format of the present paper also forbid such an exercise. But what is attempted here is a presentation and discussion of some of the substantive issues in their form/shape which they have obtained in the Plan document.

The Plan has three basic objectives which are the focal points of all the programmes including rural development. It would, obviously, be expected that each programme necessarily makes some input towards achieving these goals. These three objectives are discussed below and their linkage with the rural development aspects elucidated. Besides, the rural development programme itself gets spread across so many sectors, e.g., agriculture, industry, minimum-needs-programme (MNP), etc. And each of these sectors effect the overall plan performance in a different manner. These are analysed in subsequent sections. But before taking up this discussion, a small digression is made to restate the concept of rural development and some of the aspects which will be more operative in the discussion.

Concept of Rural Development

Rural development is one of those terms which have different meaning for different people. Some refer by it, to growth in economic yield of

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1. For a complete and comprehensive critique of the Plan, see fothcoming book of Prof. Brahmananda by Himalaya Publishing House, Bombay.

rural sectors while others would like to put more emphasis on the agro-based, cottage and small industries as the prime concern of the rural development. In some cases agricultural production becomes the core while in others mere provision of social services can be given this name. More recently, the issue of the flow of resources has also been raised. According to that view, unless the flow of men and material is reversed back to the villages, rural development will not be occurring. Obviously, in most of these interpretations there is only one constant aspect, i.e., rural region as a spatial unit. But, is it necessary to define some exclusive rural development which is in some way opposed to urban development and is necessarily different from it? Paradoxically, it is so, notwithstanding the fact that if all the schemes of rural planner were to succeed we would not have anything like rural areas left with us. All these would have been transformed like those in the western world. But why is this primacy for urban development? Why does the larger space and more populace of the two, have to be an addendum and an after-thought ? Why not the other way around ? Or, still better, why not have a policy of development which can envisage a symbiotic relationship of the rural and urban sector in a unified manner ? All the progrmmes of rural development will betray some unreality till our development theorists can overcome their academic convenience of dissecting problems along the lines of pedagogy. It is felt that the perspective planning in India has not forced this issue in its entirety. Plan after plan we have been having sectoral investments and our developing the rural sector has only meant its being subsumed by the market system. The author's submission is that this is a very limited view of the problem and going by the writing on the wall, a more comprehensive and a broader concept of rural development is needed if we are serious about it.

Unemployment

Of the three basic objectives of the Plan, the removal of unemployment and significant underemployment is one of the principal aims. The Plan begins by asserting that the estimates of unemployment in the Second and Third Plan were misleading and that the Fourth and Fifth Plan did not pay as much attention to the problem as it deserves. And whatsoever little efforts have been made in this area, have failed to bring about the desired fruits. It estimates that there are 4 million wholly unemployed persons and on any typical day there are 18.6

million persons unemployed (in the man-days sense).[2] It is well-known that the measurement of unemployment entails both kinds of problems, i.e., the conceptual/analytical type and the actual estimation problems. The estimation of unemployment deserves a separate work in its own right. But it is enough for our purpose to note that this problem is one of the most severe ones with which our economy is afflicted and in the words of the Plan itself :

> ".....in India the absolute volume of unemployment at present (20.6 million person-year) is staggeringly large and larger than in any country in the world for which any unemployment statistics are available". (p.82)

In addition to it, the plan explicitly takes note of the inability of the organised sector to cope up with the growing unemployment even if high growth rates are assumed. Only 10-11 percent of the growing labour force gets absorbed by the organised sector. Rest of the nine-tenth is borne by the agricultural and unorganised sector. The plan does not foresee any shift in this growing burden of unemployment in agriculture. Even within this, the labour market is not observed to be neutral between the male and female labour. The latter are discriminated against by low wages, bad working conditions, more uncertain employment opportunities, etc. Needless to say, the state of other weaker groups, like landless labour, scheduled castes/tribes is positively worse. In the case of rural artisans there is actually a more systematic displacement from the traditional occupations to the unemployed ranks. Gradually these skills are being rendered redundant and alternative employment opportunities are clearly eluding them. So, to sum up the Plan's position, there is a huge unemployment in which weaker sections are bearing the worst brunt and the organised industrial development as we know in this country does not hold any promise of relieving us of this problem.

The plan intends to go about solving this problem in the following manner :

(i) By adopting an employment-intensive sectoral planning.

2. For the definition of typical day and how this figure is arrived at, see Part II Ch. 4.

(ii) By regulating technological change to protect and enhance employment.

(iii) By promoting area planning for full employment.

In addition to this, the Plan expects that other redistributive and poverty reduction programmes will also indirectly increase employment due to increased consumption. But these strategies are not going to be followed in vacuum. Instead, the employment opportunities will be geared to match the "location, skill and idle time of unemployed". It is expected that the adoption of these policies will not only provide jobs for 30 million additional labour force which is going to be generated during the 1978-83 period but is also going to clear "a substantial part of backlog".

Poverty

Poverty is another problem which not only afflicts the unemployed and under-employed labour but also is vastly pervasive in some working classes. The measurement of the size of population which falls below the poverty line is again arbitrary and differs according to the purpose of definition. But according to most of the population estimates the size of the poor ranges from 40 percent of the total population to about 60 percent. The Plan document seems to put the figure at 41 percent in the case of urban population and 48 percent in the case of rural inhabitants. Thus defined, about 290 million people fall below the poverty line. Out of this 160 million are concentrated below even 75 percent of the poverty line. The Plan realises that, so far, the involvement of the poor people in the development exercise has only been marginal and unless these people are made the focus of development efforts, their relative position in the economy is not going to improve. The Commission officials have specifically taken note of the prevalence of poverty in spite of employment in some cases.[3]

The major programme by which the Plan envisages to relieve the poverty conditions is the Revised Minimum Needs Programme. The Plan continues with the basic idea mooted in the Fifth Plan under the

3. See Lakdawala (1977)

banner of Minimum Needs Programme. It expands it to include the adult education under the heading. The actual allocation for the 1978-83 period is Rs 41,800 million as compared to actual expenditure of Rs. 8000 million in the 1974-78 period. The details of this programme are discused below.

Inequality

It is another facet of the two problems discusssed above in the preceding section. The Plan specifically takes note of the inequalities in all the three sectors, i.e., in consumption, in income and wealth. As one would expect, the incidence of inequalites keeps on getting worse across these three manifestations. The concentration of land holdings in the rural sector, corporate assets and real estate in the urban areas are the examples of these inequalities. The consumption inequalities are worse in the urban centres as compared to the rural ones. In the rural sector the data reveals that the land legislation has not resulted in any improvement since the early sixties. The major suggestions which the Plan puts forth in this regard relate to land distribution, (particularly distribution of already surplus declared land), public distribution of consumption goods, credit and other agricultural inputs, provision of short-term consumption loans, etc. Finally, and perhaps which is one of the more stronger suggestions from the Commission, it points out the need for organising the poor. It acknowledges that unless the poor themselves get organised and make sure that they receive a fair share of the national product, it is going to be a difficult task to provide them with minimum facilities.

Agriculture and Rural Development

To achieve a higher rate of employment in the agricultural sector, it is necessary that the production in this sector should increase at a high rate. One of the major implications is that the provision of agricultural infrastructure will have to be done at a vast scale—particularly irrigation, facilities for multiple cropping and improved technology; only then can one hope to have higher rates of long-term growth in agriculture. In this case, the Plan puts special emphasis on the role of irrigation and energy in bringing about a higher productivity. In addition, more emphasis will have to be laid on the redistribution of land, as this will not only lead to a more equitable distribution of

asset base, but also, more employment opportunities as well, for smaller holdings have been known to be more labour-intensive. These two aspects, i.e., of more equitable holdings and their smaller size should proceed simultaneously, as it has been observed that the improved technology may be size-neutral but is not resource-netural.[4] And also that the diffusion of new technology is easier in the case of more equitable size of holdings.

As has been indicated earlier in the introduction, the allocations for the purpose of rural development have been provided under the various heads which are frequently over–lapping which each other. But the Plan provides an overall synthesised figures.[5] Out of the total provision of the Rs. 182,500 million, 53 percent is provided for the purposes of irrigation and flood control—and three-fourth of this is committed for the large and medium irrigation projects. The share of minor irrigation within this sub-sector has actually fallen from over 8 percent in the Fifth Plan to 7 percent in the Plan 78, notwithstanding the increase of 96 percent in the absolute amount of allocation. This is largely due to the fact that the allocation for the large and medium irrigation projects have registered an increase of 135 percent. Thus, out of the increased allocation for irrigation over the Fifth Plan, proportionatety more has gone out to the large and medium irrigation projects. About 22 percent of the allocation in this Plan is directly and indirectly meant for the agricultural production, and rest of the 25 percent is marked for agro-based industries and special rural development efforts. Percentages for these sectors were more or less of the same order in the Fifth Plan.

In a yet another aggregated table in the Plan, some interesting comparisons emerge.[6] For example, allocations regarding agriculture, and allied programmes (including minor irrigation), power for the rural areas, rural water, rural health and family welfare, hill and tribal areas, nutrition, social welfare have, in terms of their relative share, remained at the same level as in the previous Plan. In other words, the mutual relations of these items of expenditures have remained same and they have registered increases *pari passu* with the overall increase.

4. See H. Rao (1975)
5. See Table No. 9.2 in the Plan (131)
6. See Table No. 1.10 in the Plan (18)

Whereas the share of irrigation and flood control, traditional cottage, and household industries, and rural housing has proportionately increased over the Fifth Plan, as opposed to this, the share of fertilisers and pesticides has gone down from 10.5 percent to 5.6 percent. But keeping in view that the overall allocation for the rural development has increased from 37.5 percent in the Fifth Plan to 43.1 percent in this Plan the amount of allocation for this head actually remains slightly higher.

Cottage and Small Scale Industries

Needless to say, that next to agriculture, this is one of the principal sectors in which large number of employment opportunities can be created But the expansion of the sector is severely constrained by the size of the market, availability of raw-material, technology, and organisational/managerial expertise. It is far easier to provide credit facilities than to ensure their proper utilisation, as the sector suffers from absorption-of-capital problem. The Plan provides for various types of suggestions to improve the working of these industries including the set up of District Industries Centres (DIC). Another major aspect which the Plan provides for is with regard to reservation of some sectors of production for only small and cottage industries, e.g., it is expected that such a reservation will ensure a regular demand flow for these products. But the overall policy of the Plan is to concentrate on the few viable industries than to spread the effort thinly.

In terms of allocation of resources, the Plan provides for Rs. 14,100 million while the similar allocation over the 1974-78 period was only Rs. 3,877 million.[7] This is a clear evidence of the emphasis which is being laid on this sector. The relative share of all the sectors have remained more or less same except for the small-scale industries and for Khadi and Rural Industries. The share of the former has increased from 31.4 percent to 38.7 percent while that of the latter has gone down from 32.6 percent to 27.7 percent. Thus, on the whole, the combined share of Handloom Industries and Khadi and Rural Industries has gone down from 53 percent to 47.6 percent, while combined share of small industries and industrial estates went up from 36 percent to 42 percent. This shift indicates an important aspect that the small scale industries

7. See Table No. 1.15 in the Plan (24)

are being given more preference for future employment in the rural sector. This could be a result of inadequate capital absorption capacity of the handloom, khadi and rural industries. Therefore, the employment implications (in terms of skills demanded) for the small scale industries will be different and should be explicitly taken note of.

Area Planning for Integrated Rural Development

To achieve the various objectives which the plan has set for itself, area planning approach is intended to be utilised. As the title suggests, at least different levels of spatial units are implicit for the integration of various programmes. In the case of programmes which require major investment and have regional implications, area-wise approach is going to be preferred, while, in the case of other programmes more local-level planning may have to be resorted to. In other words, depending, upon the nature of the project, different units of regional planning are going to be used for different programmes. The government has been keen on the Integrated Rural Development for the last two to three years and the Plan seems to have seized the opportunity for pushing it. The major objective of the programme is to maximise use of local physical and human resources with increased inputs of science and technology. The planning for such utilisation is intended to be at the block level. The programme includes agriculture, allied activities (agro-based as well as cottage and small industries) etc, and the target-groups are supposed to be the primary and first-round beneficiaries of the programme.

The programme seeks to coordinate the various programmes that are ongoing at the district/block level. Out of the total 5100 blocks in the economy it seeks to intensify the work in those 2000 blocks which are already covered under SFDA, DPAP and CAD. In addition, it will also take up 300 blocks per year for intensive planning. The main technique of the development is to maximise utilisation of local resources (both physical and manpower) with the help of appropriate science and technology inputs. It is hoped that the projects will help the target group population while satisfying the market viability constraints. One wonders what this constraint of market viability means in this context. It is intended to seek a digression and describe in brief, some aspects of this constraint, as it has many repurcussions for the success of the several rural-based programmes.[8]

8. This argument was earlier made in a joint paper by S. Brahme *et. al.*—an abridged version of which is forthcoming in *Indian Journal of Social Work*, Jan. 1979.

The objectives of the Integrated Rural Development Programme can be restated as (i) maximum employment, (ii) maximum utilisation of local resources, and (iii) economic viability. Keeping in line with the intentions of the planner, the employment opportunities have to be 'local'. The unit of space being either a village or a cluster of a few villages. But the economic viability is to be considered in relation to somewhat larger region unless the goods/services produced also get fully utilised in the local area. In the absence of anything specific, the spatial dimension of economic viability can be interpreted in many ways. It may imply either kinds of products, one which is viable in the local market and the other with the regional market. It may be possible to produce such goods which can suit both local and regional market. If we stick with the local interpretation alone then we have local area planning set-up in which both local employment and resources are being maximised, the product may be viable in the local economy. But it implicitly assumes closed area with regard to the programme-related variables. The labour force and local resources do not get either sapped out or inundated from outside. The insufficiency of such a condition is quite apparent, more so when the programme is being implemented only in selected patches. On the other hand, if we take the wider interpretation of economic viability, it has already been indicated that we run into some problems. In the real market situations any attempt to superimpose economic viability, of larger markets on the objective of maximum employment and the constraint of maximal local resources utilisation is going to face a lot of problems. What it implies is that the relevant local input of resources is going to match in efficiency with input resource at large. Unless the input resource is either homogeneous (in the local area and the region at large) or is superior at the local level, the production is not going to be efficient. If it is either homogeneous or superior, the constraint becomes redundant and ineffective. But if the constraint is to be operative it will mean that local material can be 'processed' to become an acceptable substitute to 'outside' inputs and that such processing does not cause any economic distortions. Exploring that part has some interesting implications. It presumes that there exists such a technology which can transform local resources into comparable better qualitative resources available from outside. If so, in each villages or a cluster of villages there will be different types of technology to undertake such a transformation. Besides, such technology will not lead to economic distortions. In other words, this technology provides us with some degrees of freedom as market linkages will exoge-

nously determine the viability criteria. For our immediate purpose, it boils down that in each case a detailed examination will have to be carried out before economically viable projects can be launched. Secondly, we will have to make some provisions for the direction in which the market linkages are likely to change in future. Thirdly, when economic projects intend to help primarily some target group which have not been 'revealed preferred' by the market, some infra-structural service (like technology in our case) will have to compensate for the selection of these groups so that the condition of the market viability can be satisfied. It is our opinion that future of most of the cottage and small scale industries crucially hinges on this aspect.

Revised Minimum Needs Programme

As has been indicated above, this is one of the major programmes on which the Plan is banking for achieving its objectives of employment, equality and justice for the target groups. The total envisaged allocation for the plan period is Rs. 41,800 million. The programme covers essential social services like water, nutrition, health and education, etc., and basic infrastructure like roads, housing and electrification. The Plan has set itself various physical standards in each of these service sectors.[9] It was during the early 'sixties that for the first time the planners in India had started thinking in terms of minimum needs programme. Haq makes the same point pungently in his book where he says :

> "First, we must get away from the tyranny of the demand concept and replace it with the concept of minimum development, since to weight basic needs by the ability to pay is outrageous in a poor society. It will only distort the patterns of production and consumption in favour of the "haves" as has happened in many societies"[10] (p. 35).

But it was only in the Fifth Plan that the programme was actually included as an objective of the planning. But due to various obstacles the outlay during 1974-78 period could not exceed Rs. 8,000 million. So, the present plan has not only taken the task once again but has also

9. See Chapter 5 of the Plan (106)
10. Haq (1976)

revised the norms of minimum needs programme.[11] Due to comfortable food and foreign exchange situation the present government is in a good position to launch the programme. The major difficulties the government is likely to face in this context relate to the organisational aspects of the service and their delivery systems.[12]

This aspect assumes a much higher importance, keeping in view the amount of money which is going to be spent. Out of the total expenditure of Rs. 41,800 million, about 22 percent is going to be spent on education, while 19 percent is allocated for the rural roads. Rural water supply and health facilities are going to get 20 percent while rural housing is envisaged to have about 12 percent. As is obvious, such a heavy expenditure on social services should bring about qualitative improvements in the lives of the rural poor. But the economic yield from such programmes is going to take some time before resulting in gains for the economy. Even this lagged yield is going to be there only if we succeed in utilising the beneficiaries for future development. Other programmes of the plan will have to ensure this utilisation ; otherwise, it may lead to severe inflationary pressure on the economy. Another point which needs to be taken into account in this context relates to the monitoring and evaluation of the social services. It is far more difficult to assess the performance of the economy in this sector and unless special care is taken in this direction, the programmes may go on meaninglessly and grind to a halt when they run out of money. Besides, it should be noted that withdrawal of these programmes at a later date may potentially be a disconcerting event.

Annual Plan 1978–79

In the earlier section, the overall allocations of the Plan 1778-83 was discussed and compared with the Fifth Plan. Here, it is intended to have a closer examination of the first year of the Rolling Plan and evaluate how well it fits into the overall pattern. The overall size of the annual plan is Rs. 116,490 million, 58 percent of which is earmarked for agriculture, irrigation, power and rural roads. Heavy emphasis on agriculture and agricultural infrastructure (irrigation, power and roads) would seem

11. See the Plan (11)
12. See Prakash forthcoming *Indian Journal of Social Work* January 1979, also see Prakash (mimeo) "Un-rolling of Social Services—An Analysis of 1978-83 Plan".

to be quite consistent with the present state of the economy. Huge amount of food reserves, combined with another crop of 126 million tonnes in offing provides a safe margin for investments in the long-term projects. This margin will help in precluding the inflationary pressures to a large extent. Similarly, accumulation of foreign reserves also ensures much-needed financial liquidity for the economy. Indeed, it is one of the rare moments in the Indian economy when the structural constraints are not operative with their erstwhile known ferocity. But, needless to say, that these by themselves are not sufficient to ensure economic development. The working of the economy in this first year of the Plan is far from satisfactory. Actually when compared with 1977-78 and 1976-77, the performance of the economy is quite disappointing. It is particularly so on the entire industrial front—from productivity, profitability, unemployment to labour unrest. It is important to have a brisk industrial activity if the proposed infra-structural investments in the Plan are not to result in the inflationary pressures. We cannot afford to get complacent about our agricultural production either, as Indian agriculture, notwithstanding the advances in technology, is still largely dependent upon favourable weather conditions. More importantly, because of several reasons the States did not finalise their plans till quite recently. Consequently, the programmes in the areas of unemployment, poverty and inequality have not been able to get the proper attention in the first year of the Plan. One hopes that it will be amended in 1979-80, because in absence of it, the infrastructural investment is going to add to inequalities as its benefits will not be 'asset-neutral' and the employment opportunities generated by these programmes will not necessarily conform to the characteristics of the unemployed labour.

Conclusion

In conclusion the author would like to state that if unemployment, poverty and inequalities are the main concerns of the planner, then there is hardly anything in the plan which ensures their elimination. As it is, the strategy of the Plan 1978-83 is to sustain higher agricultural productivity and to that effect the provision for the necessary infrastructure is proposed. This may lead to appreciable improvements in the growth rates but it will not necessarily eliminate poverty or inequalities. Notwithstanding the agricultural growth, it may not be possible to generate enough employment opportunities as claimed. Organisation, manage-

ment and market linkages are going to be the major impediments in the way of rural-based cottage and small industries, and there is hardly much the planners can do in this context without opening up the complex issues of development ideology and its institutional underpinnings. Provision of social services may succeed in ameliorating the immediate poverty conditions and may also provide a spurt to the economy but their maintenance is going tobe a drain on the economy while their withdrawal may intensify social tension. □

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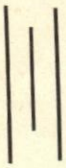
PURSUI OF EXCELLENCE

IS A WAY OF LIFE WITH US



BE IT
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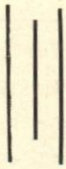
SPEEDY SERVICE WITH A
SMILE IS OUR MOTTO



THE NEW BANK OF INDIA LIMITED

(*Regd. Office* : **1–Tolstoy Marg, New Delhi–110 001**)

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Rural Development and Financial Institutions

K.S.V. Menon*

I

Why Rural Development ?

Much has been said and written about rural development. The renewed emphasis on this concept is quite understandable. Despite more than three decades of economic planning, the standard of living of millions of this country has changed only marginally, if at all. About 80 percent of the population is in India's 515 thousand odd villages. Approximately 50 percent of them are estimated to be below the poverty line. According to the 1970-71 All-India Agricultural Census, there were in all 70.5 million operational holdings, 70 percent of which were below 2 hectares.

The latest National Sample Survey revealed that per capita consumer expenditure in rural India was Rs. 53 per month in 1973-74, of which 75 percent was spent on food as against 68 percent in 1960-61. Twenty percent of rural hoseholds had assets of less than Rs. 1000 each. The Report of Labour Enquiry 1974-75 (which has just been released), disclosed that the number of full days worked by men of agricultural labour households for wage employment in different agricultural operations declined from 208 in 1964-65 to 185 in 1974-75, that by women from 138 to 129 and that by children from 167 to 145. Real wages drifted downwards by 12 percent in agricultural operations and 17 5 percent in non-agricultural operations during the same period. The percentage of agricultural labour household in debt is as high as 66 with an average debt of Rs. 584 as against Rs. 244 in 1964-65.

Electric power has not reached 64 percent of villages. On a rough estimate, out of a total of 82.1 million rural households, about 20 million of them are yet without a roof over their heads. The basic

*The views expressed in the article reflect those of the author and need not necessarily represent those of the institution where he is currently employed. The author is grateful to Shri J. L. Mehta for his suggestions on an earlier draft of the paper.

minimum requirement of clean drinking water is still a dream of no less than 152 thousand villages. The other infrastructural facilities like roads, communications, etc., are anybody's guess. For instance, as on March 31, 1977, only about 15,000 villages were within the beat of the mobile post offices, which (mobile post offices) have now reached about 68,000 villages. The number of letter boxes at 365,000 is still below the total number of villages. These are hard facts glaring at this subcontinent and its every thinking citizen.

It is also quite poignant to remember that such a state of affairs exists despite the fact that rural India sustains a wide range of industries whose combined weight is 33.68 percent in the Index of Industrial Production; it contributes about 70 percent in our foreign exchange earnings (excluding invisible export earnings), and 49.6 percent in Gross Value Added, which does not cover the contribution of the tertiary sector estimated at 39.03, a part of which can reasonably be attributed to the rural areas. The weightage given to rural-based products in the Index of Wholesale Prices (total=1000) may be estimated at 718 excluding "chemicals and chemical products", some of which find their raw material base in agriculture.

Conceptual Frame

Rural development has certain specific meaning. Winnick introduced the concept of 'place prosperity' and people prosperity'. The latter means, aid to people (the unemployed, the poor, the underprivileged, the minorities), and the former, aid to places (rural under-developed areas, old industrial regions, inner-city ghettos). In a sense, the 'place prosperity' approach implies that concern for inter-regional or other dimensions of spatial equity may contribute towards solving the problems arising from the inequitable distribution of personal income and welfare. If 'place prosperity' is a reasonable surrogate for 'people prosperity', it follows that maximising specified policy variables within a geographically defined area becomes almost equivalent to maximising the welfare of the 'target' population within that area.[1]

The spatial distribution of economic activity reflects the net impact of opposing sets of forces those of concentration (agglomeration) and those

1. Harry W. Richardson, Regional and Urban Economics, Penguin (1978), p. 221.

of dispersion. Growth rates vary among locations and over time because the relative strength of agglomeration and dispersion forces alters over space and inter-temporally. Apart from the obvious influence of spatial frictions, the most critical concepts are agglomeration economies, locational constants and locational preferences. Agglomeration economies are a multi-dimensional concept much broader than economies of scale, and are the major force promoting spatial concentration. In some circumstances of place and time, diseconomies may slow down or even reverse the rate of agglomeration (i.e., diseconomies a potential deglomerating factor). Friction costs favour dispersion while immobile locational constants impose constraints upon agglomeration. Locational preferences influence spatial distribution. In the general case, the locational preference of households perpetuate patterns of dispersion while locational preferences of firms tend to reinforce agglomeration in major metropolises.

The most challenging question facing regional development planners is to discover and adopt an approach that places regional allocation on an equal footing with sectoral allocation. The political analogue is the choice between a decentralised and a centralised planning process. Clearly, the problem is not merely one of resolving conflicts among economic goals (efficiency, equity etc.) but also of how important it may be to accommodate regional participation, autonomy and 'self reliance', in the planning process. The extreme choice is between the 'top-down' approach of the central planners and the 'bottom' approach favoured by regional planners. India, it seems, is in the process of experimenting with a compromise between these two approachss. It is in this board frame of analysis that the question of rural development has to be analysed and its implications understood for a proper appreciation of the tasks involved in the process.

When we say 'rural development', do we mean the development of 'rural poor' or both? This conceptual clarity has certain strategic and policy implications. The available instruments of policy, official announcement and other documents do not seem to provide any guidance on this issue. The result will be, within the broad contours of existing system of class and property relations, the benefit of rural development, as has been the case hitherto, may not reach the rural poor and other weaker sections of the society. To put it bluntly, rural areas may tend to get transformed, but rural poverty is unlikely to be

reduced substantially. The possibility of a further tightening of the grip of the urban bourgeoise and the rural rich, over the allocative resources with all its attendant evils on the socio-political framework cannot be ruled out—a situation which should be guarded against.[2]

Therefore, in the Indian context, rural development should be conceived as a strategy designed to improve the economic and social life of the specific group of people—the rural poor. It calls for extending the benefits of development to the poorest amongst those who seek a livelihood in rural areas such as small and marginal farmers, tenants, landless labour, etc. It should also be thought of as a process of modernisation and monetisation of rural society and its transition from traditional isolation to integration with the national economy.

Viewed thus, the objectives of rural development encompass improved productivity, increased employment and higher incomes for weaker sections (rural poor), as well as minimum acceptable levels of food, shelter, education and health. A national programme of rural development should, therefore, include a mix of activities, including schemes to raise agricultural output, create new employment opportunities, improve health and education, expand communication and improve housing. Such a programme may include single-sector and multi-sectoral projects, with components implemented concurrently or in sequence. The components and phasing must be formulated both to remove constraints and to support those forces prevailing in the target areas which are favourable to development.

Since rural development has significant equity implications, land reform is a necessary concomitant of successful rural development, depending on the prevailing pattern of land control. Where the ownership of land directly affects the nature of local institutions and the participation in them by the majority of rural people, land reform is particularly essential. However, in terms of implementation, in some situations establishing local institutions and small holder services may be a pre-requisite of land reform rather than *vice versa*. Where the existing service systems and administrative structure is geared to working with large-scale farmers, land reform without concurrent rural

2. An analytical frame and empirical evidence have been sought to be presented by Ashok Mitra, in *Terms of Trade and Class Relations*, Frank Cass & Company Ltd., London (1977).

development activity might cause hardship and economic losses which would outstrip the equity gains associated with land re-distribution. Tenancy reform, on the other hand, in so far as it stabilises the existing relationship between landowners and renters, may be a useful precursor of rural development programmes.[3]

II

In this milieu, what is expected of financial institutions? No doubt, they have been assigned an increasingly important role in the process of change in rural India. Briefly, they include Primary Agricultural Credit Societies, Commercial Banks, Regional Rural Banks (RRBs) and Development Finance Institutions (DFIs). The accent of Government policy in regard to banks has been on ensuring their penetration into rural areas. The nationalisation of the Imperial Bank of India in 1955 and 14 commercial banks in 1969 were designed to change rural landscape to the extent possible. The Lead Bank Scheme was initiated in 1970 with an objective of formulating credit plans based on district-wise techno-economic surveys. The setting up of the Regional Rural Banks since 1975 was yet another direct effort conceived to accelerate the process of economic growth in villages.

A network of development finance institutions has been set up, both at the national and state levels. Though they are primarily intended to quicken the pace of industrial development by providing necessary support, their policies and programmes are being increasingly directed towards reducing regional imbalances and developing backward areas. A specific scheme of concessional finance to industrial units in backward areas has been in operation since July 1970. Their promotional activities are being more and more addressed to help development process of medium, small and tiny sectors with a focus on employment generation, utilisation of local resources to the extent possible, meeting local demand, application of indigenous technology etc.[4]

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3. *Land Reforms* Sector Policy Paper, World Bank (1975). p. 23.

4. These aspects have been studied in detail by the author in his publication, *Development of Backward Areas through Incentives : An Indian Experiment* Vidya Vahini, New Delhi, and, as such are beyond the purview of this paper.

Looking Back

Let us briefly examine what has been the impact of these efforts on the rural economy in general and the 'target group' in particular. It will be seen from Table 1 that at the time of nationalisation of 14 commercial banks in 1969, the share of rural areas in the total branches was 22 percent which has now reached 42 percent. The deposit mobilisation has gone up from 3 percent to about 10 percent, while the advances outstanding have made a smart jump from about 5 percent to 24 percent.

Table 1 : Changing Banking Scene in Rural India

Major Indicator	*Unit*	*Rural*	*Total*	*Percentage Share*
1. Bank Branches				
June 1969	Nos.	1832	8262	22.17
June 1978	"	11802	28016	42.13
2. Deposits				
June 1969	Rs. Crores	145	4645	3.12
Dec. 1977	"	2049	21214	9.66
3. Advances				
June 1969	"	54	1140	4.74
Dec. 1977	"	3609	15316	23.56

Source : 1. Derived from Basic Statistical Returns, Reserve Bank of India.
2. Report on Trend and Progress of Banking in India, 1977-78.

There has been a considerable improvement in credit-deposit ratio (Table 2). A consistent rise has been depicted in the case of rural CDR. The average growth recorded was about over 40 percent, whereas, there was virtually negligible growth in the overall CDR (less percent). The fact, however, remains that CDR is unfavourable to rural areas and resources mobilised there still find their major application in urban and metropolitan areas because of understandable reasons.

Table 2 : Trends in Credit-Deposit Ratios of Major Population Centres

(Percentages)

Period ended December	*Rural*	*Semi-Urban*	*Urban*	*Metro-politan*	*Total*	*Index No.*	
						Rural	*Total*
1969	37.6	43.0	59.1	98.2	71.9	100.0	100.0
1970	48.3	53.3	68.3	101.4	78.9	128.5	108.6
1971	42.1	42.7	56.4	92.8	69.7	112.0	96.9
1972	47.7	41.9	57.2	87.5	67.2	126.9	93.5
1973	51.4	44.0	60.3	92.8	70.4	136.7	97.9
1974	52.3	46.5	65.6	89.7	71.0	139.1	98.7
1975	52.1	46.9	64.3	96.4	73.5	138.6	102.2
1976	55.9	47.7	64.1	103.4	77.0	148.7	107.1
1977	55.6	47.2	62.7	93.8	72.7	147.9	101.1

Source : Calculted from Basic Statistical Returns.

Table 3 shows the State-wise rural and urban Credit-Deposit Ratios. Inter-State variations are quite evident. Relatively less developed States like Himachal Pradesh, Jammu and Kashmir, Bihar, Assam, etc., lagged behind the all-India average. Rural CDR is quite favourable in the State of Maharashtra, Andhra Pardesh and Tamil Nadu, the latter to absorbing more than what they could mobilise from rural areas. One may, however, keep in mind that the ratio has been calculated at a point of time and for a meaningful analysis and a clear understanding of the resource mobilisation and deployment in rural areas, the average for the year as a whole should be worked out. Seasonal factors are quite important to be reckoned with when one examines the data at a point of time. Nevertheless, the fact remains that Rural CDR is distinctly unfavourable and there is some drain on the village economy.[5]

Sectoral Deployment of Credit

An analysis of sectoral deployment of credit also shows that the share of priority sector was 14 percent on June 30, 1969, which was 27.0 percent on June 30, 1978 (Table 4).

5. For a critical and lucid exposition of the Banking scene since 1969, see Dr. S.L. Shetty, Performance of Commercial Banks, *National Institute of Bank Management*, 1978 (Mimeo).

Table 3 : State-wise Credit-Deposit Ratio : Rural & Urban

(As on last Friday of December 1977)

State	*Rural*	*Semi-Urban*	*Urban/ Metropolitan*	*Total*
Northern Region	40.7	50.0	111.0	92.8
Haryana	62.2	59.4	66.1	61.5
Himachal Pradesh	21.2	28.8	—	24.4
Jammu & Kashmir	30.6	50.6	34.5	35.5
Punjab	30.3	42.9	48.9	42.3
Rajasthan	74.5	63.6	57.9	62.0
North-Eastern Region	29.8	32.9	63.7	44.4
Assam	29.8	32.9	63.7	40.4
Tripura	4.5	31.9	—	25.8
Arunachal Pradesh	63.9	30.3	—	36.1
Eastern Region	48.0	28.8	73.5	61.2
Bihar	68.6	30.3	43.0	39.5
Orissa	57.5	56.7	58.0	57.5
West Bengal	29.2	21.4	79.3	69.1
Central Region	51.4	45.9	45.9	46.7
Madhya Pradesh	66.5	51.6	54.1	54.8
Uttar Pradesh	47.6	43.8	43.1	44.0
Western Region	44.8	43.7	77.1	69.5
Gujarat	33.5	35.9	71.2	54.1
Maharashtra	85.5	63.9	88.5	81.3
Southern Region	85.5	63.9	88.5	81.3
Andhra Pradesh	113.1	69.9	65.5	72.5
Karnataka	84.1	76.9	85.4	83.4
Kerala	50.5	45.9	86.0	61.3
Tamil Nadu	101.0	68.9	105.8	96.7
All India	55.6	47.2	82.6	72.2

Source : Report on Trend and Progress of Banking in India, 1977-78.

Table 4: Sectoral Distribution of Credit

(Amount in Rs. Crores)

Sector	*June 1969*	*June 1970*	*June 1971*	*March 1977*	*March 1978*	*June 1978*
Gross Bank Credit	3599	4213	4805	13329	14918	15,725
1. Priority Sectors	505 (14.0)	870 (20.7)	1026 (21.4)	3378 (25.3)	4084 (27.4)	4,256 (27.0)
a. Agriculture	188	243	382	1343	1591	1694
b. Small-Scale Industries	286	414	500	1403	1667	1740
c. Others	31	114	144	632	826	822
2. Exports	258	320	382	1171	1172	1204
3. Food Procurement	233	207	379	2190	1985	2525
4. Others	2603	2816	3018	7761	8849	7740

Source : Same as in Table 1.

Taking agriculture alone, from a little over 5 percent it has more than doubled to 10.6 percent during the same period. This analysis does not, however, reveal the full story, more so the gigantic task ahead of the institutions in the rural front. A state-wise analysis of the flow of institutional credit (primary agricultural credit societies, and commercial banks) is depicted in Table 5.

Major conclusions which can be drawn from the Table are :

(i) The all-India per hectare credit was Rs. 127.7;

(ii) The per capita cradit came to Rs. 48.3;

(iii) There were distinct inter-state variations in credit absorption;

(iv) The developed states accounted for 65 percent of the institutional credit, of which the share of Tamil Nadu and Maharashtra alone was 41 percent;

Table 5 : State-wise Deployment of Institutional Credit : 1975-76

State	Gross Cropped Area (in '000 hectares)	Rural Population (1971 Census in Million)	P.A.C. Loans (in Rs. lakhs)	Commercial Bank Loans (Rs. in lakhs)	Total	Per Hectare Credit	Per Capita (Rural Credit)
1. Andhra Pradesh	12652	35.1	7351	12176	19527	154.3	55.6
2. Assam	2834	13.6	N.A.	4973	4973	175.5	36.6
3. Bihar	10693	50.7	2200	2691	4891	45.8	9.6
4. Gujarat	9933	19.2	13262	6362	19624	197.6	102.2
5. Haryana	5048	8.3	4352	2903	7255	143.7	87.4
6. Himachal Pradesh	901	3.2	581	183	764	84.8	23.9
7. Jammu & Kashmir	861	3.8	N.A.	112	861	13.0	22.7
8. Karnataka	10988	22.2	8005	10754	18759	170.7	84.5
9. Kerala	2958	17.9	4688	4811	9499	321.1	53.1
10. Madhya Pradesh	20892	34.9	6955	3903	10858	52.0	31.1
11. Maharashtra	17481	34.7	17001	14696	31696	183.3	91.3
12. Orissa	7042	20.1	2066	941	3007	42.7	15.0
13. Punjab	5724	10.3	7498	5142	12640	220.8	122.7
14. Rajasthan	16773	21.2	5965	2813	8778	52.3	41.4
15. Tamil Nadu	7642	28.7	10285	12895	23180	304.0	80.8
16. Uttar Pradesh	23025	76.0	9509	11660	21169	91.9	27.9
17. West Bengal	7271	33.3	2124	8698	10822	148.8	32.5
All India	164002	433.2	102345	106013	209358	127.7	48.3
Share of Developed States	67045 (40.9%)	174.5 (40.3%)	67215 (65.7%)	66261 (62.5%)	133476 (63.8%)	199.1 (64.1%)	76.5 (63.1%)

Source : Report of the Review Committe on Regional Rural Banks.

(v) credit absorption capicity of relatively less developed states like Bihar (Rs. 45.8), Jammu & Kashmir (Rs. 13.0), Madhya Pradesh (Rs. 52) Orissa, (Rs. 42), and Rajasthan (Rs. 52.37) is quite discernible, the per hectare institutional credit being less than one-third of the all-India average of Rs. 127.7.

An analysis of distribution of short-term and medium-term finance by commercial banks to agriculture by size of holdings is more revealing. As could be expected, the share of medium and large farmers to term loans issued by commercial banks was large. About 62 percent of the loans sanctioned went to those having more than 10 hectares. In fact, in the States like Rajasthan (82 percent), Punjab (84 percent), Gujarat (70 percent), Maharashtra (65 percent), Madhya Pradesh (65.4 percent) etc., the share of large farmers is quite substantial (Table 6).

Table 6: Share of Small and Marginal Farmers in Short and Medium Loans Outstanding—Commercial Banks (as on 30th September 1976)

(*Percentages*)

State	*Short-term*		*Medium/Long-term*	
	Upto 2.5 acres	*Above 10 acres*	*Upto 2.5 acres*	*Above 10 acres*
1. Andhra Pradesh	28.1	26.0	25.0	41.0
2. Tamil Nadu	47.1	11.6	26.1	37.5
3. Karnateka	20.5	25.5	8.7	70.6
4. Kerala	75.6	4.7	31.1	37.5
5. Gujarat	3.1	92.7	3.7	70.6
6. Maharashtra	7.1	54.9	8.4	65.0
7. Madhya Pradesh	6.5	51.9	3.1	65.4
8. Uttar Pradesh	21.6	40.8	6.5	62.5
9. Bihar	32.0	11.3	17.3	39.1
10. Orissa	30.9	11.1	18.3	16.2
11. West Bengal	48.8	4.4	36.8	20.8
12. Punjab	5.5	49.0	3.3	84.6
13. Rajasthan	9.1	52.9	1.9	82.0
All India	32.4	26.1	11.8	61.8

Source : Regional Rural Banks : Report of the Review Committee.

In case of loans from Primary Agricultural Credit Societies also, it is the big farmers who absorbed the chunk of the funds. It will be seen from Table 7 that weaker sections consisting of (a) tenant cultivators, agricultural labourers and who have no land, and (b) those having a holding of one hectare, obtained hardly 16 percent of the loans disbursed, while those owning more than 2 hectares of land accounted for 66 percent of the loans disbursed. This partly substantiates the point made earlier that the strategy of the rural development should be specifically designed to reach the target group.

Table 7 : Loans and Advances of PACs (1975-76)

Category of Holding	*Amount (Rs. Crores)*	*Percentage*
Upto 1 hectare	122.27	11.9
1—2 hectares	181.27	17.7
Above 2 hectares	678.72	66.5
Tenant Cultivators, Agricultural labourers and others	40.29	3.9
Total	1023.45	100.0

Source : Statistical Statement relating to Co-operative Movement in India.

The all-India Debt & Investment Survey, 1971-72, published recently by the Reserve Bank, shows that the percentage share of the institutional credit in the total credit of all Rural Households was 29.2 percent (Table 8). The limited impact is clear from the fact that rural artisans (4.8 percent), agricultural labourers (4.5 percent), small cultivators (6.20 percent), etc., depended less on institutional finance consisting of (a) government (b) cooperative, and (c) commercial banks.

Table 8 : Percentage Share of Institutional Credit Agencies in the Total Debt of Each Category of Household

(As on June 30, 1971)

1.	All Rural Households	29.2
2.	Cultivators	31.7
	Asset Group :	
	Rs. 0—500	6.2
	Rs. 500—1000	6.3
	Rs. 1000—2500	10.4
	Rs. 2500—5000	14.5
3.	Agriculture Labourers	4.5
4.	Rural Artisans	4.8
5.	Other non-cultivator rural households	16.8

Source : All India Debt & Investment Survey, 1971-72.

That commercial banks have touched only the surface of the problem is further clear form Table 9, which indicates the institution-wise position. Thus, money-lenders and others still dominate the scene. 95 per cent of rural artisans' requirement was met by 'others', is a telling commentary of the limited impact of institutional finance to reach the target group.

Table 9 : Cash Debt to Different Agencies (As on June 30, 1971)

(In Percentages)

Category	*Government*	*Co – operative*	*Commercial Banks*	*All Others*
1. Cultivators	7.1	22.0	2.4	68.5
2. Small Cultivators				
Asset Group				
Rs. 0— 500	2.9	2.5	0.3	94.3
Rs. 500—1000	1.4	4.2	0.6	93.8
Rs. 1000—2500	5.1	5.0	0.3	89.6
Rs. 2500—5000	5.6	8.6	0.2	85.6
3. Agricultural Labourers	1.3	3.0	—	95.7
4. Rural Artisans	2.7	1.7	0.3	95.3
5. Other noncultivators	5.1	9.2	1.4	84.3
6. Total noncultivators	3.4	6.0	0.8	89.8

Source : Ibid.

Farmers' Service Societies (FSS)

On the recommendation of the National Commission on Agriculture, a scheme of organisation of Farmers' Service Societies has been in operation since 1973-74. The basic objectives underlying the organisation of FSS are :

(i) A Farmers' Service Society is expected to provide besides credit, full package of servicies and guidance needed by farmers, particularly the small farmers for increasing production, for diversification of farm activities, etc., in an integrated manner and at one contact point.

(ii) While farmers belonging to all categories in the area would be served by FSS, the control over the society would vest in a board on which two of the elected members would represent weaker sections with a view to creating atmosphere favourable for flow of credit as well as provide services and technical guidance to the weaker sections.

(iii) To enable FSS to maintain expert as also trained managerial staff for undertaking the diverse activities expected of it and at the same time functioning as a viable unit, it should have effective cover of a large area of operations extending, say, a block or population of 10,000.

By the end of December 1976, there were about 311 FSS, of which 181 were sponsored by commercial banks and 130 by cooperatives. Their state-wise distribution is most uneven (Table 10). As many as 116 out of 311 were in Karnataka, out of which 87 were in sponsored by commecial banks. Gujarat had 33 and all but one were sponsored by cooperative banks.

FSS constitutes an important component of the system of rural credit as visualised by NCA and the Working Group on Rural Banks. However, for a variety of reasons, the progress achieved by its establishment is far from satisfactory. More importantly, most of them appear to be a highly diluted version of the grand design of NCA and are hardly distinguishable from the reformed PACs.

Table 10: State-wise Distribution of Farmers' Service Societies

(As on June 30, 1977)

State	*Sponsored by Commercial Banks*	*Sponsored by Co-operative Banks*	*Total*
1. Andhra Pradesh	15	6	21
2. Bihar	4	—	4
3. Gujarat	1	32	33
4. Haryana	5	1	6
5. Jammu & Kashmir	1	—	1
6. Karnataka	87	29	116
7. Kerala	—	10	10
8. Maharashtra	15	4	19
9. Manipur	1	1	2
10. Madhya Pradesh	16	9	25
11. Rajasthan	5	—	5
12. Tamil Nadu	—	11	11
13. Tripura	1	—	1
14. Uttar Pardesh	12	16	28
15. West Bengal	18	8	26
16. Orissa	—	1	1
17. Goa, Diu and Daman	—	2	2
Total (all-India)	181	130	311

Source: Report of the Review Committee.

Regional Rural Banks

Starting with 5 banks in October 1975, 48 Regional Rural Banks were set up by end of June 1978. They had opened 767 branches at the end of June 1977, by December 1977, the number had reached 1172,

and by June-end 1978, 1405 branches had been opened (Table 11).

Table 11 : State-wise Offices of Regional Rural Banks (As on June 30, 1978)

States	*No. of RRBs*	*No. of Branches*
1. Andhra Pradesh	3	184
2. Assam	1	25
3. Bihar	7	152
4. Haryana	2	46
5. Himachal Pradesh	1	13
6. Jammu & Kashmir	1	39
7. Karnataka	3	89
8. Kerala	2	87
9. Madhya Pradesh	4	99
10. Maharashtra	1	27
11. Orissa	4	129
12. Rajashthan	3	114
13. Tamil Nadu	1	42
14. Tripura	1	22
15. Uttar Pradesh	10	249
16. West Bengal	4	88
Total	48	1405

Source: Reserve Bank of India Bulletin, June 1978.

Deployment of local resources for development of agriculture in the jurisdiction of each RRB is one of the key features in the scheme of rural banks. The performance of RRBs in this respect can be judged with respect to their credit-deposit ratios (Table 12). The average CDR at 125 percent was highly favourable compared to that of the rural branches of commercial banks. In respect of 24 RRBs out of 47, (one RRB was started only a year back), this ratio was above 100, indicating that they have deployed in their area more resources than those collected by way of deposits in those areas.

Table 12 : CDR of Regional Rural Banks

Credit-Deposit Ratio (Range) percent	*No. of Regional Rural Banks*
1. Below 50	12
2. 50 to 100	11
3. 100 to 150	11
4. 150 to 200	5
5. 200 to 250	5
6. Above 250	3
Total	47

Source: Regional Rural Banks, Report of the Review Committee.

The Working Group had stated that "one of the more important objectives of the rural banks would be to attempt effective coverage of small and marginal farmers, landless labourers, rural artisans, etc. The performance of these banks will be judged by their success in coverage of such categories of borrowers". The Dantwala Committee minced no words in stating that "Judged by this criterion the performance of the surveyed RRBs does not appear satisfactory".[6]

One reason was, the Committee added, that these banks had hardly completed one and a half years of their working by June 1977. Besides, as a result of the deliberate choice of locations, the proportion of the weaker sections was quite large. Even so, it should be admitted that there are obvious limitations to larger direct lending to the weaker sections by RRBs. Wherever PACs/FSS have been ceded to RRBs, the magnitude of lending is larger. While RRBs have to intensify their efforts to extend the coverage of the weaker sections to retain their image of the small man's bank, the linking of co-operative societies with RRB becomes important. They will have to be actively assisted by the development agencies of the State Government. Voluntary agencies can also play a useful role in this direction.[7]

6. Quoted in Regional Rural Banks: Report of the Review Committee, *Reserve Bank of India* (1978). p. 48.

7. *Ibid*. p.49.

III

Looking Ahead

We have thus surveyed the existing institutional structure in rural India with a focus on finance. Though finance is the most important input, by itself, nothing much can be done to transform the economic scene. The function of finance and financial institutions providing it is to generate conditions whereby the target group is ensured, a reasonable flow of income through gainful employment, which, in turn, will contribute to the overall development of rural areas through the multiplier effect on economic activity in general. There is no denying the fact that the environment in the country today is conducive for concerted action in improving rural standards. In this movement, a number of small but successful experiments and changes can do a lot to increase people's enthusiasm and confidence. If the initiatives by financial institutions can help in achieving this even to a small extent, their efforts would have fructified.[8]

Bankable Schemes

The District Credit Plan, within the broad framework of the 'Lead Bank Scheme' and district economic planning, if properly conceived and implemented through the network of RRBs, can be regarded as an important instrument in rural development. A District Credit Plan is a development plan consisting of technically feasible and financially viable schemes which can be taken up for financing by financial institutions within the existing or marginally strengthened framework of infrastructure and other facilities. Technical feasibility in this context would mean that inputs, facilities and services required for implementing the schemes are available and markets exist for the resulting incremental outputs. Financial viability would mean that the incremental money incomes generated are accrued to the borrowers who implement the schemes and are large enough to pay back the loans with interest in the normal periods of banking operations.[9]

The plan is expected to be a strategy of development suitable to the

8. Perspectives in Rural Development, *ICICI* (1977) p. 34.
9. L. D' Mello, *State Bank of India Bulletin*, February 1976.

district, taking into account its natural endowments, the principal economic activities and their potential for development, current and proposed development projects prepared by the district development authorities and other developmental agencies and the felt-needs of the people. It would be comprehensive and integrated in the sense that the various schemes included in the plan would cover all the major sectors of the economy, depending upon their natural linkages.

Though growth centre strategy of economic development is not fully relevant to the implementation of credit plans because financial institutions can finance only production and investment programmes whose implementation can be organised, controlled and measured, nevertheless, action programmes included in credit plans do propose convenient location of infrastructure and service facilities, input supply points and produce sale outlets. In fact, organised implementation of development projects and control of the same through branches is facilitated if it is arranged through a select number of growth centres.

Besides, it is neither possible nor necessary to locate service and market facilities in all the villages in any district, considering particularly, the fact that most villages in India are too small to sustain them. To facilitate implementation of a credit plan in rural areas with population widely dispersed in small villages, it is necessary to select some appropriately situated central villages.

In such central villages, basic services such as market, distribution agencies for inputs, implements and essential consumption articles, extension services, agro-services centres, processing facilities, credit, etc., can be located, so as to be within easy reach of the dependent villages. The choice of central villages may be based on population, the functions and services presently performed by them for the hinterland, the location of and the link with the dependent villages, easy accessibility to the urban base and the extent to which the economy of the surrounding dependent villages can be integrated with.

But credit planning without a proper district economic planning will tend to be a futile excercise in financial calculations. At the same time, the District Planning cannot be conceived under the umbrella of credit planning. This is a vicious circle. How to break this vicious circle? In the author's view, both credit planning and district planning can be viewed

as an integral part of economic growth; though both are separate yet they are inter-related exercises. What is called for is the realisation of the basic objective of 'area approach' and the need for adequate understanding and cooperative attitude to work closely by different agencies concerned with both these aspects.

A credit plan is expected to contain various bankable schemes and regional rural banks can take up the implementation of these schemes in so far as the benefit under these can be extended to their target group of population, viz., small and marginal farmers or rural artisans. In fact, the credit plan may give some idea to the rural bank about the credit potential that is available in the district in terms of bankable schemes, carefully worked out by the lead bank so that its loaning operations can commence forthwith.

Since the primary function of rural banks is to dispense credit to the poorer sections of the population, it would be ideal if these banks could associate themselves with developmental agencies operating in their districts. It may also be possible for rural banks to promote and adopt co-operative societies for rural artisans, small entrepreneurs and persons of small means engaged in trade and other activities in the area of their operations. This will link up the banking system with the promotional and developmental agencies sponsored by the government.

The role of district plan thus in the development of the district acquires an added thrust with the introduction of rural banks. The district credit plans are the kingpin of the lead bank scheme. The preparation of credit plans should now enable the banks to make a systematic beginning in extending credit on the basis of their resources and felt-needs of the people. Rural banks provide the organisational structure required for effective implementation of the credit plans and, therfore, the lead bank scheme.

It is too early to evaluate the impact of the Village Adoption Scheme for extending financial assistance for an integrated development of the rural economy. At the end of June 1977, banks had adopted 49,700 villages and financed 1.3 million farmers to the extent of Rs. 249.79 crores. In the budget for 1977-78, the Central Government had introduced tax incentives to encourage companies to undertake rural development projects by allowing deduction in computing taxable profits

in respect of any expenditure incurred by them on such programmes. In reply to a question in Parliament on July 18, 1978, the Finance Minister disclosed that only sixty-four companies have adopted villages under the scheme.[10] One-third of these companies beloged to the House of Tatas. The other companies which figure in the list belonged mainly to Mafatlal and Modis. Commercial banks, who are in direct touch with companies in the private corporate sector, can accelerate the process of 'village adoption' programme by business houses, keeping, of course, in mind the limitations of the whole approach.

As a seasoned regional development banker says [11], DFIs can help improve non-farm income by not merely the attention they pay to backward areas, but also by arranging with their borrowers that small components and sub-assemblies required in the industrial process, as well as processing of agricultural inputs into industry, are progressively done in rural areas. This would, of course, mean that the industrial enterprises concerned would have to be prepared to take the trouble to structure such activities under proper technical supervision in rural areas. It would not be excessive for the DFIs, whose assistance to their borrowers is crucial to their success and growth, to ask that their beneficiaries take this trouble wherever possible and even with some risks. DFIs may also find ways and means to give incentives for such action.

Some of the state governments have also initiated a programme of setting up of rural growth centres. Necessary facilities including guidance to entrepreneurs in regard to identification of suitable projects, process technology, market intelligence, etc., can be provided by the financial institutions. A scheme of this nature on an extensive scale may, however, pose problems of management and marketing. Financial institutions, particularly commercial banks, should strengthen their development wings to study these aspects in detail and render such assistance as is necessary to make the growth centre concept a worthwhile experiment in rural reconstruction and development.

The institutional innovation which has been sought to be introduced through the District Industries Centres has bestowed an important

10. *Economic Trends.* (FICCI), August 18, 1978.

11. C. S. Krishna Moorthi, Development Banks: A Growing Role; IFCI, 1977, p.39-40.

responsibility on financial institutions and other agencies working at different levels. DICs, as conceived in the Industrial Policy Statement of December 1977, are expected to provide, under one roof, all the services and support required by small and village entrepreneurs in setting up small and tiny projects in rural and other areas. These services include economic investigation of the districts' raw material and other resources, supply of machinery and equipment, provision of raw materials, arrangements for credit facilities, effective set up for marketing and a cell for quality control, research and extension. DIC will have a separate wing for looking after the special needs of cottage and household industries as distinct from small industries. Financial institutions, with their vast experience in financing and store house of industrial intelligence, can play a crucial role in releasing the objective of DIC, which is expected to work in close co-ordinate and co-operation with various developmental and promotional agencies.

Development Finance Institutions have set up a number of Technical Consultancy Organisations at the State level with a view to preparing feasibility reports, market surveys, etc. It is now envisaged that they will work in close collaboration with District Industries Centres. The experience gained, expertise built up and information available with these agencies will be a useful input in their endeavour to stimulate industrial development in rural areas with a focus on tiny sectors suitable in a particular area.

DFIs can also sponsor sectoral studies towards (a) identification and focusing on target zones and population, (b) assessing technological constraints and potential for small/tiny sectors in different areas, (c) examining infrastructural requirements (d) evaluating the capacity of existing service systems and their potential, reviewing administrative arrangements and capability for rural sector, and (e) studying national policies relating to rural development. They should also help govenment to frame suitable guidelines for identification, design and implementation of appropriate rural development projects which should be possible through such in-depth studies. DFIs at all-India level have a specific responsibility in this respect.

This naturally warrants the need for building up suitable expertise in regional economic analysis. When rural development programmes and projects incorporating a variety of objectives and activities are con-

templated, including not only private agricultural and industrial activity, but also governmental infrastructure and social services, the locational aspects of the units of non-farm activities acquire careful consideration. Whereas agricultural activity is soil-bound, many alternative locations may be feasible for non-farm activities. Economies of scale and external economies due to the interdependence of different activities can be very significant. Problems obviously arise in determining the optimal areas and populations to be served by a local market centre, an electricity transmission station, a water supply system, a school, an extension office, a research station, a feeder road, a medical clinic, a bank or a credit cooperative. Thus, the formulation and implementation of appropriate scheme and programmes for rural development should be conceived within the broad framework of balanced growth of rural and urban areas. The role of DFIs in this task is challenging indeed.

It is not adequately recognised that one of the major challenges in the next decade is going to be in the field of marketing. The villager and the villages are being increasingly drawn into ever-widening circles or circuits of input supplies and product sales. The sale-purchase, operations of a large majority of villagers would be, of course, confined to the minimum both in area as well as monetarily, but the example of rice- growers in Punjab and wheat-growers in some other states who are farming for marketing is a telling indicator of the possibilities of external linkages Properly handled, the expansion in the output of allied activities and rural industries as well as crop farming should lead to a widening of the production-consumption cycle at the local level in some commodities; it should provide non-rural trading and marketing channels with the rural producers getting a fair return for the commodities.

Marketing is not merely an "economic activity", it is essentially a physical process and requires not only the development of roads and other means of transport and communications but a series of complementary facilities like warehousing, refrigeration, packaging and processing. A number of state-sector corporations have begun to enter rural areas with a package of services for warehousing, cold storage, agro-processing and merchandising etc. It is time that DFIs thought of financing such schemes/activities which may, in most cases, call for suitable amendments to their statutes.

These are some of the areas where financial institutions can address themselves in the years ahead to accelerate the process of rural development. But it has to be admitted that their role can only be limited. Ultimately, it is only an integrated approach embracing many aspects of development which will bring in lasting solution to the problem of eradication of rural poverty which is or ought to be, the avowed objective of rural development. However, there are certain fundamentals which cannot be ignored, if we are to move in that direction. These fundamentals may perhaps be best summed up in the words of E. F. Schumacher, thus;

"Development does not start with goods; it starts with people and their education, organisation and discipline. Without these three, all resources remain latent, untapped potential. There are prosperous societies with but the scantiest basis of natural wealth, and we have had plenty of opportunity to observe the primacy of the invisible factors after the War. Every country, no matter how devastated, which had a high level of education, organisation and discipline, produced an 'economic miracle. In fact, these were miracles only for people whose attention is focused on the tip of the iceberg. The tip had been smashed to pieces, but the base, which is education, organisation, and discipline, was still there.'

"Here, then, lies the central problem of development. If the primary causes of poverty are deficiencies in these three respects, then the alleviation of poverty depends primarily on the removal of these deficiencies. Here lies the reason why development cannot be an act of creation, why it cannot be ordered, bought, comprehensively planned: why it requires a process of great subtlety. Education does not 'jump'; it is a cruel process of great subtlety. Organisation does not 'jump'; it must gradually evolve to fit changing circumstances. And much the same goes for discipline. All three must evolve step by step, and the foremost task of development policy must be to speed this evolution. All three must become the property of not merely of a tiny minority, but of whole society".[12] This is more so in the realm of rural development. □

12. E. F. Schumacher : *Small is Beautiful;* Blond Briggs, London. p. 151. Indian Reprint (1978) p. 151.

Annexure I

A Socio-Economic Profile of Rural India

Major Indicator	*Year*	*Unit*	
1. Rural Population to Total Population	1971	Percentage	80.09
2. Rural Population Below the Poverty line	1978	,,	47.85
3. Unemployment			
a) Usual Status (Chronic)	1978	Million	2.00
b) Weekly Status	1978	,,	8.15
c) Daily Status	1978	,,	16.47
4. Per Capita Consumer Expenditure	1973-74	Rs. per month	53.01
5. Consumption Standard of Weaker Sections	1973-74	,,	26.91
6. Debt Owned to Landlords and Agricultural Money lenders	1970-71	Percentage	31.75
7. Share of Institutional Credit in the total Debt of Rural Households	June 1971	,,	29.2
8. Share of Co-operative Credit to Total Debt Outstanding	,,	,,	22.0
9. Per Hectare Credit by Primary Agricultural Credit Societies	1975-76	Rs.	62.00
10. Villages Electrified	1977	Percentage	36.00
11. No. of Rural households without land seeking housing assistance	1978	Million	17.00
12. Water Supply			
a) Villages which did not have an assured source of drinking water	1978	Nos.	90.656
b) Villages where water supply is susceptible to water-borne diseases	,,	,,	37,041
c) Villages suffering from excessive salinity, iron or flourides	,,	,,	24,778

Source: Compiled from various sources like the Census of India, National Sample Survey, Census of Agricultural Holdings, Statistical Returns Relating to Co-operative Movement in India, Basic Statistical Returns, Draft Sixth Five-Year Plan, etc.

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Transformation Model for Rural Development : A Geographical Appraisal of Spatial Inequality

R. L. Singh* & Rana P. B. Singh**

INTRODUCTION

The changing trend of geographic researches towards axiology provides a potential base for its recognition as 'a science of transformation' with a view to analysing the values and norms for the promotion of human welfare. With such an aim, geographic tasks rest upon five considerations—description, explanation, evaluation, prescription and implementation. In a rational frame of integration and feedback, these aspects form the base of transformatory analysis, through which transformation (which includes planning, change and modernisation) of the environment could be achieved in a time-span. With such initiatives, it is now possible to present models capable of structuring, synthesising, and producing plan and policy-oriented viable platform for rural development. Within such a line of research, development of spatial policy is basically needed which will depend on two considerations : (i) preparation of spatial process models as frame, and (ii) policy formulation for structural changes in the light of spatial integration and planning strategy; these considerations are complementary to each other.[1]

The concept of transformation is basically interrelated with the emerging notion of space-time continuum now being recognised as spatio-temporal.[2] To analyse any geographical problem which, in fact, is basically discriminatory in space and indeterminatory in time, the models become a part to analyse the structure on the one hand and to predict the future on the other. As such, the geographical models have two wages, *or*, so-called two distinctive procedures : one *Kinematic* with an aim to parameterise the forms/structures, or the states of the process

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1. For details see Singhs, R. L. and Rana P. B. (eds.), *Transformation of Rural Habitat Indian Perspective*, Chapter I, Varanasi : N.G.S.I. Res. Pub. No. 19 (1978).
2. Singhs, R. L. and Rana P. B., *Spatial Planning in Indian Perspective*, Varanasi: N.G.S.I. Res. Bulletin No. 28 (1978), p. 8.

under consideration, and the other *Dynamic*, describing the growth and evolution of those forms in time.[3] Since these two are complementary to each other, for a balanced analysis, it becomes necessary to apply *Kinematico-dynamic* vision in transformation model which will deal with the cause-and-effect relationship. Since all growth processes and their consequences occur in space, it is treated as the fundamental base for planning postulates; on the other hand, the nodal point/growth centres may be further concieved as the centre of innovation and communication.

With the above purview, development of settlement system has been perceived, which forms an integral part of the regional development. Morever, a settlement system may also be accepted as a spatial framework of the social and economic activities. With this analogy, an attempt is made here to deal with the model of rural development.

Rural India : A March Towards Approach

Although 65% of the total workers are engaged in agricultural sector, they provide only about 45.1% of the total Gross Domestic Product. This indicates the need for giving the first priority to this sector. Moreover, concentration of resources within limited territories is one of the restraint factors for balanced growth; in fact, it causes spatial inequality. It has, rightly been felt recently, that decentralisation of cultural resources and their mobilisation through a balanced settlement system having cybernetic devices will promote rural upliftment. In this context, it may be noted that in most of the developing countries of South Asia, government policy has "a pronounced class bias which cuts across the sectoral divisions of the economy"[4], which further results into spatial imbalances. Higher production along with better distribution and its management, are equally necessary for removing spatial inequality.

In the above concern application of the concept of growth centres/nodal centres/service centres promoting innovation and diffusion of rural/ appropriate technology with a process system of fusion and fission of development energy and resource mobilisation is necessary. The

3. Thom, Rene, *Structural Stability and Morphogenesis*, Reading Mass.: Benjamin Inc. (1975), pp. 2-3.
4. Griffen, G., *Land Concentration and Rural Poverty*, London: Methuen (1976), p. 6.

approach of agropolitan strategy will have to be advocated in the frame of *agropolitan centres* while at micro scale where due to absence of even threshold population a village does not form a viable unit, the combination of villages into the frame of *village cluster* would be more feasible.[5] Its basic aim must also include improvement in agricultural productivity, water harvesting and management along with conservation of soils and their moisture at various horizons, expansion of rural services and employment, and establishment of agro-based industries employing appropriate technology, etc.

Like most of the developing countries the spatial inequality in India has its own distinction—concentration of more population in the rural areas where traditional economy and culture form the base for system operation (see Fig. 1). In such a situation, spatial planning strategy needs a model with heirarchical system of interaction and feedback processes operated through the formation of spatio-temporal organisation — it is governed by the locational behaviour (so-called spatial pattern) of the two basic requisites—social and economic; and further at the second level by the local resources—their potential and the level of utilisation. The appraisal and utilisation of resources are controlled by the combination of three attributes—plan, technology and tranport system (see Fig. 2). This set is further followed by the infra-structural coordinates (i. e., primary, secondary and tertiary activities) which fundamentally develop through economic dimension; consequently, in feedback process it also affects the social demands. In this system the set is formed with the components of social values and institution.

Finally, as a result of combined effect of all interactions, processing, operation and regulation, the system takes the form of spatial-functional organisation which has two attributional subsets viz., settlement and functions; equilibrium between these two sub-systems is maintained through the *Esoteric Box*[6]. A glance at Fig. 2 clarifies that at every level in the hierarchy there appears to be feedback process which is necessary for maintaining balance among needs, demands, plans and expectations in an integrated way.

Although much emphasis has been laid on the GNP or PCI in the

5. Singhs, R. L. and Rana P. B., ref. 2, pp. 46-47.
6. Beer, Stafford, *Platform for Change*, London: John Wiley, (1975), pp. 402-403.

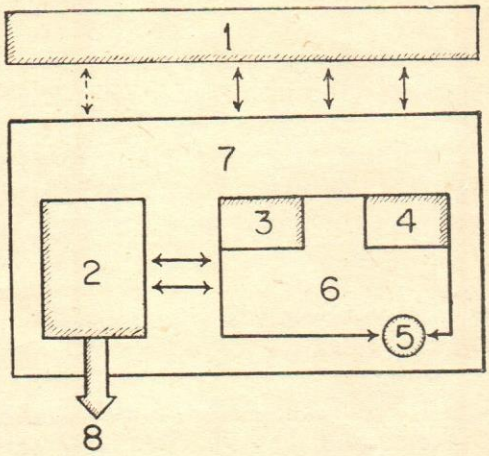


Fig. 1

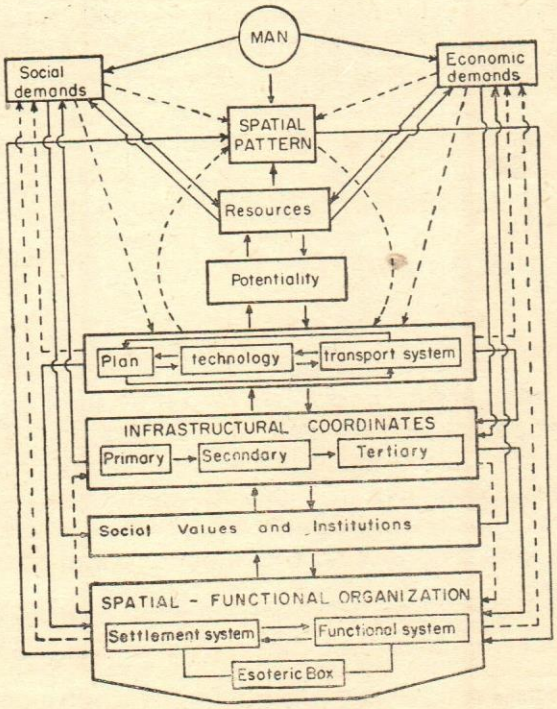


Fig. 2 : Spatial Organisation

national context, yet the problem of regional disparities in spatial context has not been considered to any considerable extent. With proper investigation one may note that gross regional disparity is mainly due to mobility factors. Moreover, market distortions have created a bias leading to the growth of selected areas resulting in sporadic developments. It has been observed that regional disparities in per capita net domestic product increased from 1.9 : 1 in 1960-61 to 2.6 : 1 in 1969-70 (Table 1). Twelve out of twenty states having 54.9% of the total population have less than the average per capita net domestic product. The richest state of Punjab has a per capita of 171% of the national average compared to Bihar (70%). Moreover, in the low income states of Orissa, Rajasthan, etc., the rate of growth is low while it is rather very high in high income states (Punjab and Haryana).[7]

To identify regional inequality *deviation index of weighted coefficient of regional inequality* (DRI)[8] is expressed as :

$$DRI_j = V/C \qquad \text{in which}$$

$$V = \left\{(Z_j - /\bar{Z})^2 \, (p_j/\Sigma p)\right\} \, /\bar{Z} \quad \text{and}$$

$$C = \left(\sum_{j=1}^{n} V \right) /n$$

where Z = net domestic product, $\bar{Z}$ = National average of net domestic product, p_j = population of state j, Σp = Total National Population, n = number of states.

The distribution of DRI for Indian states (Table 1) may be grouped into three type areas : *High Inequality* (DRI > 1.25) comprising Bihar, Haryana, Maharashtrra, Punjab, and Uttar Pradesh, *Medium Inequality* (0.75—1.25) consisting of Gujarat, Madhya Pradesh, Rajasthan and West Bengal, and *Low Inequality* (< 0.75) includes A. P., Assam, H. P., J. & K., Karnataka, Kerala, Manipur, Nagaland, Orissa, Tamil Nadu and Tripura. With the use of statistical measures like standard deviation, σ (2.04795)

7. Mathur, O. P. "The Problem of Indian Disparities" in *Growth Pole Strategy and Regional Development Planning in Asia* (Proceedings of Nagoya Seminar), Nagoya: UNCRD (1976), p.4.

8. For similar approach, see D. M. Smith, *Human Geography, A Welfare Approach*, London, Edward Arnold (1977), pp. 225-228

and coefficient of variation, v (146.756), it has been further stressed that there is a wide regional variation in the inequality pattern.

Table 1. India: Economic Structure and Spatial Inequality

State	%age Share of Individual States in Total		Per Capita Net Domestic Product (Rs.)		Level of Inequality	
	Domestic Production (1969-70)	Population (1971)	1960-61	1969-70	V	DRI
1. Andhra P.	7.6	7.9	314	554	0.0853	0.0611
2. Assam+ Meghalaya	2.7	2.9	349	554	0.0313	0.0224
3. Bihar	7.2	10.3	216	404	5.4480	3.9040
4. Gujarat	5.9	4.9	380	701	1.2596	0.9026
5. Haryana	2.9	1.8	350	921	3.6362	2.6057
6. H. P.	0.7	0.6	—	610	0.0099	0.0071
7. J & K	0.7	0.8	267	451	0.2264	0.1622
8. Karnataka	5.5	5.3	292	591	0.0132	0.0095
9. Kerala	4.0	3.9	278	607	0.0523	0 0378
10. M. P.	6.2	7.6	274	476	1.3925	0.9979
11. Maharashtra	11.4	9.2	419	720	3.1590	2 2637
12. Manipur	0.1	0.2	—	423	0.0841	0.0603
13. Nagaland	0.1	0.1	—	416	0.0459	0.0329
14. Orissa	3.6	4.0	226	514	0.2919	0.2092
15. Punjab	4.2	2.5	383	992	7.3648	5.2776
16. Rajasthan	3.8	4.7	271	456	1.2281	0.8801
17. Tamil Nadu	7.7	7.5	344	591	0.0083	0 0059
18. Tripura	0.2	0.3	—	493	0.0383	0.0274
19. U. P.	13.9	16.1	244	495	1.9620	1.4059
20. W. Bengal	4.6	8.1	386	685	1.5719	1.1264
All India	97.9	98 7	307	579	1.3955	—

Source: Mathur, 1976, ref. 7, and authors observations

In the above context it is worth observing that high inequality states are comparatively more developed; even in terms of allocation of central assistance they have received rather a bigger share than the less inequality states. Such subsidy pattern has also caused regional imbalances further restricting the proper transformation/development of rural India.

The basic need in this context is to reduce the regional gap with the consideration of stepping-up the growth of per capita GNP of the low income states without slowing down the rate of growth in the high income states.[9] Considering the Indian settlement system and the pattern of economy it is observed that about 37.9% of the total rural population lives in villages having less than 1000 population and another 25.8% in villages having a population under 2000; such a settlement pattern can hardly support any system of channelising services and facilities. For this purpose, the concept of *village cluster* has been suggested which should be strengthened with a view to achieving viability of population (approx.5000) of villages by combining two or more villages, e.g , *Gram Sabha*. With the extension of elementary facilities and amenities like education, rural health and water supply, nutrition, road connection, electrification, etc., such programmes would be more feasible in launching the National Programme of Minimum Needs through support by the locally available resources. An example of such a case is discussed in the sequel.

In reducing spatial disparity, the orientation of integrated area approach and service centre planning at district level is justified on the basis that India's natural environment is inter-regionally differentiated with diverse variation having different stages of socio-economic development; even district level administrative control is independent, at least in channelising the local resources. Although preparation of district level integrated plans have been somewhat in practice, it has a negligible consideration of conceptual, analytical and spatial perspectives which is also responsible for the failure of such development plans.

Since man is the core concern of any planning, the taxonomy of population/resource regionalisation is a necessary task before preparing any

9. Mathur, O. P., *op. cit.*, p. 4.

integrated plan. In reference to this context, population variables are considered at one level either through multi-variate analysis or through using deviation system analysis, denoted with mean deviation index, Di; and finally, on this basis, three type areas may be identified:

Dynamic Region (Di >1.25) supplying advanced industrial area with a predominance of urban population and high level of modernisation, that may transform the untapped resources for diverting population; *Prospective Region* (Di $=0.75$-1.25) denoting vast resource potentiality but due to less developed *technical and socio-economic* level of utilisation, the transformation of resources is interposed; and *Problem Region* (Di <0.75) showing a little promise at least for the immediate future; moreover, it has insignificant contact with the developed region. With the comparison of DRI and Di it is obvious that there appears to be a positive relationship: the prosperous regions are to be further characterised with high level of inequality. To present more realistic picture, a combinational index may have to be developed; in this reference Economic Efficiency Index (EEI) could be taken as the function of a large number of variables pertaining to resource potentials, socio-economic development, level of resource utilisation, etc. With such postulates, the rural personality of India may be distinctly identified, on whose basis a model frame of channelising development energy should be prepared.

Another approach in making a transformation model in regional context is related with spatial organisation. With the identification of growth/service centres through functional distinctiveness, functional magnitude or percentage share in the regional commercial population or with a composite index of numerous variables at different levels, a system of spatial organisation (Fig.2) of a region may be prepared with a view to promoting the hierarchical system of growth/service centres in corroboration to the balanced national settlement system. The system will only be an organised and balanced one when each settlement in reference to its service efficiency is managed spatially, vertically and even horizontally on the basis of socio-economic functions. For this purpose,cybernetic tools would be more helpful. Further, at each level, an *uncertainty factor* may also be added in reference to growth and transformation so that the system may be more elastic. The localisation of such centres, especially lower order, need be in accordance with the territorial distribution of population and resources along with the level of consumption and exploita-

tion. With this additive postulate the infrastructural network will be intensified and there will be provision for spatial mobility.[10]

At the third level of analysis, *village cluster* (e. g., *Gram Sabha*) may be considered. For such an analysis Chamaon Gram Sabha (Varanasi, U. P.) has been taken as a sample. As usual, in any integrated approach of planning, there appears to be two basic considerations: attributional/ sectoral (e. g., socio-economic conditions, and spatial development frame).

Situated on the west of Varanasi city, at a distance of about 7 kms. from the main city Centre, Chamaon Gram Shabha presents a wide range of inequality at both intra and inter-community level (Table 2)[11]. Taking per capita income as base, three indices V, DRI, Di (deviation index of per capita income) have been computed. Since computed standard deviation, σ (1.8807) and coefficient of variance, v (119.3716) are very high, they further support the above hypothesis. It has been noted that there appears to be a wide inequality in higher income groups, especially in case of the *Bisen Rajput* and the *Kayastha*. On the other hand, there is very little inequality in the *Ahir*, the *Kaushik Rajput* and the *Pasi* (Table 2).

It has been estimated that by AD 2001, the population of the *Gram Sabha* will be doubled; as such, about twice the present number of dwellings will be needed by that period, i.e., about 380. According to spatial development plan (Fig. 3), which has been prepared taking the basis of people's consciousness, it has been calculated that by AD 2001, about 21.05 acres (4.78 of the total area) will be available for settlement expansion—this will accommodate about 380 families.

Keeping in view the fact that the Varanasi Municipal Corporation has announced the inclusion of the rural territory including the present Gram Sabha in its Regulated Area Plan, it is very likely that more area

10. See M. Koloszar, "Interrelations between Settlement Systems and Socio-economic Development" in *National Settlement Strategies, East and West*, ed. H. Swain, Luxembourg: I. I. A. S. A. Pub. No. CP-75-3 (1975), pp. 70-71.
11. For detailed information, see Singhs, R. L. and Rana P. B., *Rural Development in Indian Environment: Assessment and Prospects, A Case Study of Chamaon Gram Sabha* (UNO Project Report), Varanasi: N. G. S. I. Res. Bulletin No. 29 (1977).

Table 2 : Chamaon Gram Sabha's-Socio-Economic Structure, 1977

Caste/ Clan	Total Population	No. of Households	% of Population	% land ownership	Per Capita land ownership	Per Capita monthly income (Rs.)	Di of income	V	DRI
1. Rajput	121	8	9.66	37.01	0.997	143	1.59	3.015	1.914
i) Bisen	61	2	4.87	30.30	1.620	188	2.09	5.197	3.298
ii) Kaushik	60	6	4.79	6 71	0.360	98	1.09	0.034	0.022
2. Brahman	29	3	2.32	5.18	0.580	192	2.13	2.682	1.702
3. Ahir	77	12	6.15	8.64	0 365	90	1.00	0.001	0.000
4. Kayastha	79	4	6.31	8.63	0.356	179	1.99	5.553	3.525
5. Soiri	82	12	6.55	7.62	0.303	115	1.28	0.455	0.289
6. Gareria	26	3	2.08	2.14	0.268	38	0.42	0.625	0.397
7. Kurmi	362	61	28.91	24.75	0.164	108	1.20	1.041	0.660
8. Lohar	90	16	7.17	2.91	0.105	72	0.80	0.259	0.164
9. Musahar	56	10	4.47	1.53	0 089	40	0.44	1.242	0.788
10. Chamar	278	53	22.20	1.56	0.018	55	9.61	0.218	1.918
11. Kumhar	24	1	1.92	0 03	0.004	58	0.64	0.28	0.139
12. Gonr	22	4	1.76	—	—	35	0.39	0.597	0.375
13. Pasi	6	1	0.48	—	—	45	0.50	0.108	0.068
	1252	188	100.00	100 00	0.260	90	—	1.576	—

Source: Singhs, R. L and Rana P. B. ref. 11, and authors' observations

might be required for the extension of settlements to serve the needs of the city, though the city Administration has not yet been able to prepare any specific plan to this effect. To provide a plan for such a settlement, expansion, the proposed street linking the main settlement (J in Fig. 3) with the approach road may serve as an axis for such developments in the long run. The rest of the Gram Sabha land may continue to be developed according to the spatial view shown in the figure.

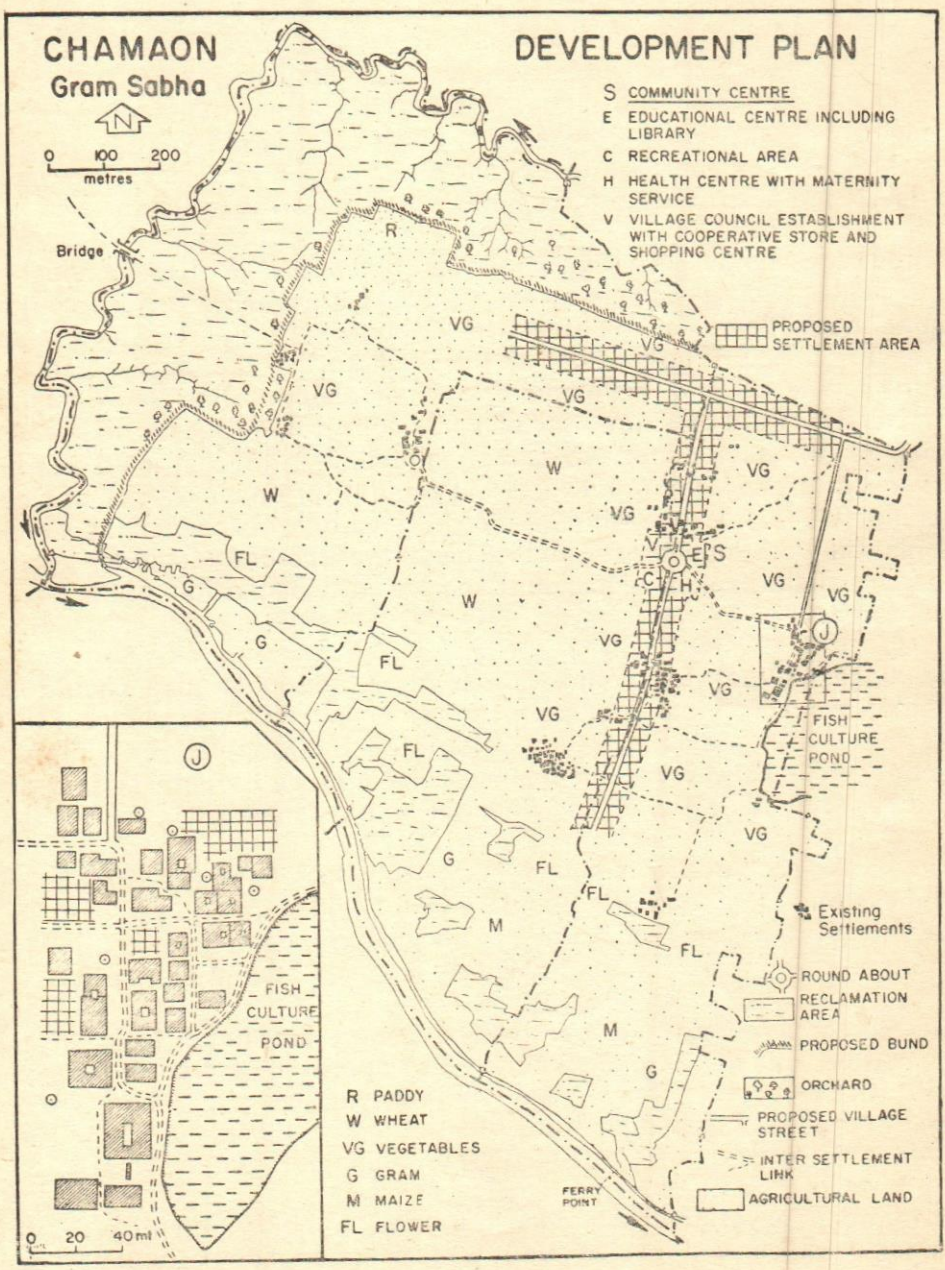
In preparing spatial plan (Fig. 3), it has been attempted to connect all settlements with a common road which can provide a close contact among the settlements. In such a plan, houses are to be placed close to each other on both sides of the road, so that the 'social distance' can be regulated and maintained in a balanced form. Provision of Community Centre (having establishments concerninge ducational, recreational, health, stock depot and marketing facilities) in the middle of the settlement area, further activates the settlers for enhancement of close social distance, because within a closed territory of community centre people will work together for mutual benefit, peace and security. Moreover, in such a plan, community centre will play a role of the sociopetal force.

It is suggested that for house construction, maximum use should be made of available local materials in order to reduce costs. Such materials include stabilised soil, straw and mud, ordinary burnt bricks, bamboo, etc. However, some materials have to be brought in from the nearby manufacturing sites like Sheopur and Varanasi City.

Through the proper provision of community facilities and introduction of innovations, the economic standard of the villagers can be improved. The introduction of fish culture (pisciculture), dairy farming, poultry farming and vegetable gardening will be the main source of income.

With the cooperation of adjacent village *Koeran* the pond lying in the east can be utilised for fish culture. The approximate area of the pond is about five acres. Since this will involve seasonal labour, about fifteen persons are sufficient for the purpose. Ultimately, this is likely to add an average income of Rs. 100 per capita per month.

The introduction of poultry farming will be yet another potential source of income which will involve about 80 families engaging about 150 per-


CHAMAON
Gram Sabha
DEVELOPMENT PLAN
N
0 100 200
metres
Bridge
S COMMUNITY CENTRE
E EDUCATIONAL CENTRE INCLUDING LIBRARY
C RECREATIONAL AREA
H HEALTH CENTRE WITH MATERNITY SERVICE
V VILLAGE COUNCIL ESTABLISHMENT WITH COOPERATIVE STORE AND SHOPPING CENTRE
PROPOSED SETTLEMENT AREA
FISH CULTURE POND
Existing Settlements
ROUND ABOUT
RECLAMATION AREA
PROPOSED BUND
ORCHARD
PROPOSED VILLAGE STREET
INTER SETTLEMENT LINK
AGRICULTURAL LAND
FERRY POINT
R PADDY
W WHEAT
VG VEGETABLES
G GRAM
M MAIZE
FL FLOWER
0 20 40 mt

sons as part-time/full-time workers. It is estimated that within twenty years this industry will be in a position to give an additional income of Rs. 150 per capita per month.

Among vegetables and fruits, potato, cucumber, papaya, banana, guava and mango will be new additions to agricultural activity. Although the village is well known for brinjal cultivation, yet its varieties need to be improved so that the production as well as nutritional value is increased.

Finally, with such advancement by AD 2001, per capita income per month will be about Rs. 450 while at present it is only Rs. 90—it means that by AD 2001 the income level will increase at least five times, which will be above the mean subsistence level.

The main sources of financial support are Cooperative Credit Societies, Land Mortgage Bank, Union Bank of India, and State Bank of India. Subsidies are provided by District Planning Office (DPO) through the B. D. O. (Block Development Officer), although smooth channelisation of financial assistance has to be made simpler and more effective and attractive.

In this Gram Sabha, two community councils have been established to look after settlement improvement programme, viz., (i) *Mahto Council* (of the Kurmis), and (ii) *Chaudhary Council* (of the Harijans) These councils look after the interests of their community. Such councils should be encouraged and advised for the functional motivation and participation in the planning programme as well, so that without disturbing the socio-cultural values it may be used to rationalise the utilisation of resources for mutual benefit; further, socio-political organisations have to be established to check the emergence of inter-group frictional tendencies at least at such micro levels.

Conclusion

In conclusion, it is advocated that spatial perspective must be taken as a controllable phenomena in policy formulation for rural development. Promotion of proper spatial structure and model frame for spatial organisation along with associated policy formulation will lead to diffuse transformatory energy in the territory through the transport system and

appropriate technology. It is notable that in the spatial organisation of rural resource utilisation and development with different hierarchical orders, it is possible to operationalise integrated regional development involving the crystallisation of regional settlement system oriented to developing transport network having optimal connectivity. Even at micro level, establishment of community centre is essential, which will serve as a nucleus of energy regulation and control. This system will promote the transformation of rural habitat. The basic consequences of spatial inequality need be analysed fully so that it may be easier to prepare a coherent model as near to reality as possible. □

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Marketing in Rural India

Manendra Mohan*

Rural Development

The focus of development activities in the rural sector of India has been on agricultural growth since Independence. The past three decades have seen numerous changes in the rural scene brought about by a variety of programmes aimed at increasing the agricultural yield and improving the lot of persons engaged in agriculture. Similar effort has also been made through organisations like the Khadi and Village Industries Commission for promoting the production of Khadi, handloom fabric and a number of basic village industries such as processing cereals and pulses, and production of Ghani oil, Khandsari and Cane gur, palm gur and other palm products, village leather, village pottery and non-edible oils and soap. The emphasis of these programmes of development of agriculture as well as village industries has largely been on improving the incomes of farmers and village artisans, as well as, to an extent, that of the landless labour.

There is still a long way to go in improving the levels of living of the rural population. The marked skewness in income distribution between different sections of rural India and between various parts of the country makes the problem even more complex. In spite of these noticeable drawbacks in the pattern of growth in the rural sector, a considerable headway has been made in making the country self-sufficient in foodgrains and bringing certain degree of prosperity to the rural areas.

The rationale of equating rural growth with agricultural growth was obvious in a predominantly agricultural country like India. The process of transferring the ownership of land to the tiller had to be initiated as a part of the overall agrarian development programme for the country. It was also necessary to provide the inputs for raising agricultural productivity such as irrigation, better methods of cultivation, high-yielding varieties of seeds, fertilisers and plant protection measures. The cultivator has also been provided with the assurance of getting a fair

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return for a number of basic crops through the Agricultural Prices Support policy. The establishment of purchasing depots at the minimum support prices for the specified crops may be considered as a major step towards introduction of an organised marketing system in the rural sector, although it is of a very special type.

Evolution of Rural Marketing Channels

The marketing system in rural India has evolved gradually over years. Nevertheless, the number of rural retail outlets is quite substantial and was estimated at about 1.5 million compared with about 0.6 million in the urban areas. The average offtake per outlet in the rural areas was, of course, much smaller compared with that in the urban sector.[1] This data, which is in the process of being updated, indicates clearly the existence of a substantial distribution set-up in rural areas. The more remarkable is the fact that it has grown without any concerted effort for its development except for the contribution made by the cooperative marketing societies and the sales stores for khadi and village industries.

A recent government proposal aims at the provision of a fair price shop for every two thousand persons living in rural areas. The number of fair price shops in the country was reported as 240,000, of which 60,000 were in the private sector. The implementation of the proposal for extending fair price shops to cover all villages, including the provision of a shop for villages having a population of under two thousand which cannot be grouped with any other village for this purpose, would require the extension of the network by a further 40,000 shops. All this expansion would have to come in the private sector.[2]

New Development Perspective

The brief review of the growth of development of agriculture and, to an extent, Khadi and Village Industries and that of the evolution of the marketing system in rural India brings forth two salient features :

(a) When it comes to seeking further avenues for generation of employ-

1. O.R.G., Baroda, Census of Outlets 1969
2. *Economic Times*, August 10, 1978

ment and income only marginal gains may come from agriculture, especially in respect of tackling the problem of rural unemployment.

(b) Being used to conditions of shortage, the development effort has been directed towards increasing the production and raising productivity. The marketing of the produce has been taken largely for granted.

The initiative taken by the Government of India in launching a major drive for taking the process of industrialisation outside the major urban centres is a logical extension of the first point. The need for greater involvement of the rural population in industries located nearer their home base is greater now than at any time before. The scheme for the establishment of District Industries Centres should help achieve this objective.

Concept of Marketing

We must appreciate that the philosophy of economic growth in our country has been largely production-oriented owing to conditions of shortage in every sphere of the Indian economy. It is the opportune moment to grow out of that philosophy, otherwise, it will obviously inhibit the process of growth. The function of marketing is not merely that of an adjunct of the production process but more as the fountainhead of such activity.[3]

Marketing may aptly be described as "the process by which the demand structure for economic goods and services in a society is anticipated or enlarged or satisfied through the conception of promotion, exchange and physical distribution of such goods and services".[4] This comprehensive coverage of the marketing function has to be given its due weightage at the present juncture of our economic growth when the country has clearly reached the take-off stage in its overall economic development. Particular attention has to be given to the fact that India also has a large industrial base and ranks amongst the ten largest industrial nations of the world. It is not only the extensive industrial base but also the range of industry and technology employed which encompass some of

3. Manendra Mohan, The Dynamic Concept of Marketing, *Economic & Political Weekly*, (Vol. V. No. 22) *Review of Management*, May 1970

4. Marketing Staff of the Ohio State University—"The Statement of Marketing Philosophy", *Journal of Marketing*, January 1965, p. 43

the latest advances. Further growth of industry, and particutarly its extension to the rural environment, hitherto uninitiated in industrial entrepreneurship, can progress as planned only if the marketing aspects are taken into account. This may be illustrated by making a reference to the various aspects of marketing.

Estimation of Market Potential :

The first and the foremost facet of marketing is the assessment of the needs of the present and potential consumers and an estimation of the demand for products. This aspect is unfortunately, neglected in many instances and this may well be the cause of sickness of many industries and firms, particularly those in the small scale sector. Not only at the firm level, but also in national planning, the aspect of estimation of demand and market potential is of crucial importance. This can make all the difference between the success and failures of the relevant plans. We should also take into account the fact that this process is not a static one. The assessment of market is a continuous process.

Marketing Environment :

There are two factors in the assessment of market potential which are particularly relevant, apart from the methodology and the validity of the data available and that collected for this purpose. One of these is the market environment which may vary between regions, socio-economic-occupational groups, urban and rural habitat and similar factors and it may indeed be influenced by policy changes. Moreover, the market environment is always in the process of flux. Any assessment and review of market potential without reference to the changes in environment may become not only meaningless but also misleading.

Product Concept and Design :

Another relevant feature, once again often overlooked, is the question of product concept. The same need may be filled by a number of products with varying designs. We may illustrate this point in the context of a proposal by a sub-group of the working group on petroleum in the Ministry of Petroleum, Chemicals and Fertilisers for extending the usage of plastics in the rural sector in the next ten years. This sub-group has recommended setting up of plastic conversion units

In rural areas in order to provide employment to the local population. This, *prima-facie*, is an excellent proposal considering that the size of the plants in terms of the investment required and the labour-intensive nature of the processes for manufacturing products like PVC footwear, hose and pipes, plastic buckets and articles of household use should fit in perfectly with the concept of industrialisation in rural areas and consequent generation of employment.[5] However, the whole scheme can flounder if entrepreneurs were to rush in without regard to the type and design of products which will be required and accepted in the markets where they are planned to be sold. The experience of some small-scale units in the above product range has been mixed. Some of them are doing well while others have not been able to progress owing to their inability to come to grips with the problems inherent in rural marketing.

It may be worthwhile raising the following type of questions before plunging into the production process in the above context. Is the product in question—whether PVC Sandals or binding tape, or a plastic bucket or a mug—likely to gain acceptance in the rural setting or not ? Would Sandals of Hawai type, which are suitable for use in bathrooms or outside wear in urban areas where streets are paved, be also the right type of product for villages ? If not, should one make sandals or a shoe which may give more protection to the foot ? Would the village women take to plastic bucket since they have been used to earthen or metal pots ? They have to carry water on their heads for long distances for storage. If that practice continues, would a bucke be the suitable vessel for carrying and storage of water ? What sort of cleaning material one should use for cleaning a plastic bucket ? Answers to such questions can make all the difference between the success and the failure of a product.

Price :

The economic viability of the proposed units will depend on what price the potential consumers in the rural areas would be willing to pay for the new product. If the price is worked out merely on the basis of the apparent production costs, the scheme may not be a viable one. There may be a need to innovate and improvise to meet

6. *Economic Times*, 17 July 1978

the existing and anticipated requirements of the consumers for whom products are intended. This can take the form of alterations and modifications in the product design or collaborative arrangement in the form of a design centre or for purposes of distribution.

Distribution :

The best product, eminently suited to the needs of the customers, may turn out to be a miserable failure if the channels of distribution are not available for making the product available at points where consumers would buy it. The success of products of widespread use like, tea and tobacco in rural areas owes a great deal to the extensive distribution system which made these products readily available in large number of villages.

Promotion :

A blind spot in the rural marketing has been the lack of promotional activity. There are a very few manufacturers of consumer products of common usage, or even producers and marketers of agricultural inputs and implements, who have given much attention to the question of promotion at the grass-roots level. Amongst these handful of enterprising and forward-looking manufacturers mention may be made of IFFCO who have set up demonstration farms and the mere name of IFFCO at these farms in the form of a small board possibly gives them a tremendous mileage. A somewhat stereotyped argument against active promotional activity on the part of manufacturers and marketers in India relates to the lack of adequate market potential in rural areas which would justify advertising and sales promotion. The effect of this approach has resulted in confining the benefits of both officially sponsored, or for that matter commercial marketing programmes, to those limited segments of rural society who have had access to the urban channels of communication and information.

An actual observation in a recent study on rural marketing undertaken by author for the Industrial Credit and Investment Corporation of India, would serve to illustrate this point. It was noted that in villages which are not on main roads or even on feeder roads, the known brands of consumer products were mainly sold in village shops. This pattern contrasted with the availability of unbranded products in

the higher category of villages which have somewhat more developed market centres. At the same time, advertising and sales promotion in the former category of 'outlying' villages was minimal. If the phenomenon of brand awareness and usage is of common occurance in the outlying villages in the country, it will obviously be in the interest of manufacturers themselves to extend their sales promotion activities, duly supported by the distribution system to these villages.

Communication :

The basic function of advertising and sales promotion is obviously the communication of the salient features of products and services to the potential users and dev eloping the urge to buy products/services apart from retaining the loyalty of the existing users. The function of communication is no less important in uninitiated village communities than in urban areas where people are already exposed to it. The villagers should not be left to gather second-hand impressions and information from the opinion leaders who, in turn, may have received the message owing to their urban exposure. The effectiveness of promotional activity directed at rural population and specifically designed for them would be substantial. This approach was successfully tried at the initial stages of the 'Nirodh' Marketing Programme by projecting simple messages for the rural population through homely media like wall painting in the villages.

Rural Marketing Infrastructure

There is an aversion to entering the rural markets owing to the lack of infrastructure, namely, the means of taking the products to the rural outlets, and limited availability of channels of distribution. One out of every three villages is more than 7.5 Kms away from serviceable roads.[6] The programme of rural road development, which has already made headway in a few states and has recently been given high priority in some states like Maharashtra, will help in increasing the access both ways for the population of the outlying villages. This will be a major incentive to the forward-looking marketers who want to expand their

6. According to R. Thillainayagam, President of the Indian Institute of Road Transport at the Seminar of the Golden Jubilee celebration of the Indian Roads and Transport Development Association, at Madras, on 21 October, 1978,

distribution and communication network right into the hinterland of the country. The income accruing from rural road works programmes will also give a fillip to increasing saving as well as consumption in rural areas.

Channels of Distribution :

The channels of distribution need to be strengthened in rural areas although the framework is already there. There are two aspects which need to be given special attention :

(a). The turnover of an average village shop in an outlying village for packaged consumer goods is barely Rs. 10 per day according to the Rural Marketing Study referred to above. The offtake of packaged consumer goods is an indicator of the growth of the trading activity in these villages.

(b). The expansion of offtake of such outlets is inhibited not only by the limitation of market but also, to a large extent, by the availability of cash for purchase of stocks with the village shopkeepers. The limited range of stocks is a disincentive for the higher expenditure brackets of the rural population for shopping in the village itself. Instead, they prefer to go to the nearby towns and cities where they get better choice of goods and usually at lower prices.

Classification of Rural Markets :

Village markets other than *hats* and fairs, may be divided into three broad types:

The first type of village markets are located at the *tehsil* headquarters and other big villages which are on the main roads and are graduating to the category of town areas. They have already assumed the urban marketing characteristics to an extent and act as supply points to the village outlets as well as for retail purchases by households.

The second category of village markets are located at communication points which have most shops in a market place or one or two shopping streets.

The third type of village markets are in outlying villages where shops are typically located on the ground floor of the house instead of being on separate premises.

The shops in the first category enjoy the maximum advantages from every point of view. They are on the distribution routes of the companies having extensive distribution system They are given advertising and sales promotion support, both, in the form of point of purchase material as well as limited advertising in the place where they are located. The shops of the second category also enjoy some of these advantages although they may not be getting supplies of stocks at their door-step as several outlets in the first category may do.

The shops in the outlying villages have the least access to communication and lag far behind in respect of availability of sales promotion material and there is practically no advertising support except through the media of radio commercials. The shopkeepers in these villages have to go to nearby towns and cities to get the supplies of their stocks periodically. They usually get no preferential treatment from wholesalers or semi-wholesalers from where they get their stocks. They do not enjoy any credit facility except in cases where they have been able to build up their relations with their regular suppliers.

The retail outlets in outlying villages face the biggest handicap and yet they perform an important function of market development by placing goods within the reach of the lowest expenditure groups in the villages. It is not surprising that they charge a premium for it. At the same time, they may also extend credit facilities to their customers merely on the basis of acquaintance. In fact, sometimes consumers in such villages take advantage of this practice by switching their clientele from one shop to another in the village in order to take maximum advantage of the credit facility.

Neglected Interior :

The village shopkeepers in outlying villages, and also, to a fair extent, in the villages having market centres, have to procure their stocks from semi-wholesalers and wholesalers in nearby big villages (newly developing town areas) and towns and cities. They have to spend their

time and money for obtaining their supplies. At the same time, they get no special terms from these wholesalers. They may be treated for all practical purposes as households making bulk sales. At the same time, we must appreciate that a typical wholesaler in a small town performs the wholesaling function for a very minimal incentive of 2 to 3 percent discount. His major gains come from his role as a retailer as the wholesale and retail function in small towns are usually combined. There is little evidence of any major support being given to wholesalers at that level in promoting the market development in the interior. Very few manufacturers or marketers have made any organised effort to explore the potential and problems of the so-called "interior".

Development of Rural Marketing

The development of rural marketing should not be equated with the extension of the distribution system which is surely one important aspect of the process of marketing. The role of marketing at the present stage of rural growth is more fundamental, almost vital. The process of distribution would make the goods and services available to the far flung areas. To that extent, the proposal to extend the chain of fair price shops to all villages is a welcome step. Marketing, however, has to be viewed as the initiation of the process of motivation for the bulk of rural population, especially in those states which have not yet tasted the new agricultural prosperity. There are the following questions to which we must address ourselves in the above perspective.

1. *How to create motivation amongst the bulk of the rurai population for improving their levels of living ?*

Income generation is a necessary but not a sufficient condition for inducing the less well-off sections of community for upgrading their levels of living. This was the clear indication obtained from some anticipatory data on choices for utilising assumed additional income in the rural marketing study referred to above.

2. *How to increase opportunities for spending rural incomes within the rural sector rather than in the urban areas ?*

If most of additional rural incomes are being spent on purchase of goods and services in urban areas, the incremental effect of such

expenditure does not permeate to the rural sector. The purchases of consumer goods, to say nothing of durables and agricultural and other equipment, in urban areas by the sections of the rural community having the bulk of purchasing power is a case in point. If only a fraction of those purchases can be diverted to village shops, it will go a long way toward bringing additional income to villages and its resultant effects on the stocking patterns of village shops and in the form of additional economic activity.

3. *How to minimise the differentials between prices in village shops and those obtaining in urban areas ?*

There is a choice between the system of control and marketing mechanism. The long-term and lasting solution may possibly be found in the latter. This can be done by understanding the problems faced by the village shopkeepers, particularly by those located in outlying villages. There was a suggestion by Chief Minister of states for providing transport subsidy for essential items as a price equalisation device. The same logic applies to availability of consumer goods of usage in villages.

If due weightage is given to the trading sector in the credit plans of the lead banks for the rural areas, this will also help achieve the desired objective. Even small loans of Rs. 200-500 to retail outlets in villages, and to the new entrants to trading activity, can lead to better and more viable stocking patterns. This will help in attracting more business within the village from the more affluent sections of the rural population. This process, in turn, will result in reducing price differentials between urban and rural outlets.

4. *How to equip the rural sector for harnessing the benefit of the process of industrialisation in rural areas ?*

The viability of many an industrial venture will depend not merely on availability of finances, raw materials and technical expertise apart from the necessary equipment, but also, to an increasing extent, on acquiring marketing skills. The induction of marketing orientation at the grass-roots level will obviously be a slow process and it should be commenced without losing time.

The Khadi and Village Industries Commission has approved setting up of 3,600 units in Uttar Pradesh in 1978-79. This will involve an expenditure of about Rs. 40 million and will provide employment to 20,000 persons. The Uttar Pradesh Government has agreed to provide marketing support for the programme through establishment of a dozen sales depots apart from two warehouses as well as 11 raw material banks.[7] This is an excellent plan and it requires an investment of Rs. 2,000 to provide employment to one person. In order to get the maximum benefit from the proposed investment, it will be necessary to bring in the marketing inputs as well as marketing information systems for increasing the chances of success of this scheme and at the same time for keeping a track of the progress made and the problems faced.

5. *How to open channels of communication in rural markets ?*

The manufacturers and marketers have a major role to play in hitherto neglected rural markets. They have to look beyond the urban areas where their major marketing effort has been concentrated. To begin with, they can take a lead in opening up channels of communication with rural retail outlets as an extension of their promotional activity. The experiments carried out by a company in this direction have indicated that such a step would bring in adequate dividends to the company concerned.

Marketing should not be treated as a one-way process even if the necessary inputs are provided. The function of marketing, as pointed out in the first place, is to anticipate consumers' wants and changes in patterns of consumption. Taking the Khadi and Village Industries Commission's scheme in Uttar Pradesh and as an illustration, it will be highly desirable to institute even a modicum of feedback from sales depots in order to be able to assess the impact of the scheme. In fact, the basic questions like the number of sales depots and their location, the requirements of the sales staff in terms of their numbers and type, the pattern of stocking and the need for promotional effort should be viewed scientifically rather than subjectively. The products do not always move from shelves merely because they are put there.

7. *Financial Express*, 18 June 1978

6. How to develop rural entrepreneurship ?

Rural entrepreneurship is the key to future growth of villages and the only mechanism for passing on the gains of development on the agricultural front to persons engaged or likely to be engaged in non-farm activities and for achieving a better income distribution. If this is not done the owners of farms, especially those having large farms, will continue to remain a privilleged class. The vital factor in the whole process is developing a sense of expectation and cultivating and acquiring the knowledge and knack of taking risk for a potentially gainful activity. This has been considered more of an urban trait, a characteristic of industrial society. It is through a broad perspective of the marketing function that some enterprising villagers may gradually get accustomed to the purpose and pay-off of entrepreneurship and yet retain their roots and habitat in villages.

Relevance of Marketing to Rural Society

The marketing approach, apart from being of direct economic benefit to the rural population, has also its socially relevant applications. A community receptive to the marketing viewpoint may also be initiated with a greater degree of success, and yet at a lesser cost, in virtues of preventive aspects of health care or, for that matter, family planning. The experience of coercion in this respect during the Emergency regime shows a dehumanised approach to a highly personal and sensitive subject of limiting one's family. In a democratic country any pressure or coercion on a matter like this is clearly a violation of an individual's liberty. The protest has since been registered but the problem remains. Not many persons would dispute the need for limiting the growth of population in India. However, in a democratic society, the only alternative to a mechanical and possibly inhuman angle lies in the fullest use of marketing tools and this approach is currently reflected in the formulation of the marketing programme of the Department of Family Welfare.

The marketing approach can be effectively used in educating farmers and artisans in increasing their efficiency, rural womenfolk in pooling cowdung for manure or for Gobar gas rather than burning it, the new generations in taking to trade and industry rather than depending on agriculture or looking for jobs, and at the same time in providing the wherewithal for making these programmes feasible and rewarding. □



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Appropriate Technology for Rural Development

S. Rajagopalan* & Vinod Vyasulu*

In Independent India, the role of technology has been to add a new class of people to the massive traditional poor. The greatest technological intervention in rural India in the last two decades has been the "green revolution". The impact of technology is governed by the nature of socio-political structure into which technology is introduced. The green revolution introduced a highly inegalitarian structure, hence aggravated disparities.[1]

This is not the type of rural development we have in our mind. Rural development to us means emancipation of the oppressed and exploited poor. This emancipation encompasses economic, political, social and cultural fields. Only when this class of people acquire socio-economic power, can we say that they have been developed. So far, efforts have been made to increase the income of this poor so that they can fulfil their essential needs. But these programmes did not take into account social structure in villages. Hence their failure.

The reason for poverty is that the people who add value by their labour and people who realise this added value are different. The 'value adders' are dependent on 'value realisers' for their day to day living.[2] Though the case is same in an urban factory setting, the rural value adders are more dependent on value realisers. This is because the rural poor lack skill, are unorganised, uneducated and divided into various caste groups (this social divisions among these value adders are kept alive deliberately by the social process dominated by value realisers). So, rural poor lack bargaining power for better economic standing compared to that of urban value adders.

The distinction between value realisers and those who control means of production is quite important. It is possible, in rural areas, for one

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1. Frankel, Francine, India's Green Revolution, Oxford Univ. Press., 1971
2. For a concrete example, see Sudipto Mundle, *Bonded Labour in Palamau : A Study in Agrarian Relations*, mimeo, Indian Institute of Public Administration, New Delhi, 1978.

to control means of production but still be dependent on a value realiser to realise the value of his product. For instance, marginal and small farmers do control means of production. But they are dependent on village money lenders, traders, etc., so as to market their produce.

Rural development then is to increase the autonomy of value adders. This process would help them to achieve socio-economic power. Poverty in effect is a consequence of vulnerability or lack of control over value realisation, not a cultural or psychological attribute.[3]

This process proceeds in stages. The first stage would be assuring full employment to the rural value adders. This would help them to increase their economic power and hence the bargaining power with value realisers. Another stage would be educating them on the intricate business practices and organising them so as to prevent 'distress transaction' with urban value realisers.

Then development is a process of social change by which the exploited become more autonomous, and participate fully in each and every decision affecting their life.[4]

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3. Ghosh Anjan, Transforming the Rural Poor : Issues and Problems, mimeo., I. I. T. Delhi, 1978.

   Anjan Ghosh also shares the view of increasing the autonomy of rural poor. But he assumes that value realisers necessarily control means of production and vice-versa.

4. Various contributors to the theory of eco-development have held that eco-development is :

   a) satisfaction of essential needs
   b) creation of an infrastructure of economic activities which will be self-sustaining in the long run
   c) ensuring voluntary participation of value adders
   d) a balance between economic growth and ecological, social and other environmental facts of society.

   All these points lead us to increasing autonomy of value added. For a good description of eco-development, see "Mahadevapura Eco-development Project", Mahadevapura Team, mimeo, CHES, Indian Institute of Management, 1978. This is part of a project on "Technology Improvements in Non-land Based Cooperative Economic Activities in Bidadi Hobli" being conducted at IIM, Bangalore, and financed by the Karnataka State Council of Science and Technology, Bangalore.

Technology is one of the key variables in the interaction matrix of a society. In most of the cases, technology determines other variables such as labour, capital, sophistication of equipments, etc., and is, in turn, determined by the class which controls the power structure in that society. In the present context, it is value realisers who determine the technology level. Hence it serves the purpose of this class.[5]

Appropriate technology, as we understand it, consciously and deliberately takes the side of value adders.[6] It aims at increasing their autonomy.

As we have already identified, the first stage of this process is ensuring full employment. It is essential then to identify economic activities *independent of present value realisers* and to organise the poor to perform these activities. Then we have to identify in the initial stages non-land based economic activities which shall use *local resources*. If that economic activity depends on imported resources, then it just transfers the dependancy from local value realisers to external value realisers.

The economic activity should be a self-sustaining one. Either the product should be usable by the poor themselves or should have a market elsewhere. If it has a market outside the group, it does impose a certain form of dependancy but certainly better than the previous precarious condition of the value adders. If the market is external, the need for a well-knit self-managing organisation is more evident.

Hence technology should also promote self management. Self-management is voluntary participation of the group in decision-making. This would come about only when each and every one knows the decision process, the elements of operation of that economic activity and its relation with external environment. We are opposed to setting up of cooperatives solely because there is no full participation in decision-making process. There is a political dependancy on office bearers of cooperatives. We fully understand that in a complex activity, the

5. See "Introduction" in *Technological Choice in the Indian Environment* (ed.) V. Vyasulu, Proceedings of a National Seminar, *Sterling Publishers*, New Delhi, forthcoming.
6. This is in line with the nature of action research, as recently decided in a National Seminar sponsored by the ICSSR in Lonavala, October 5-7, 1978. The report will be published shortly.

industry has to be managed by the representatives of the group. But when each and every one knows about operations, then there is a considerable pressure on these representatives and they cannot corner power. Hence in self-management scheme, the decisions of representatives would be analysed carefully by the group as a whole. This does not take place in cooperatives.

These objectives of appropriate technology determine the characteristics of technology, i. e., the technology constraints. The next step is to choose a particular technology which fits in this technology space bounded by constraints.[7]

The technologist has got a very major role to play. He should have leadership qualities, first to organise the rural poor for economic activity, to teach them the operational details and the various decision processes. He should slowly dilute his position as a leader by delegating authority to the group. Finally, he should make himself redundant and then withdraw from the group. Only a courageous person with vision can do this.

There has been an impression that Appropriate Technology means low productivity. Productivity is the ratio of output to input. This ratio can so as to have meaning only to 'value realisers'. They would try to reduce the input so as to reap more benefit. Because of the disparity between value adders and value realisers, the value adders are not motivated to use their entire potential in production process. But in an appropriate technology scheme, they would be motivated to produce more using entire skills, as value adders and value realisers are one and the same. Besides appropriate technology improves their skill through a process of voluntary participation. Hence only in an appropriate technology scheme, would productivity be the most. □

7. Some of the general constraints have been defined in a report on Appropriate Technology submitted by Prof. A. K. N. Reddy to United Nations Environment Programme, mimeo.

Nonformal Education and Training for Rural Development

Dennis A Rondinelli* & Kenneth Ruddle**

Education can play a crucial role in increasing productivity and promoting social changes needed to accelerate rural development. But in rural areas of much of the developing world, formal education, adapted or transferred from industrialised nations, has had little impact on stimulating rural development. Indeed, in many countries it has been dysfunctional. Dissatisfaction with formal educational systems—which often deny access to the majority of rural people or offer programmes of little relevance to their needs—has led to a search for educational and training programmes better suited to rural societies. This paper reviews some of the fundamental limitations of formal education for promoting rural development, explains the nature and characteristics of nonformal and informal approaches and outlines the features of an educational and training programme needed to stimulate rural productivity and economic growth in developing countries.[1]

LIMITATIONS OF FORMAL EDUCATION FOR RURAL DEVELOPMENT

Recent studies of education in the developing world have increasingly come to the conclusion that the highly formalised and institutionalised systems that provide universal education in urban, industrial nations have severe limitations in predominantly rural, agricultural societies. The problems lie partly in the nature of formal education, and partly in the special needs of rural people. Formal education, as Harbison observes, "connotes age-specific, full-time classroom attendance in a linear graded system geared to certificates, diplomas, degrees and other formal credentials. It is associated mostly with the young."[2] In addition, formal education is usually highly structured. Content is often abstract,

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1. The place of education and training in overall rural development is discussed in detail in Dennis A. Rondinelli and Kenneth Ruddle, *Urbanizaion and Rural Development: A Spatial Policy for Equitable Growth*, (New York: Praeger, 1978) Chapter 4.
2. Frederik Harbison, *Human Resources as the Wealth of Nations*, (New York : Oxford University Press, 1973), p. 52.

academic and theoretical, highly standardised and stresses enculturation and socialisation in the *status quo*. All, or most learners are assumed to have similar needs, interests and abilities, and the emphasis of classroom teaching is on individual competition and reinforcement of conforming behaviour. The knowledge imparted is usually cognitive (stressing information, facts and numbers), generally future-oriented and preparatory (often to establish eligibility for further schooling) and not directly related to improving occupational or functional skills. Knowledge is transmitted in small blocks, imparted over a relatively long period of time and delivered at standard locations. Moreover, knowledge is transmitted from teacher to pupils in rather inflexible, non-innovative ways, often depending on student memorisation of facts and numbers by rote, with testing as the mojor instrument of evaluation and standard of success and punishment used as a major incentive to increase learning motivation.[3]

Dissatisfaction with formal education in developing countries centres on a number of its deficiencies—its high cost, inability to meet rising demands, inappropriate methods and outputs, and unsuitability to improving the vocational skills of rural people. The sharply rising costs of education makes continued expansion of formal systems at past rates beyond the financial capacity of most developing countries. In all Latin American nations during the period from 1960 to 1968, for instance, the increase in expenditures on formal education exceeded the growth rate of GNP. Enrolments increased at a rate of more than 6 percent a year, but formal education expenditures leapt by more than 11 percent.[4]

Similar trends appear in East and South-East Asia, where the problems are exacerbated by high dependency ratios and rapidly increasing population growth in rural regions, creating greater demands for education. Coombs and Ahmed point out that the percentage of population under the age of twenty—the primary consumers of formal education—is sub-

3. See R. G. Paulston (ed.) *Nonformal Education: An Annotated International Bibliography*. (New York: Praeger, 1972). A detailed discussion can be found in T. Ward, L. McKinney, J. Dettoni, J. Emery and N. Anderson, "Planning for Effective Learning in Nonformal Education: A Learning Systems Approach," in T. Ward and W.A. Herzog, Jr. (eds) Effective Learning in Nonformal Education, (East Lansing, Michigan: Michigan State University Institute for International Studies, 1974), pp. 65-126.

4. World Bank, *Education Sector Working Paper* (Washington, The World Bank, 1971).

stantially higher in developing than in industrialised countries. In Korea and Thailand, for example, those under twenty years constitute 53 percent of the population, compared to about 30 percent in Western societies. In India, the under-twenty group makes up over 50 percent of the total, accounting for more than 280 million people.[5]

The dual pressures of rising costs and increasing demand exclude larger numbers of eligible people from obtaining formal education and reduce the quality of the education offered. Common problems appear throughout the developing world —insufficient numbers of instructors, outdated and irrelevant curricula, low salaries and inferior status for teachers, and high levels of drop-out among primary school pupils.

Of the many who are denied access to formal education in developing nations, the rural and urban poor, women, and older adults usually have the least hope of obtaining benefits from schooling. Formal education caters to and creates a small urban elite, highly trained but sometimes unemployable in economies that have grown too slowly to absorb their educated labour force. The World Bank observes that "emphasis on the development of the modern sector, providing employment to a small and intensively trained elite, leads to the neglect of the 60-80 percent of the population living in sectors characterised by traditionally lower productivity."[6]

Moreover, the very nature of formal education, its content and means of delivery, are usually unsuited to rural vocational or occupational requirements or for stimulating rural development. In agricultural areas, where children are an important part of the family work force, few can attend long years of formal schooling on a regular basis, and even if they could, the knowledge imparted beyond basic numeracy and literacy is usually unrelated to their potential work or functional needs. Moreover, the formal school system simply excludes the vast majority of rural adults in need of vocational training—young farmers and men in the productive age groups, women and mothers who are primarily responsible for child rearing and household management, but who also constitute

5. Philip Coombs and Monzoor Ahmed, *Attacking Rural Poverty: How Nonformal Education Can Help*, (Baltimore: The Johns Hopkins University Press, 1974), pp. 11-12.

6. World Bank, "Education," in *The Assault on World Poverty : Problems of Rural Development, Education and Health*, (Baltimore: The Johns Hopkins University Press, 1975), p. 273.

an important part of the agricultural labour force, small businessmen and-entrepreneurs, and those engaged in off-farm commercial and manufacturing activities. Their most important needs are immediate, skill oriented and not amenable to delivery through short standardised lessons delivered over long periods of time in a classroom environment. "The frustration with the expense, rigidity and perceived low quality of the programmes in the formal school system has perhaps been the greatest stimulus" to the search for educational alternatives, Adams notes. "Nonformal education is thus viewed as offering more flexibility in imparting skills and knowledge, more responsiveness in adjusting to changing needs or demands, and hopefully, a more equitable distribution of educational opportunities."[7]

NONFORMAL AND INFORMAL EDUCATION

Because of the limitations of formal education in accelerating rural development and meeting the needs and demands of rural people, many developing countries have turned to nonformal and informal educational programmes to supplement formal education in rural areas and to disseminate knowledge and skills to groups unable to participate in formal training.

Nonformal education is a varied set of organised activities such as agricultural extension, adult literacy, community improvement or skill development programmes, undertaken outside of a formal education system, providing selected knowledge to particular groups of people. It is usually concerned with achieving immediate and practical objectives, stresses immediate rewards and skill development, and is offered at sites that are convenient to participants and that provide appropriate job-related experiences. Testing and evaluation tends to be based on performance and the criterion of success is the ability to perform successfully the tasks and activities taught. Certification is generally of secondary importance and most participants join voluntarily, on a part time basis. They are not subjected to academic admissions criteria, but are selected on the basis of need or potential ability. Teachers are also selected on the basis of demonstrated ability to perform successfully those tasks or

7. D. Adams, "Forward," in Paulston, op. cit., p. vii.

activities to be taught rather than on academic credentials, and participants are actively engaged in learning and teaching.[8]

Evaluations of nonformal education programmes in agriculture, family planning, literacy, health and sanitation, industrial manpower development and apprenticeship training in a number of developing countries, Kleis found, produced four types of participant changes where the programmes were successfully conducted: 1) new information related to production systems, industrial jobs, community improvement and personal and family living conditions was acquired relatively quickly; 2) new and improved skills related to production systems, jobs, communication and ability to cope with community and family roles were obtained; 3) ability to plan and manage personal production, family and community affairs was increased substantially, and 4) particpants acquired a new openness to change; that is, as a result of training they sought out information and other knowledge relevant to a given problem, were able to generate their own knowledge through certain simple procedures, and became more willing to accept new ideas.[9] All of these objectives are fundamental for increasing productivity and economic growth in rural areas.

In addition, a great deal of knowledge in rural areas is acquired through informal education, which must also be considered as an important vehicle for rural development. Informal education is regarded as "... the lifelong process by which every person acquires and accumulates knowledge, skills, attitudes and insights from daily experiences and exposure to the environment—at home, at work, at play; from the example and attitudes of families and friends. ...Generally, informal education is unorganised and often unsystematic; yet it accounts for the great bulk of any person's lifetime learning."[10]

Traditional education—knowledge and skills passed on from older generations to younger through child rearing and on-the-job demonstrations—has rarely been perceived of as education, yet it plays a vital role in transferring well-organised information about rural life to succeeding generations. Although not abstracted from daily life, training for food

8. Russell Kleis, "Introduction," in R. Kleis, (ed.) *Case Studies in Nonformal Education*, (East Lansing, Michigan: Michigan State University, Institute of International Studies in Education, 1974), pp. 8-9.
9. Russell Kleis, "Summary and Conclusions," *Ibid.*, pp. 312-320.
10. Coombs and Ahmed, *op. cit.*, p. 8.

procurement, for instance, has analogs of most elements of formal education. In their study of child training for food procurement in the Orinoco Delta of Venezuela, Ruddle and Chesterfield found that subsistence communities have highly sophisticated and organised procedures. They found specific age divisions for task training, and different tasks being taught by adults in a similar and systematic manner, in a sequence ranging from simple to complex. Moreover, tasks were sex and age specific, taught by members of the appropriate sex, usually by kinfolk at sites and locations where they were to be performed. Reward and punishment were associated with certain tasks and successful accomplishment resulted in societal acceptance as a peer, and recognition by adults. Learned knowledge was directly applied to food procurement activities.[11]

Such training can be regarded as a process of cultural transmission deliberately organised to transfer information about subsistence activities. It could, with a greater understanding to its processes and techniques, be used to introduce information and skills that would increase agricultural productivity, and eventually commercialise subsistence system. Moreover, if traditional education is recognised as a legitimate vehicle for delivering knowledge and skills, even the world's poorest zones already have a substantial part of the resources to meet the diverse needs of rural people. Informal learning systems are rich in culture, tradition and practical teaching techniques and, if used innovatively, could contribute to increasing rural productivity. Informal education systems should also perform an intermediate function, however, serving as a point of entry into nonformal and, to a lesser extent, formal education in the local community.

Thus, for maximum development impact, education should be viewed as "learning" rather than as "schooling", and emphasise the needs of the learners. Formal, organised activities are clearly important, but nonformal education is crucial for meeting the learning needs of populations not served by formal systems. An innovative rural education system should weld together formal, nonformal and informal approaches into a system that reaches a majority of rural people. Such a composite system is inherently more versatile than each of its component parts and, therefore, more suitable for promoting rural development.

11. Kenneth Ruddle and Ray Chesterfield, *Education for Traditional Food Procurement in the Orinoco Delta*, Berkeley. University of California Press, 1977.

CHARACTERISTICS AND COMPONENTS OF A NONFORMAL EDUCATION AND TRAINING PROGRAMME FOR RURAL DEVELOPMENT

Two components of a nonformal education and training programme are needed to accelerate development and increase productivity in rural areas.

1) an organised means of diffusing innovation—new ideas, knowledge, information, skills and techniques—for agricultural, industrial and social services development on a broad scale to a large majority of people in rural areas ; and

2) specific training programmes designed to increase particular skills and knowledge for well-defined occupational or functional groups within rural areas, such as small-scale farmers, out-of-school adolescents, craftsmen, or small businessmen. The two components have somewhat different characteristics, preconditions and requirements for success, but they should be mutually reinforcing in an overall programme for rural development.

Innovation Diffusion and Extension Programmes

New technologies are needed in most developing areas to raise levels of agricultural and manufacturing production and to deliver more widely and efficiently the social services essential to increasing individual productivity. Adoption of new technology depends on the success of programme for diffusing innovation. Diffusion, the process by which innovations are communicated to members of a social system, is primarily a communication process. Indeed, as Rogers and Shoemaker suggest, "perhaps all analysis of social change must ultimately centre primary attention upon communications processes. In fact, all explanations of human behaviour directly stem from an examination of how individuals acquire and modify ideas through communication with others. The learning process, the diffusion process, the change process... all basically involve the communication of new ideas."[12] A communication system for innovation diffu-

12. E. M. Rogers and F.F. Shoemaker, *Communication of Innovations*, (New York: The Free Press, 1971), p. 11.

sion consists of six elements : a source, a message, transmitters, channels, receivers and feedback.

1. *Source*: The sources of new industrial or agricultural technologies are often an institution specialising in experimentation and adaptation—such as the scientific laboratories of agricultural research stations, industrial testing laboratories or agricultural information centres—private agribusinesses or industrial firms in routine attempts to improve their products, or the discoveries of individual inventors. In rural development programmes, institutions must be established specifically to search for and test innovations. In Kenya, for example, a network of some 30 research stations, complemented by widely dispersed experiment substations, conducts applied research in agriculture and livestock production—in such areas as animal crop breeding, plant pathology, soil and agriculture chemistry and mechanisation—conducts agronomy and fertiliser trials, and tests new techniques of farm management. Information is coordinated, for extension purposes, through the Agricultural Information Centre.[13] Realising the importance of having sources of innovation and institutions to test new agricultural technologies under local conditions, most developing countries have established some form of agricultural research system.

2. *Message*: Development of subsistence agricultural systems or promotion of agro-processing industries requires that messages concerning new ways of cultivating, fertilising, harvesting, processing, marketing and distributing agricultural goods must be transmitted to farmers and potential entrepreneurs in order to make them aware of new possibilities and opportunities. Messages may be selected and abstracted by the transmitter—usually a government agency or extension office—or they may have stimulus characteristics that do not require a transmitter. If the transmitter chooses the messages, with the intent of modifying farmers' attitudes and behaviour, it is an example of "deliberate education." Of course, rural people may interpret a message in ways other than intended, or simply ignore information designed to change their attitudes or behaviour. Such information

13. See P. Mbithi, "Issues in the Transfer of Useful Knowledge in Agricultural Development in Kenya," *Agricultural Administration*, Vol. 1, No. 4, (October 1974), pp. 285-299.

passed through a communication channel, is considered "nondeliberate education."

3. *Transmitter* : Extension agents and local opinion leaders are the main types of message transmitters in the diffusion of innovation in rural areas. Characteristically, an extension agent is formally trained to compile, transmit and assist in the application of information concerning agricultural development in rural areas; but village elders, influential community leaders or "progressive farmers" may also serve as transmitters. Although little is known about the nature of small community opinion leadership, (an important topic which has, surprisingly, been largely unstudied by those attempting to accelerate rural development), it is generally acknowledged that opinion leaders are those members of a community who, operating informally, are able to influence the attitudes, and, eventually, the overt behaviour of others in a way desired by change agents. Opinion leaders play an important role in the diffusion of innovation by serving as intermediaries between the sources of innovation and the larger population. Effective opinion leaders often are able to disseminate messages to much wider audiences than could extension agents or training programmes.

4. *Channels* : As noted earlier, two main types of channels exist in most development programmes: deliberate and nondeliberate. Deliberate channels are those created by the transmitter to relay specific messages. These channels may be used to provide information about such things as crop spraying or availability of credit. Channels most widely and consciously used by extension agents to transmit messages to farmers are formal meetings, inspection visits, pamphlets and demonstrations, public and official notices and instructional classes. Radio and other mass media are also frequently used to reach large numbers of people. As Figure 1 illustrates each channel has somewhat different purposes and uses.

A nondeliberate channel is one in which a message is perceived and interpreted by the receiver when no message was intended. Construction of a dam to control flooding in a river valley, for instance, might coincide with villagers experiencing poor fishing immediately after the dam's completion. If local people believe that the dam prevented the normal migration of fish and that it was part of a scheme to destroy their livelihood, the construction programme would serve as

Figure 1

Use of Channels in the Diffusion Process

Channel	*Definition*	*Principal Use*
(a) Formal Meeting	Prearranged gatherings, structured in terms of time, place, attendance, between development programme official and "target" population.	Present titles; credit proceedings, schedule agricultural work; vaccinate livestock, bring machinery and other inputs to fields.
(b) Inspection Visit	Scheduled or unscheduled visits by officials to examine progress of a project or its element.	Public relations; administrative verification of progress.
(c) Pamphlets and Official Notices	Written information or instructional guidelines	Propaganda; notices for future activities/actions; admonitions.
(d) Demonstrations	Nonrepetitive practical field instruction of new technologies, followed up by reinforcement visits.	Demonstrate aspects of new agricultural technology, e.g., sowing, weeding, application of fertilisers and herbicides.
(e) Classes	Periods of instruction held at fixed locations.	Each class is designed to present a body of information on new technology in accordance with a teacher's curriculum. Classes should be additive and sequential.
(f) Mass Media	Radio, T.V., Newspapers.	Reinforcement; advice; explication.

a nondeliberate channel. Deliberate channels can function as nondeliberate channels if the receiver perceives the message differently than intended by the transmitter.

5. *Receivers*: Receivers are the population groups at which messages are aimed.

6. *Feedback*: Attitudinal and behavioural responses to messages and situations created for their delivery comprise feedback, which should be used by extension personnel to evaluate the effectiveness of a delivery system and as the basis for modifying it.

The success of innovation diffusion programmes depends on a number of preconditions and requirements that must be taken into consideration in their design. Studies indicate that in order for a dissemination programme to be successful, the innovation must be proven effective locally, the change agents' competence (both technical knowledge and communications skill) must be recognised and accepted by villagers, the agents must be persistent, dedicated and exhibit strong leadership ability, and supplementary supplies and equipment necessary to make the innovation work must be readily available to adopters. Moreover, the innovations must be compatible with the biophysical environment into which they are introduced; adverse climatic conditions, inappropriate soil or the presence of debilitating pests and diseases that reduce the effectiveness of the innovation create skepticism or hostility among rural people. In addition, experience indicates that innovation is more likely to be accepted in rural areas where people have been previously exposed to and have accepted other innovations, where at least some portion of the community is highly motivated or generally open to acceptance of change, and where traditional attitudes, institutional structures, or customs do not impose overwhelming social costs on early adopters. Above all, adoption of the innovation must prove economically profitable to those who employ it.[14]

Many of the problems of innovation diffusion in rural areas are closely related to those of extension education. The problems most commonly encountered are the attitudes and behaviour of the extension agent, the nature of the agent's job, lack of information about the local community, failure to understand the human ecosystems in which they are intervening, and operational impacts of programme design errors.

14. See David Hapgood (ed.), *Policies for Promoting Agricultural Development*, (Cambridge: MIT Centre for International Studies, 1965); Rogelio V. Cuyno, "Nonformal Education for Rural Agricultural Development," In Kleis, *op, cit.*, pp, 25-52; and Development Alternatives Inc., *Strategies for Small Farmer Development: An Empirical Study of Rural Development Projects*, (Washington: U S Agency for International Development, 1975).

A recurrent problem in the relationship between extension agents and local populations in many rural areas is the agents' sense of elitism. This is especially important in countries such as India where the caste system has been strong and where a professional civil service drawn largely from upper socio-economic classes has a long tradition.[15] This almost universal problem was described concisely by Chesterfield and Ruddle in their study of Venezuela's Orinoco Delta:

> Galling to the peasants is their perception of the agents' sense of superiority and maintenance of social distance. The islanders are always spoken to with the familiar "tu" whereas the agents insist on being addressed as "doctor." The perception is reinforced because the agents never leave their jeeps to visit the houses, but, instead, beckon members of the household to their car. They seldom show any of the normal Venezuelan signs of friendship such as an *abrazo* or the slapping of arms. The seemingly foppish cleaning of town shoes with a paper handkerchief to remove the mere suggestion of mud and the taking of fruit without asking are other perceived manifestations of the extention agents' sense of superiority."[16]

Other problems arise from the urban backgrounds of many extension agents, and their lack of identification with the rural communities to which they are assigned. In many cases, agents refuse to live in rural areas, preferring to travel (as infrequently as possible) from the nearest town to their field sites. But in countries where agents live as well as work in close contact with farmers the rate of adoption of innovations tends to increase.

Still other problems arise from the nature of the agents' job. They are generally too swamped with a miscellany of unrelated, time-consu-

15. The problems of extension in India are well illustrated in Stanley J. Higgenbotham's *Cultures in Conflict: Four Faces of Indian Burearucracy*, (New York: Columbia University Press, 1975).

16. R. Chesterfield and K. Ruddle, "Nondeliberate Education: Venezuelan Campesino Perceptions of Extension Agents and their Message," in T. J. Labelle (ed.) *Educational Alternatives in Latin America*, Latin American Center Publications, Vol. 30 (Los Angeles: University of California, 1975). p. 153.

ming administrative tasks to pay proper attention to extension activities. This may well account for the superficiality of many pre-extension work surveys, and lead to the mis-identification of opinion leaders and to faulty analysis of the human ecosystem into which they attempt to introduce innovation. But perhaps the biggest block to successful diffusion of innovation is the extension agents' lack of understanding of traditional methods and procedures and time-honoured ways of using renewable natural resources. In reality, many traditional food procurement systems represent sophisticated ways of manipulating available resources. But often extension aims at a total replacement of time-honoured practices, which are fully understood by cultivators, with one that is considered by agents to be more modern and therefore better. Thus, despite the aspirations of those involved in extension work, many projects are doomed to failure given the agent's *a priori* attitude that all traditional practices are inefficient, maladaptive and unsophisticated.

Implicit in these problems are important characteristics of a successful nonformal education system for innovation diffusion:

1. To reach those most in need of assistance, extension programmes should be active rather than passive; that is, instead of responding to client demand, which favours large producers having the wherewithal to take advantage of modern inputs, change agents must actively seek out poorer farmers and cultivators.

2. Intimate participation of extension agents in community life may lead to a better understanding of the potential for development in those villages to which they are assigned. In understanding the needs and problems of local communities, they might become better able to use existing practices and institutions as instruments of change. They might build on reciprocal work relationships, for instance, to form agricultural cooperatives, and seek out the advice of older respected men for their agricultural expertise and employ them as aides in extension work. The use of culturally imbedded practices and institutions to disseminate innovation can be an effective and low-cost educational technique.

3. The position of the potential adopter within his own community must be thoroughly understood. In many cases of programme malfunc-

tion, those who were approached as opinion leaders and "early adopters" by extension specialists have not been real influentials, and were ostracized by their communities when they embraced new ideas, methods or techniques.

4. The "trickle down" of innovation adoption from progressive to late adopters usually does not always occur unaided in rural communities. Instead, the diffusion process within rural areas must be consciously facilitated by small group training session, generally with farmers of the same community and status, supported by regular follow-up sessions and demonstrations.

5. As far as possible, established local organisations or traditional institutions should be responsible for extension education work in a community. It is often useful to assign extension agents to existing local organisations rather than establishing new ones for training or other dissemination activities.

6. Close involvement of rural people in extension programme design and implementation appears to be esesntial for success. Agent and farmers must discuss local needs and problems in advance of technical assistance. The discussions, if properly conducted, allow farmers to express their problems as community concerns best handled through community action, making them feel self-reliant and creating a more equitable relationship between farmer and agent. Later, demonstration centres can be established. If genuine desire for change is aroused, then selected volunteers may try out innovations, determine successes and failures through self, evaluation, and identify the problems to be overcome by modifications. At this stage, the extension, agent is consulted as an adviser, and successful innovators are trained to take over the role of instructor for other groups who will test the innovation later.

Rural Development Training Programmes

Rural development is not likely to be self-sustaining without a range of diverse yet related training programmes to supplement innovation diffusion activities. Training can be an important mechanism for involving local people in the development process and for modernising traditional institutions.

Training programmes for rural development must take a number of forms aimed at a variety of groups within rural areas :

1. *Participant Training Programmes* : Although "popular participation" is a goal of most rural development projects, it is rarely achieved in practice. Projects calling for client population involvement in planning and in assessing local needs often emphasise that such participation can develop the self-reliance needed for accelerated rural development. But when projects are implemented local participation often falls by the wayside or, at most, is limited to token activities. In many cases rural people are not even informed of projects that are to be undertaken in their communities or, if they are, it is generally perfunctorily through either formal public meeting or notices and bulletins, or via mass media. But if rural people are truly to participate in development projects, they must be informed of objectives, methods and procedures, trained in tasks and activities required to achieve project goals, and given the opportunity to influence project design and implementation. Moreover, to the extent that local people can be recruited for positions of responsibility in project implementation, they may be better able to assess realistically the methods most suited to local conditions and needs.

2. *Functional Literacy Programmes* : Self-sustaining rural development, requires that at least some adult members of a community be functionally literate. The inability of illiterate farmers to defend their interests at market or to keep accurate records, is a cause of many failures in rural development projects. Although illiteracy is a major constraint on rural development, relatively few development projects include adult literacy programmes. Where they have been tried, however, they contribute substantially to increasing communications and understanding of both development problems and project objectives. Imaginative variants of this idea, which convey the rudiments of numeracy and standard symbols but make no attempt to teach people to read, involve the use of traditional village theatres. In some countries, for example, village theatrical techniques are used to include farmers to act out and repeatedly rehearse marketing scenes and encounters with credit agents, so that when the real situation arose, they avoided being duped. Clearly, the traditional theatre has wide application to the transmission of development messages, as evidenced by its widespread use in the People's Republic of China and the social commentary written into many rural dramas in Indonesia.

3. *Vocational Training* : In most rural regions with high seasonal unemployment or underemployment, properly designed training programmes teaching non-agricultural skills could contribute greatly to the reduction of joblessness. The range of new skills needed in rural areas include those for workers in agro-industries, for routine maintenance of physical infrastructure such as roads, construction work, and machinery and equipment repair. Other programmes should seek to upgrade such traditional skills as carpentry and blacksmithing to make them more relevant to the demands of a modernising region. Programmes based on upgrading traditional skills appear to be more successful than those teaching new ones, since they build on the familiarity with traditional tools and meterials and show a greater comprehension of how modest, sequential, and additive improvements to time-honoured ways contribute to development. A programme in one developing country which trained local blacksmiths to repair cultivating machines, ploughs, and other modern agricultural implements, and later to manufacture simple spare parts for them, was so successful that some smiths bought welding equipment and began to repair bicyles and motorcycles.[17]

4. *General Education* : In addition to participant and vocational training, programmes are needed to provide basic literacy and numeracy for school drop-outs, out-of-school youth and adults. Such training should also cover general education subjects needed by participant to function effectively as active members of their community. A number of rural people who cannot attend school on a regular basis still desire to achieve literacy, and general education programmes suited to their needs and constraints must be a part of an overall nonformal education programme for rural development.

5. *Women's Training Programmes :* In almost all developing countries programmes aimed at preparing rural women to participate in development focus on child welfare, nutrition, meal preparation, home economics, hygiene, door-yard gardening, domestic livestock raising and sometimes handicrafts. But other forms of training are also needed. Uma Lele notes in many developing countries women "have constiuted an important part of the productive labour force; yet their participation

17. See Uma Lele, *The Design of Rural Development*, (Baltimore : The Johns Hopkins University Press, 1975).

in agricultural training has been very limited."[18] To the extent that women contribute an important part of the agricultural labour in rural areas or are primarily responsible for sideline production, they must be included in agricultural training programmes if productivity is to be raised. Moreover, in many countries women dominate some type of small businesses and commercial activities and would benefit from basic business and management skills training.

6. *Agricultural Training Courses* : The most common nonformal training programmes found in rural areas are those in agricultural development. They generally disseminate information about improved seed varieties, methods of cultivation, marketing and storage methods, credit availability, fertilising and irrigating techniques, and overall management. Usually, however, information dissemination alone is ineffective, and training must focus on application of knowledge in field situations, demonstration of new techniques and methods, supervision and field assistance, and be supplemented by regular evaluation and follow-up aid. Training should also address methods of sideline production and be made available through both short courses and longer-term training and extension courses that are geared to the crop patterns and planting and harvesting cycles found in different rural regions.

7. *Small Entrepreneur and Business Management Training* : Finally, training programmes are needed for workers in and owners of small commercial and manufacturing operations, handicraft and cottage industries, and agro-processing or agribusiness establishments. The training should be suplemented with programmes in entrepreneur identification and development, and the procedures and requirements for establishing and operating small businesses of various kinds usually found in rural communities.

Undoubtedly, there are other groups in rural communities who would also benefit from informal or nonformal training and education. But the point to be emphasised in concluding is that an educational system suited to rural development must possess the following characteristics :

a) it provides or improves skills and knowledge related to fundamental needs of rural people and builds on those already familiar to them;

18. *Ibid*, p. 168

b) it addresses the needs of all potential clients—adult males and females, out-of-school youth and children;

c) it is flexible in design, building on the inherent advantages of nonformal and informal education in rural communities and can be readily adapted to changing needs and circumstances;

d) it is coordinated and incorporates the work of public, private and volunatry organisations; and

e) uses teachers who are familiar with the needs of, and able to communicate with, rural people and who are willing to employ educational methods based on dialogue, mutual learning and performance. Such an educational system can make an important and lasting contribution to increasing productivity and raising levels of living in rural areas of developing countries. □

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Rural Energy Scene in India

Lalit K. Sen*

In the extant literature on energy use, per capita energy consumption has been considered a reasonably reliable index for measuring a country's economic development and standard of living. It has been observed, for example, that there is a strong linear relationship between per capita income and per capita energy consumption. By available statistics, India's per capita income and energy consumption are among the lowest in the world. Some relevant data are presented in Table 1.

Table 1: Annual Per Captia Income and Energy Consumption in a Few Selected Countries

Country	*Per Captia Income (in U.S. dollars)*	*Per Capita Energy Use (in Millon BTUs)*
U.S.A.	3,700	400
Canada	2,200	300
Sweden	2,800	200
U.K.	1,400	175
France	1,800	100
W.Germany	1,500	150
Japan	1,100	100
Mexico	500	30
Brazil	300	25
India	150	15

Source: U.S. Dept. of the Interior, *United States Energy : A Summary Review*, Washington, 1972.

It may be noted, however, that comparative statistics on energy consumption in all developing countries, including India, are incomplete because, for the most part, these figures reflect only the use of commercial energy (coal, petroleum and electricity). Although data on

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Views expressed in this article are the author's own and do not necessarily reflect those of his organisation.

the use of non-commercial energy are difficult to obtain, it is known that in India about half of the total energy consumed comes from traditional and non-commercial sources, a fact which is rarely recorded in official statistics and international comparisons. The linear relationship between per capita income and energy use (including energy from traditional and non-commercial sources) may, however, still be valid because of the poor efficiency and low productivity of all human, animal and non-commercial sources of energy.

Data on the total consumption of commercial and non-commercial energy for the entire country as well as per capita consumption are presented in Table 2.

Table 2 : Commerical and Non-commercial Energy Consumption in India.[1]

Source of Energy	*Total Consumption (million tonne coal replacement)*			*Per Capita Consumption (tonne coal replacement)*		
	1964	1974	1977	1964	1974	1977
Commercial Energy						
Coal	48.56	56.47	66.80	0.104	0.097	0.107
Pertroleum and Allied Products	59.00	116 59	129.10	0.127	0.201	0 206
Electricity	25.25	55.80	71.90	0.054	0.096	0.115
Total	132.81	228.86	267.80	0.285	0.394	0.428
Non-Commercial Energy						
Firewood	112.67	125.39	145.00	0.242	0.216	0.232
Dung Cake	16.68	14.35	30.00	0.036	0.025	0.048
Vegetable Waste	30.77	36.70	45.00	0.066	0.063	0.072
Total	160.12	176.44	220.00	0.344	0.304	0.351
Grand Total of all Energy Sources.	292.93	405.30	487.80	0.629	0.798	0.779

Sources : 1) Satish Chandran, T. R., "Outlook for Energy in the Coming Decade", *Commerce*, Annual Number, 1977.
2) Mahendru, R.G., "Return of King Coal", *Ibid.*

1 Data used in this table have been drawn from the 18th and 28th rounds of the *National Sample Survey*.

It may be seen that the total consumption of energy in million tonne coal replacement value (MTCR) has gone up from 292.93 to 487.80, during 1964-77. The per capita consumption during the same years has gone up from 0.629 to 0.779 in tonne coal replacement value (TCR). Although the proportional use of non-commercial energy shows a decline over the 13-year period—55% in 1964, 50% in 1974 and 46% in 1977—it still accounts for a very large component of our energy use. In aboslute terms, there is an increase in both commercial and non-commercial energy use, but the increase in the use of commercial energy has taken place at a higher rate.

This higher rate of increase in the consumption of commercial energy is symptomatic of the growth of our urban industrial-cum-commercial complexes. As can be seen (Table 3), the lion's share of commercial energy is used in urban industrial-cum-commercial activities. The only exception is kerosene which is extensively used in rural areas for domestic lighting. Agriculture accounts for only 4.6% of the total commercial energy used in the country.

Table 3 : Sector-wise Consumption of Commercial Energy

Sectors	*Energy Consumption (in coal replacement)* %
Mining and manufacturing	38.9
Transport	32.4
Domestic	18.1
Commercial, Govt. etc.	6.0
Agriculture	4.9
Total	100.0

Source : Parikh, K.S., *Second India Studies : Energy*, Macmillan, India, 1976.

Patterns of Energy Use in Rural India

A comprehensive analysis of the pattern of energy use by sources in rural India is yet to be made. Although the general pattern is well-known, precise data are not easy to come by. One major source of

information is Revelle's article on "Energy Use in Rural India" published in 1976.[2]

According to Revelle, of the total energy used in rural India (11.42 x 10^{14} kcal), the share of human and animal power is 15%, non-commercial sources (firewood, cattle dung, agricultural waste, etc.) 65% and commercial energy 20%. Thus 80% of our rural energy still comes from traditional and non-commercial sources. Activity-wise, the proportional uses of commercial and non-commercial energy including human and animal power) are as follows:

Activities	*Commercial Energy*	*Animal-human Power and Non-comercial Energy*
Agriculture	23% (Fertiliser—14% Diesel — 3% Electricity— 6%	77%
Domestic (Cooking, house work etc.)	2% (Coal)	98%
Lighting	100% (Kerosene—87% Electricity —13%	Nil
Non-agricultural work (pottery, brick-making, metal work, carpentry, bleck-smithy etc.)	Nil	100%
Transportation etc.	Nil	100%

Revelle also reports on the quantum of energy use in Kcal in different activities. These activities and the energy used are ranked below:

Activities	*Energy used (Kcal)*	%	*Per capita (Kcal)*
Domestic (Cooking, housework etc.)	7.31 x 10^{14}	64.0	4.55 x 10^3
Agriculture	2.52 x 10^{14}	22.0	1.57 x 10^3
Non-agriculture work (pottery, brick-making, metal work, carpentry, black-smithy etc.)	0.76 x 10^{14}	7.0	0.47 x 10^3
Lighting	0.48 x 10^{14}	4.0	0.30 x 10^3
Transportation etc.	0.35 x 10^{14}	3.0	0.22 x 10^3
Total	11.42 x 10^{14}	100.0	7.11 x 10^3

2. Revelle, R., "Energy use in Rural India", *Science*, June, 1976.

These data clearly show the rural-urban dichotomy in energy use. We have seen that 80% of rural energy comes fron traditional and non-commercial sources, whereas in urban areas the situation is reverse. The energy balance between commercial and non-commercial sources and between rural and urban areas is the result of a long and complex process of impoverishment of the countryside. Because of the continuous shifting of the definition of poverty, it is almost impossible to come to a definite conclusion about the proportion of people below the poverty line. Depending upon the criteria adopted, the figure for the rural areas could lie anywhere between 46% to 70%.[3] For these people with a per capita income of less than Rs. 20 per month, the only viable alternative energy sources are those which are either completely free of cost or very cheap. Data presented here also indicate that in Indian villages the most energy-intensive activity is cooking. About two-thirds of the total energy used is spent on this activity. Only 22% is used in agriculture, 7% in village industries, 4% in lighting and 3% in transportation. These figures, more than anything else, portray the level of subsistence in Indian villages. In a developed situation, the order would have been reversed with industry, agriculture and transportation coming at the top and cooking and domestic lighting remaining at the bottom. Cooking in a subsistence situation takes the highest priority for sheer survival and some form of energy is necessary for it. Other activities can be neglected not out of choice but out of economic compulsion.

As seen from the data, cooking in Indian villages is done almost entirely with firewood, animal dung cakes and agricultural waste. Because these are available free or at a very nominal cost, it will be foolish for any family to use expensive commercial energy such as liquid petroleum gas (LPG) or electricity even if these were available. Yet, the tremendous pressure on firewood is denuding our dangerously shrinking forests causing destructive soil erosion and floods.[4] The individual consumer of firewood, unfortunately, does not connect the cause and effect between burning firewood and floods. It is too remote a relationship and the compulsion to collect free fuel for survival is too great. Burning animal dung cake as fuel destroys valuable organic

3. See for example, Johri, C. K. and S.M. Pandey, "Dimensions of Poverty and Incomes Policy", *Indian Journal of Industrial Relations*, July, 1978.
4. For a State-wise break-up of the loss in forest areas and reasons, see the "Documentation Column" in *Voluntary Action*, December, 1978.

manure. The cause and effect here is much more direct and easily understood. Yet, the compulsions of obtaining free fuel overrides all other considerations.

In agriculture, 77% of the required energy is derived from animal and human power. The small component of commercial energy (23%) is used in the from of chemical fertilisers (14%), electricity (16%) and diesel (3%). The higher percentage of animal and human energy use in Indian agriculture is again understandable because of an abundant and cheap supply of labour and animal power. The use of the small amount of commercial energy is naturally limited to those farmers who can afford the price. The question of using or not using commercial energy in agriculture does not evoke as clear-cut an answer as in the case of cooking. It is a proven fact that electricity or diesel help bring more acreage under irrigation and that chemical fertilisers increase productivity. These inputs are also essential for growing high-yielding varieties of crops. From the point of view of society, these inputs increase employment instead of decreasing it by encouraging multiple-cropping in place of single cropping. Thus, while commercial energy is more expensive, the return is greater. The only difficulty a farmer faces is in raising enough funds for the initial capital investment on a pumpset or on the first purchase of chemical fertilisers.

Non-agricultural activities such as pottery, brick-making, metal work, carpentry, blacksmithy etc., are entirely dependent on traditional and non-commercial sources of energy. Unlike in agriculture, the low productivity and low efficiency of these sources of energy have affected the very survival of this sector. Unable to withstand competition from manufacturing industries there is a continuous depletion of numbers among village artisans, many of whom annually join the already large body of landless agricultural labourers.[5] Whether mechanisation of village crafts with the help of commercial energy will stop the decline of this sector is difficult to say. Adapting traditional equipments to an electric or a diesel motor requires specialised knowledge and initial capital, aside from funds to pay for the energy.

5. Asok Mitra presents a convincing and factual argument on this point. See his paper on "The Status of Women: Employment and Literacy" (Mimeo), Centre for Regional Development, Jawaharlal Nehru University, 1976.

Official help in this regard is tardy, in spite of vocal commitments to help the artisans. It is more likely that the existing situation will continue until artisan products become a novelty and a large market at competitive prices is found among urban consumers.

The only sector of village life where commercial energy has completely replaced non-commercial energy is domestic lighting. Kerosene, a petroleum product, accounts for 87% of light energy while electricity provides the remaining 13%. In spite of its erratic supply and relatively high price, kerosene is still the cheapest lighting fuel available. High oil seed prices have completely eliminated other oils as lighting fuel. Electricity tariff for domestic lighting is high although the intensity of electric light is higher than kerosene lamps. A large number of households in the villages severely ration their kerosene consumption by using only one lamp for only a few hours. It is not improbable that many go without any lights for few days in a month.

Transportation in villages is based entirely on animal and human power (bullock carts, walking and bicycling). These modes of transportation are time-consuming but economical. Normally, the same bullocks are used for agriculture also. Walking, of course, is free, unless undertaken by hired persons. For a long time to come, this sector may draw upon the same sources of energy without any damage to an expanding village economy and without additional investment on roads required by automobiles. The need for a change will be felt only when time and speed acquire a special value. At the present time and perhaps for a long time to come, this will be the least of villagers' problems.

Future Outlook : Appropriate Sources of Energy

The existing energy situation in rural India is, therefore, a part of the well-known vicious circle of low energy input, low productivity and poverty. Even this low energy input is mostly for such non-productive activities as cooking for reasons of sheer survival. Although the private cost of this energy (firewood, animal-dung etc.) is practically zero for the user, the social cost is heavy. In productive activities such as agriculture and village industries, energy input is negligible.

The lack of purchasing power of the rural consumer has been the legitimate concern of many energy specialists. However, if this

becomes the dominant consideration for future energy planning, then there is no way other than breaking the vicious circle and changing the *status quo*. There is a school of thought which suggests that the people are the best judges of what energy they should use. The current situation according to this school of thought is a result of people's rational choice based on their ability to pay. If the economic conditions improve, energy consumption will also increase. There is no need, for example, to spend millions of rupees on rural electrification which is too expensive for the society and which the people can hardly afford. In short, the energy problem of the country should be solved by the market forces of demand and supply. The best among these energy specialists have been suggesting several alternative sources of energy, many of which are of dubious practical value.

There are several things wrong with this argument. The economic status of more than half of our rural population is such that they depend entirely on free fuel collected by muscle power. Earning less than Rs. 20 per head per month does not leave much scope for *any* source of energy including some of the oft-quoted fashionable alternatives. Secondly, if left to the market forces of demand and supply, the situation will get worse, not better. The rapid increase in population, international uncertainties about oil, our dwindling forest reserves and a host of other factors will ensure that. However, the greatest difficulty with this argument is that it completely misses the point of development and the State's role in it. Caught in the vice of the vicious circle of low energy input, low productivity and poverty, the private consumer in a developing country has very few options. Yet it is well-known that unless a large part of human and animal labour as well as highly inefficient and wasteful sources of non-commercial energy are gradually replaced wherever necessary by more efficient and more productive commercial energy, there will be no economic development.[6] This is not to deny the economic compulsions of the moment or several other human, institutional and technological constraints. As in other fields of development, it is the State's responsibility to take the major burden of defining and spearheading the most appropriate forms of energy. The financial risk involved in the initial stages is so great that only the State can absorb it until the vicious circle is reversed.

6. National Academy of Sciences, *Energy for Rural Development*, Washington D.C., 1976.

It is not to suggest here that the country should follow a policy that completely switches over to commercial energy either immediately or in the distant future. Such a policy is neither practical nor desirable. It is not practical because of the zero purchasing power of more than half the rural population. It is not desirable because of the well-known harmful and negative effects of some commercial sources on the environment and on employment. It will also tie us down to eternal dependence on oil-producing countries. What is necessary is a sector by sector analysis of energy needs and the most appropriate sources (commercial as well as non-commercial or a combination of both) that might provide the required quantum of energy. Full attention must be also paid to the potential alternative sources of energy such as solar energy, wind power and bio-gas which might possibly fit into total energy picture even in the remote future.[7] The intervention of the State in defining, planning and intitiating the optimum mix of appropriate sources of energy is necessary because no profit-oriented commercial enterprises will undertake losses for long stretches of time for the ultimate good of the society. Only the State can play the role of a development agent.

Before analysing the energy needs of different sectors of village life and the appropriate sources of energy that might provide the required inputs, it would be proper to briefly examine the concept of "appropriateness" in the rural context. Past studies on the adoption of innovations in rural India and other developing countries point out a few essential characteristics of innovations which are considered acceptable by the rural population.[8] Some of these characteristics are :

(1) technical feasibility—they should do what they are expected to do;

(2) simplicity of operation—they should not be so complex that village people require long training to understand, repair and maintain them;

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7. *Ibid* : See also UNIDO, Report of Working Group No. 11 on Appropriate Technology for Rural Energy", *International Forum on Appropriate Industrial Technology*, held in New Delhi November, 1978.

8. *Annotated Bibliography on Diffusion of Innovations in Rural Societies*, Department of Communication, Michigan State University, 1970.

(3) profitability—elementary and intuitive benefit-cost analysis by village people should convince them of their desirability;

(4) low cost—the capital as well as the operation—maintenance cost should be lowest of all alternatives, and finally,

(5) social acceptability—it should not do violence to the cultural, religious and social practices of a community.

From the point of view of society, the following considerations are important. Appropriate innovations should not damage the enviornment and upset ecological balance. They should not accentuate the existing social cleavages, and they should be accessible to the poorer sections of the population. In a labour-surplus situation, they should not only not displace labour but provide more employment.

Appropriate Energy for Various Sectors

For a comprehensive analysis of rural energy needs, one should study these needs in the five most important sectors of village life : cooking, agriculture, rural industries, lighting and transportation. For reasons of space, however, we shall make a depth study of only the first two sectors which account for more than two-thirds of our current energy use.

1) Cooking

We have seen earlier that in Indian villages, two-thirds of the total energy in use is spent on cooking by burning firewood, animal dung cake and agricultural waste which can be collected free of cost. Cooking is the most essential activity for survival and is also the most energy destructive sector. In the rural context, top priority must, therefore, be given to finding substitutes for these valuable resources. Of the three major commercial sources namely, coal, petroleum, and electricity, none is suitable for the simple reason that they are either too expensive or are not available. A very small percentage (2%) use coal only when it can be collected free from steam engine wastes or nearby coal pitheads.

Solar energy holds out high hopes as it is readily available in a sun-

blessed country like India. Simple and relatively inexpensive solar cookers which directly convert sunlight into heat have been designed for rural use. The cheapest model built by a staff member of ICRISAT in Hyderabad, costs only Rs. 50. For those families who would find even this low one-time expenditure too heavy, one could think of distributing these cookers at a subsidised rate or even free. It is always a wise policy, however, to charge a nominal price in order to establish the credibility of an innovation. If the price charged is Rs. 10 then in an average village of 200 families, 100 families (50%) will pay Rs. 1000, wheareas the actual cost will be Rs. 5000. The difference of Rs. 4000 will have to be subsidised either by the village panchayat or by the state government. The total cost for 5,76,000 villages will be Rs. 230.4 million—an average Rs. 10 million per state. Considering the amount spent on relief and reconstruction after every annual flood, this expenditure is not only small but a wise long-term investment.

Before a large-scale programme of solar cookers is launched, it will however, be wise to review the reasons for the failure of earlier programmes. There were technical difficulties on cloudy or rainy days but these were not insurmountable. All that needed to be done was to fall back on firewood etc., for a couple of months. The problem which was found most difficult to solve was sociological. The solar cookers have to be used outdoors to catch direct sunlight and village women found that this is a violation of their privacy. Although in small communities there is no secret about neighbours' eating habits, village women found it revolting to deliberately advertise them. Ritual cleanliness, a cultural imperative was also difficult to observe. Normally after cooking, cow-dung or plain water is smeared over the *Chula* (mud oven). With solar cookers this is not possible and one is forced to use a "dirty" oven polluted by yesterday's cooking. In order to be accepted, a solar cooker must be placed inside the home with a collector located outside. Since the collector will be separated from the cooker and out of sight, it will not be considered unclean. The cooker itself can be "cleaned". Technical difficulties in transmitting heat through a metal rod or liquid can be solved but the cost will go up and the cooker will require some maintenance. At the present time, the available solar cookers are not useable for reasons mentioned above. More research is needed to make them socially acceptable and economical.

Another relevant agent for cooking in Indian villages is bio-gas which can be produced from animal dung, agricultural waste, weeds such as water hyacinth and even human excreta. This certainly will cut down on the heavy consumption of firewood and animal dung. The nitrogen-rich residue of dung after gassification can be profitably used as organic manure and even as a subsititute for energy-intensive chemical fertilisers, to a great extent. In India, cattle dung is preferred as the raw material for bio-gas plants because there is no religious or social inhibition in using it for cooking purposes. Cow-dung has been traditionally used in village homes for cleaning floors and Chulas. The use of agricultural wastes and weeds as raw material is not extensive but there is future potential. Human excreta has been used in other countries as raw material but its use should be ruled out in Indian villages because of its polluting and contaminating image.

The Khadi and Village Industries Commission (KVIC) has perfected the design of a family-size bio-gas plant of about 60 to 100 cft of gas per day capacity and requiring dung from 3-4 heads of cattle. The cost of this plant is about Rs 3000.[9] However, only a few can afford either the capital investment or the required number of cattle. With KVIC's help, about 45,000 of these units have been established in the country so far.[10] There is a plan to instal another 5 lakh units (less than 1 unit per village on an average) during the next 5 years, with a financial outlay (mostly in the form of subsidy) of Rs. 3000 million. This is, of course, a drop in the bucket and there is a case here for encouraging families with 3 or more cattle to have bio-gas plants. It has been estimated that in India about 12 million families (60 million people) own 5 or more cattle and if they can find Rs. 3000 each, 12 million bio-gas plants can be installed without difficulty. This will, however, serve only about 10% of the total rural population.

For the remaining 90%, community bio-gas plants could be a solution. Community plants have been successful in situations where cattle are herded together as in the Masai areas in Tanzania. In India, although technically and financially feasible, community plants will have several institutional, marginal and sociological problems. Lessons learnt from the few operational community bio-gas plants (all run on experimental basis) confirm this. A pilot project set up under the auspices of

9. UNIDO, *op cit*,

10. *Ibid*

the Council for Scientific and Industrial Research (CSIR) and the Rural Electrification Corporation (REC) in Karimnagar district in Andhra Pradesh has faced the following problems[11] :

(1) collection of dung; villagers do not come forward with dung and two people had to be hired for collection;

(2) per cattle producion of dung is less than estimated, probably because they are underfed or because of the type of feed they are given;

(3) one has to keep track of dung contribution, a difficult accounting procedure since slurry is distributed in proportion to dung contribution;

(4) after the plant was operational and pipes were laid connecting 30 houses (with future provision for 60 houses) for a free supply of gas, only 23 took gas. It was found that the defaulters were affiliated to a different political group from that of the village panchayat president who generously offered land for the plant and it was accepted as a symbol of people's participation;

(5) the off-take of slurry (in spite of its rich nitrogen content) is very slow. Rumours have been spread (orign not known, that it is harmful to land ("its strength is gone as gas has been taken out of it");

(6) among users this is a tendency for the more affluent to monopolise the products and pressures are brought to bear on the management;

(7) Several technical problems which arose from time to time but could be solved although a full time technical person was required to sort these out.

The economics of bio-gas shows that the family size plant providing 100 cft of gas is by definition limited to families owning 5 heads of cattle or more. This constitutes only 10% of the total number of rural families. The capital and, investment of Rs. 3000 per plant is subsid-

11. *Vijayan, K., Bio-gas for Rural Development,* (unpublished manuscript), 1978.

ised by the government and, therefore, is not a very large investment for these families. A recent survey of 173 plant-owners in Madhya Pradesh, Uttar Pradesh, Haryana, and Andhra Pradesh found that the average land holding of plant owners was 30.78 acres and the average number of cattle owned was 12.[12] The community size plants can serve more families owning fewer cattle or none at all. The capital investment of a community plant producing 4500 cft of gas is about Rs.124,000 and the annual operational cost is Rs 25,840.[13] In an average village of 200 families, the monthly expenditure per family comes to Rs. 10. In addition, there is an additional one-time expenditure on the burner. However, even this may be too heavy an expenditure for families, somehow surviving below the poverty line, with a monthly income of less than Rs.20. In order to minimise the distribution cost for community plants (about Rs.48,000 for a 4,500 cft. plant), community kitchens near the plants have been suggested.[14] Unfortunately, the suggestion in the rural context, is not a practical one. Village women in India could never be pursuaded to share a kitchen with others especially a public kitchen.

Those who cannot afford either an indoor solar cooker, even at a subsidised price (outdoor cookers are not relevant in Indian villages) or bio-gas from a community plant, will continue to use the usual non-commercial sources. Recently, several state governments have introduced a programme on "Social Forestry" for developing forests for firewood and grazing. The collection of firewood and grazing will be free but controlled in such a manner that timber and grass are protected and allowed to grow, at a rate higher than the rate of cutting. Afforestation, a ban on cutting younger plants and cutting in a scientific manner so that new branches may sprout from the stem again, are essential features of the social forestry programme. It is also proposed under this programme to develop forests near human settlements so that firewood collection and grazing can be done conveniently. The existing forest lands which have suffered from indiscriminate cutting or grazing and empty lands owned by the railways, highway departments, and other government agencies will be utilised for this purpose. Depending on

12. Moulik, T. K,. Srivastava U, K. and Shinghl, P.M. *Bio-gas Systems in India — A Socio Economic Evaluation*, Indian Institute of Management, Ahmedabad, 1978.
13. Vijayan, K., *op cit.*
14. Parikh, J.K., and Parikh, K.S. "Mobilisation and Impacts of Bio-gas Technologies" *Energy*, Vol. 2, Pergamon Press, 1977.

how sincerely and expeditiously the programme is implemented, this seems to be an ideal solution for the energy-starved poor. It will also protect the forests and prevent soil and wind erosion in barren and fallow lands. The problem will be to find enough empty and unused land for this purpose.

2) Agriculture

Although agriculture is the most important economic activity in the country, with about 80% of the population depending on it for livelihood, the total energy input in kcal units is about one-third that of cooking. As mentioned earlier, about 77% of the total energy for agriculture comes from human and animal power, 14% from chemical fertilisers,6% from electricity and 3% from diesel. If the statistics on agricultural production in the country are studied side by side with the energy input figures, a few interesting conclusions emerge. In spite of periodic droughts, floods and other disasters, agricultural production in India has steadily gone up (Table 4).

Table 4: Agricultural Inputs and Agricultural Production in India, 1951—78

Year	*Net irrigated to Net area sown %*	*Fertilizer cosumption per hectare of cropped area (Kgs)*	*Pumpsets (in lakhs)*		*Agricultural Production (Index Numbers)*		
			Electrical	*Diesel*	*Foodgrains*	*Non-Food grains*	*All commodities*
					Base : Triennium ending 1969-70:100)		
1950-51	17.6	0.5 (1952—53)	0.21	0.82	57.1	62.0	58.5
1955-56	17.6	0.9	0.56	1.23	72.6	70.1	71.9
1960-61	18.5	1.9	1.99	2.30	86.1	88.1	86.7
1965-66	19.3	4.9	5.13	4.65	75.8	91.3	80,8
1969-70	21.9	12.6	13.54	7.22	104.0	103.6	103.8
1973-74	22.8	17.4	24.26	17.52	110.3	117.0	112.4
1974-75	24.4	15.8	26.12	—	104.3	118.3	108.8
1975-76	24.3	16.9	27.93	—	127.2	121.8	125.5
1976-77	—	20.8	30.41	—	116.5	118.6	117.1
1977-78	25.0	26.2	33.09	20.00	133.3	132.3	133.0

Source : 1) Basic statistics relating to the Indian Economy Vol. 1 All India Oct. '78 Centre for Monitoring Indian Economy, Bombay.

2) Commercial Directorate of Central Electricity Authority, Govt. of India, New Delhi, 1978.

It can be seen that agricultural production has more than doubled during the past 25 years. Instead of importing food we are now exporting it. Periodic good monsoons have certainly contributed their share but this cannot explain the steady increase in production even during droughts. Assuming that human and animal labour has remained practically constant, the only noticeable change that has taken place over the years is in irrigated acreage and in per capita fertiliser consumption. Yet, as a percentage of the total energy input in agriculture, the use of commerical energy in the form of electricity, diesel and chemical fertilisers has been very small (23%). About 3.3 million electric pumpsets and an estimated 2.0 million diesel pumpsets are being used for irrigation in the country. This is less than half of the total pontentialities of about 12 million pumpsets, an estimate based on groundwater availability.[15] The per capita fertiliser consumption is also low as compared to the consumption in other countries. The answer to this dilemma lies in the fact that the small amount of commercial energy used in agriculture has been limited to the most crucial inputs, namely irrigation and fertiliser. The use of energy-intensive mechanised agricultural machinery is practically non-existent except in small areas. The Government has also wisely banned the import of machineries like the harvesters. Energy use in irrigation and fertilisers has had the salutary effect of increasing employment by encouraging high-yielding short-duration crops. Agricultural machinery, on the contrary, tends to displace labour.

Human and animal labour has, therefore, remained the backbone of our agriculture. In a labour-surplus country, this is the only way, provided there is a judicious mixture of commercial energy with it. With a gradual increase in the consumption of commercial energy in irrigation and fertilisers, the utilisation of labour (a large percentage of whom are seasonally or permanently unemployed) will also be higher and the process will inevitably lead to even higher agricultural production. In the Indian situation there is, therefore, scope for a combined and complementary increase in the use of commercial energy and animal and human labour. It is necessary, however, to critically examine the various sources of commercial and other energies and their social and economic implications in order to decide which is more appropriate under what circumstances.

15. Report of the Working Group on "Minor Irrigation", Ministry of Agriculture, Govt. of India, 1976.

Before discussing individual sources and their appropriateness for agriculture, a few comments on the impact of commercial energy as a whole on three major groups is offered: agricultural labour, small and marginal farmers, and medium and large farmers. For agricultural labour, increased employment will generate more purchasing power although wage level may remain the same for some time to come. As is well-known, wage-level and supply of labour are inversely related. As it is, the supply seems to be increasing not just because of population growth but because of a steady erosion in other sectors of the village economy, particularly in cottage and village industries. This whole question is too large to be tackled in a piecemeal fashion and is beyond the scope of this article. One can only say that while employment opportunities in agriculture are likely to improve in future, this may not be sufficient for a steadily increasing labour supply. Concerted action is also required to revive and strengthen the non-farm sector either in the villages themselves or in small towns and growth centres.[16]

The question of small and marginal farmers is perhaps the most crucial.[17] They are chronically short of capital to take advantage of the modern inputs and invest in motorised pumpsets. There are special programmes, such as the Small and Marginal Farmers' Development programme, the Drought-prone Area programme and so on which are specifically directed towards this group. Credit on very soft terms and subsidies are made available by these programmes through government and institutional sources. Recent evaluations of these programmes have pointed out that progress is uneven and a large number of small and marginal farmers are yet to be reached.[18] For every small and marginal farmers holding less than 1 hectare, some of the inputs are not economical and their ability to pay is less than the market price of fertilisers, diesel or the subsidised tariff for electricity. They certainly cannot afford the

16. Sen, L. K. "Growth Centres and Rural Employment, "*Community Development and Panchayati Raj Digest*, Obtober, 1971.
17. In India, 46.23% of the farmers have less than 1 hectare land and 22.10% between 1 and 2 hectares. Thus about 68% of all farmers can be defined as "small" and 46% as "marginal". However, these estimates are slightly on the higher side as farmers holding more than a hectare of irrigated land are not considered small.
Source: 26th round of the *National Sample Survey*.
18. See, for example, several studies recently completed by the Shri Ram Centre for Industrial Relations and Human Resources under the leadership of S.M. Pandey, in Rae Bareilly, Badaun, Fathepur and Mathura Districts in U.P. Ajmer and Udaipur Districts in Rajasthan; Faridkot District in Punjab; and in Delhi.

capital required for pumpsets or pay interest on borrowed capital. This is the basis of the major criticism levelled against all commercial energy. In subsequent discussion below, appropriateness of other alternative energy sources for small and marginal farmers shall be explored.

For a large proportion of the medium and large farmers with holdings of 2.5 hectares and above, the modern inputs are economical. Yet a large section of this group has either used these inputs perfunctorily or not at all. Chemical fertilisers are, however, universally popular. Motorised pumpsets are not necessary for those who live in the command areas of river valley projects or who have a good supply of surface water. For those remaining, electric pumpsets are academic if the village is not electrified. Data on underground water resources show that about half of our total ground water resources and more in the Indo-Gangetic basin is yet to be exploited.[19] It is possible at least for this group to consume more commercial energy for a higher agricultural production. The positive impact of this will also be felt on employment.

It may be noted that this group of farmers has been much maligned by all shades of political opinion in the country. Yet, to become a medium or a large farmer has always been the ambition of small and marginal farmers. The various official programmes for small and marginal farmers are also directed towards this goal. However, because land is limited, not every farmer can become a large farmer and, in an input-and credit-deficient situation, the large farmers manipulate and pull strings to retain their land, their affluence and their political leverage. Undoubtedly, the contribution of these farmers in increasing agricultural production is the highest in the country. While this motivation should be encouraged for the benefit of the country, some of their unequal advantages should be curtailed. A case in point is the subsidsed electricity tariff for agriculture. Tariff in all states is applied equally to all farmers regardless of their landholding status. Large farmers enjoy this undue advantage at the cost of many small and marginal farmers who are unable to afford even the subsidised rate. One can understand the procedural and accounting complexities involved in a land-based progressive system of tariff especially when land is not a fixed asset, but for the credibility

19, Report of the Working Group on "Minor Irrigation", Ministry of Agriculture, *Ibid.*

of a vital input such as electricity, the task should be undertaken without delay.

It has been seen that among individual energy sources for agriculture, fertiliser is the most popular. Chemical fertilisers are petroleum products which have been extensively used in western countries as well as in Japan. High Yielding Varieties programme also depends a great deal on intensive fertiliser application and without doubt, chemical fertilisers have improved crop productivity in this country. One is also painfully aware of the uncertain status of petroleum supply in the world today and our dependence on it. The drastic price rise in the international market has also forcefully drawn our attention to the limited reserve of this vital fuel. The estimated world reserve at the present rate of consumption (in which the industrially advanced states have a lion's share) may not last another half a century. This fact more than anything else pre-empts our options regarding the use of petroleum and its products. Our own production meets only one-third of the total consumption. Off-shore reserves and their eventual exploitation will take time and by then our demand (at the present rate of growth) will increase manifold. The consensus among all energy specialists in the country is to continue prospecting for more oil while deemphasising use of petroleum in non-priority sectors. At the same time, a concerted search is on for alternative sources of energy which can replace petroleum and its products without damaging the economy.

The recent search for an alternative to chemical fertilisers has a brighter side. Recent studies in western countries show that continuous and intensive application of chemical fertilisers may damage some of the intrinsic properties of land. In addition, the law of diminishing return starts operating after the saturation point is reached. Reddy points out that agriculture in developed countries has become an "energy sink" rather than an "energy source".[20] He cites the example of US, where 10 calories of energy has to be sunk in order to recover 1 calorie of energy from food in contrast to a South East Asian farmer who invests 1 calorie of energy to recover 50 calories in food. Energy here, of course, includes all sources, not just fertiliser. Our

20. Reddy, A.K.N. and Krishna Prasad K., "Technological Alternatives and Indian Energy Crisis", *Economic and Political Weekly*, Special Number, August, 1977.

search for a substitute can, therefore, proceed with a clear conscience, as a blind pursuit of the energy intensive western pattern of agriculture is not relevant for a capital short and labour-surplus country like India. It has already been indicated that fertilisers and irrigation are the two energy inputs which can increase production as well as employment.

Of all the substitutes for chemical fertilisers, the organic residue of bio-gas, slurry or sludge is the most suitable. It is richer in Nitrogen (2%) than ordinary farm yard manure (0.75%) and also contains humus. The farmers are reported to have obtained 25-30% more yield with this manure than with ordinary farm yard manure. This compares favourably with the yield obtained from chemical fertilisers. In addition, it mixes easily with the soil, improves its water retention capacity and does not allow the plant food to be washed away in heavy rains. For the same amount of cattle dung, the slurry from the bio-gas plant produces 10 cartloads of manure as against 7 of ordinary farm yard manure. Farmers have also acknowledged the advantage of composting additional organic wastes in the slurry pit as the time needed for the material to be effectively composted is reduced by nearly 75%.

Because of the intrinsic properties of the slurry and its healthy impact on the soil, it has a better chance of being adopted by our farmers than bio-gas. To start with, it can be used in combination with reduced doses of chemical fertiliser, farm yard manure or ordinary compost. If a programme of bio-gas plants gets into full swing, it has the potential of replacing chemical fertilisers altogether. However, as we have noted earlier, only community size bio-gas plants can meet the requirements of small and marginal farmers and unless most of the technical, organisational and sociological problems described earlier are solved and a vigorous extension programme is launched, a useful, practical and valuable alternative source of energy will forever go up in smoke in village *Chulas*.

Next to fertilisers, irrigation consumes most of the energy in agriculture. The proportion of net irrigated area in the country has gone up from 17.6% in 1951 to 25% in 1978. It has been estimated that of the irrigated area, about 63% is irrigated with surface water from canals, rivers, streams, and tanks and the remaining 37% with ground

water lifted either manually or by motorised pumpsets. There are approximately 5 million motorised pumpsets and an unaccounted number of mannually operated wells which annually lift about half of our total ground-water reserve.[21] Motorised lift is obviously more efficient and effective than manual lift because of time constraints in irrigation. The command area of a motorised lift is also much larger. While a motorised pumpset may displace a few manual operators, it more than compensates this by enlarging the command area and intensifying the cropping pattern. Where the water table is deep, motorised lifts are the only means of irrigation.

Diesel and electricity are the two major sources of energy for running pumpsets. As reported in Table 4, until 1961, there were more diesel sets in the country than electric sets. By 1966, when only 10% of our villages were electrified, electric sets had an edge over diesel sets by about 47,000. By 1978, with about 40% of our villages electrified, there are about 3.3 million electric sets as against an estimated number of 2.0 million diesel sets. Although owning electric sets is contingent upon village electrification and their smooth running depends on availability of power and quality servicing, our farmers definitely prefer electric sets. Diesel sets are mostly operated in unelectrified areas and as stand-bys in electrified villages. The main reasons for this preference as reported by farmers are: (i) they are more economical to run (electricity tariff for agriculture is subsidised); (ii) operation and maintenance are relatively more simple and less expensive. Table 5 below provides information on the comparative economics of 5 h.p. diesel and electric drives.

Although the comparative economics definitely favour the electric set over diesel, diesel sets are not confined to unelectrified villages only. Farmers who switched over to electric sets prefer to keep their old diesel sets as a stand-by in case of power cuts and voltage fluctuations. Diesel sets are still competitive because of the shortage of power during moments of need and because of the poor quality of electricity supply. However, our dependence for diesel on the oil producing countries, the drastic rise in price and uncertainties in supply during political turmoils in these countries rule out diesel as a viable long-term alternative for irrigation. Electricity, on the other hand, seems

21. Report of the Working Group on "Minor Irrigation", *op cit.*

Table 5 : Comparative Economics of Diesel and Electric Pumpsets (5 h.p.)

Cost Items	*Diesel Drive (Rs.)*	*Electric Drive (Rs.)*
1. Capital Investment	4,720	4,500
2. Cost of fuel for 1,200 hours per annum.	2,215	1,004
3. Cost of maintenance (including lubricant in the case of diesel)	500	200
3. Depreciation charges (assuming 10 years of life for diesel and 15 years for electric pumpset)	250	167
5. Interest on Capital	300	250
6. Maintenance and depreciation on the network created for electrification	—	270
Total Operational Cost	**3,265**	**1,891**

Source : 1) Dawar, G.R., "Comparative Study of Economics of Electric and Diesel Pumpsets", *Economic Times*, October 9, 1978.

2) Deshmukh, D.S. and Rao S.V.R. "Rural Electrification and Groundwater Resources", (unpublished manuscripts), 1978.

like the only alternative because of its economic advantage over diesel and because it is indigenously produced from our abundant coal and water resources. In addition, once a village is electrified, the same lines can be used for a number of other purposes such as lighting, industries and cold storage. This is not possible with diesel.

Critics who are opposed to rural electrification suggest that small and marginal farmers cannot afford electric pumpsets even at a subsidised rate. They point out, for example, that inspite of the very heavy expenditure on generation and transmission of electricity, only large villages and only 6% of India's rural population have benefitted from it.[22] Then they go on to repeat the standard solution of replacing rural electrification by decentralised sources, e.g., wind power, bio-gas and micro-hydel plants assuming of course, that small and marginal farmers will be able to pay for these. They are of the opinion,

22. See for example, Makhijani, A., "Energy Policy in Rural India", *Economic and Political Weekly*, Special Number, August, 1977.

however, that some commercial energy is necessary for our village people.

Let us look at the alternatives suggested. Wind power is useful only where there is wind. Latest studies show that availability of wind is seasonal and is highly localised.[23] The coastal areas, desert areas and some of the foothills are possible locations. Can one run a national irrigation programme on such a highly localised energy source? Research done on the possibility of generating power with wind mills has pointed out the technical problems of storing electricity and the heavy cost of power. Next is bio-gas. Technically, it is possible to run irrgation pumpsets with bio-gas. However, from a practical point of view, it is as remote as the windmill. First of all, there has to be gas, presumably from a community plant because family size plants are all owned by rich farmers with an average land holding size of 30 acres. But how much gas can a community plant supply after making allowance for cooking and how many pumpsets can be run on this gas? What will be the cost? Will the small and marginal farmers be able to afford it? Who will pay for the pumpsets?

As Reddy has pointed out, the unit cost of running an irrigation pumpset with bio-gas is 3 to 7 paise pre Kwhe as compared with the actual (not subsidised) costs of rural electrification of about 7 to 9 paise per kwhe.[24] The subsidised cost which the farmer actually pays is about the same as he would incur using bio-gas. Also the very large bio-gas plants which are necessary for running irrigation pumpsets can only be located in very large villages with a large cattle population and enough grazing space. Thus, in order to be of practical use, bio-gas plants must be located in large villages and only the rich will be able to afford them. Under these circumstances, electricity and bio-gas become competitive and if asked to make a choice, it is very unlikely that the farmer will choose bio-gas. The supply of gas to the field will be a daunting problem in itself.

However, the criticism that rural electrification is expensive and that

23. Krishnan, A., "A Case for Wind Power Utilisation", *Commerce*, Annual Number, 1977.
24. Reddy, *op. cit.*

the immediate results are not commensurate with the expenditure is quite valid in the immediate sense. However, in any development programme the initial investment is always heavy. Villages, big or small, can be electrified and pumpsets energised, only after a whole network of transmission, sub-transmission and distribution is built up. In later stages, the infrastructure thus created can be utilised for further electrification at a much reduced cost. Also, the load factor in the initial years is low because of smaller utilisation. With time, load develops and cost comes down even further. The World Bank paper on "Rural Electrification" has shown that electricity supplied from a grid to a large body of consumers is cheaper than "auto-generation" (small-scale power plants) serving a small number of consumers.[25] With a high turnover the cost is spread over a large number of consumers.

A judicious mix of thermal and hydro-electric sources will also bring down the cost of electricity considerably. It is known that hydro-electricity is cheaper than thermal-electricity by a factor of 4. Only about 20% of our total known hydro potential has so far been exploited, and a vast potential remains to be tapped. It will be risky however, to depend mainly on hydro-electricity as it is sensitive to the vagaries of monsoon. A 50-50 mix will reduce the risk as well as the cost by about half.

Transmission loss has been one of the major sources of the high cost of electricity. To some extent, some loss is inevitable (about 10%) because of low load density, poor load factor and a wide geographical coverage. The average transmission loss in India is about 20% which can certainly be reduced by proper system planning, use of capacitors and better workmanship.[26] Theft of electricity, another major source of loss, is a law and order problem and can be reduced in collaboration with village panchayats and other local agencies.

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25. World Bank, *Rural Electrification*, October 1975.

26. Measures mentioned here for reducing transmission losses have already been initiated by the Rural Electrification Corporation. Details on this and other programmes of REC for backward and specially under developed areas, see the Annual Reports of Corporation 1969-78 and Addresses to the Shareholders by its Chairman Dr. B. Venkatappiah.

These are all measures which will make electricity less costly in the future. However, even this low cost may be high for small and marginal farmers. In the past, as critics have rightly pointed out, rural electrification has by and large passed the small and marginal farmers by. If, however, we are agreed on the basic premises that electricity is the most practicable source of energy for irrigation as we have tried to argue earlier, then the next step is to consider how in the immediate future, it can be made more acceptable to small and marginal farmers. It does not help either to damn it on ideological grounds or to argue that other comparable commercial energy sources are as expensive as electricity. Electricity as a multi-faceted energy source and a modernising agent must touch the lives of the economically poorer sections.

Since small and marginal farmers are unable to afford the price of a pumpset and the cost of running it on their own, it is the responsibility of the State to bring the benefits of electricity to them. Large tubewells owned and managed by the State can distribute water to small and marginal holdings at the prevailing subsidised prices or, if necessary, at an even lower price which these farmers can afford. This will eliminate the need for buying a pumpset and paying for its maintenance. Without doubt there will be organisational difficulties, as in the case of scattered and fragmented holdings, but these problems are not insuperable. Small farmers who would not or could not take advantage of the benefits of State tubewells may find a progressive tariff structure based on land-holding size attractive. The burden of this tariff structure will naturally fall on the larger farmers who are able to pay but may resist it.

3) *Village Industries, Domestic Lighting and Transportation*

We have seen that in caloric value, these three sectors together account for only 14% (industries 7% lighting 4%, and transportation 3%) of the total energy use in rural India. For heating, village industries depend entirely on non-commercial sources such as firewood and agricultural waste. Manual labour provides the rest of the required energy. While electricity can operate a lathe machine, a potter's wheel, a power loom or a carpenter's drill, our village artisans are generally reluctant to use

it.[27] For their small-scale operations they prefer manual labour as it is free of cost and they are used to it. Use of electricity will increase their cost of production and will definitely put them at a disadvantage with the manufacturing industries which can produce on a mass scale and at a cheaper price. Some artisans have also expressed the opinion that mechanisation will lower the quality of their product. For most artisans, a large number of hurdles intervene between manual operations and future mechanisation. These are primarily financial, technological and psychological. The only exceptions to this generally depressing picture are village industries which have found urban or international markets and are being gradually modernised.

Village industries form a small part of the official category of 'small-scale' industries. Definitions of various categories are based on the size of capital investment.[28] For example, capital investment in a small-scale industry must not exceed Rs. 10 lakhs. In order to provide financial and institutional support to a large unorganised sector (about 91% of all small-scale industries), primarily in villages, a new category of "tiny sector" has been created for units with less than Rs. 1 lakh investment. In addition to providing financial help, a vigorous and imaginative R&D and extension programme is required for adapting traditional crafts to electricity and *vice-versa*. It has been observed that small-scale industries with larger capital are more amenable to mechanisation. As a matter of fact, availability of power is one of the major considerations for an entrepreneur before he builds his plant. It has also been observed that electrified villages with a larger population base and small towns attract a larger number of industries than smaller villages.[29] The most ubiquitous industries are the food processing units such as rice, flour and dal mills.

Excluding village artisan units, energy for the rural industries sector as a whole comes mainly from electricity as there are no practical and viable alternatives at the present time. Bio-gas can provide heat for relatively small units such as smithies and brick kiln from community

27. SIET Institute, *Prospects for Modernising Rural Artisans Trades and Decentralised Small Industries (mimeo)*, Hyderabad, 1978.

28. Nagaiya, D., "Development of Tiny Sector", *Khadi Gramodyog*, October 1978.

29. SIET Institute, *Impact of Electrification on Rural Industrial Development* (Mimeo), Hyderabad, 1977.

plants. However, to what extent it is a practical alternative is yet to be seen.

For domestic lighting, kerosene is the universal fuel in our villages. Bio-gas lighting is technically possible but creates safety hazards in village houses with thatched roofs. Moreover, pipes, holders and mantles require capital investment. Electricity is safe but expensive. In addition, internal wiring requires substantial investment. As we have seen earlier, only 13% of light energy is provided by electricity. Kerosene is a convenient fuel because it can be purchased at the village grocery (unless there is an international crisis), and for purposes of lighting, is perhaps the cheapest available fuel. The only problem with kerosene is that it is a petroleum product and we are dependent on other countries for two-thirds of our requirements. From a practical point of view, it is difficult at the present time to find a suitable alternative to kerosene unless electricity rates for domestic lighting are converted into a blanket rate of Rs. 2-5 a month or even less. In any case, for a long time to come, kerosene cannot be replaced as a lighting fuel and provision should be made for its supply to the rural areas on a priority basis.

Regarding transportation, our bullock carts and bicycles service the need adequately. Since automobiles have not made inroads into our villages yet the need for them is not felt. For long distance trips, trains and buses are available. In this sector of the village economy, human and animal power provides the required energy inputs and saves the country an enormous amount of foreign exchange in oil. Also there are several indirect benefits from the use of bullock carts and bicycles. First an enormous expenditure on roads is saved. Secondly, blacksmiths who make and repair bullock cart wheels and carpenters who build the body are kept in business (there are about 12 million bullock carts in the country). Actually, these are the only two groups of village artisans who can still be found in practically all villages. Potters, weavers, and metal workers are still around but in depleted numbers. Most others have simply been swallowed up by agriculture. Bicycles have made distances relatively shorter for villagers and have kept an urban industry thriving. The multiple use of bicycles as a passenger vehicle, a department store on wheels, a knife sharpening industry and a portable water pump shows the ingenuity of our village people in using an elementary machine. The energy input in all this is under-

standably low but there seems no reason to change this.

Summary and Conclusions

Low energy input and a heavy dependence on traditional and non-commercial sources of energy in India, particularly in its rural areas, is clearly a function of the backwardness of its economy. A sector by sector analysis of the appropriateness of the various alternative sources of energy shows that in domestic activities, solar cookers and bio-gas for cooking have possibilities. However, more research and experimentation are necessary for solving technical, financial and organisational problems. Immediately, firewood could be supplied from "Social forests" developed only for this purpose. Domestic lighting is heavily depenpent on kerosene a rather uncertain source considering the international market situation. Eventually, we may have to depend completely on domestic production of kerosene and at the same time lower the rates of electricity.

In agriculture, commercial energy input is not only feasible but beneficial in the fields of irrigation and fertiliser application. Unfortunately, both of these fields are greatly dependent at present on petroleum products namely diesel and oil-based chemical fertilisers, the future supply of which is by no means assured. Electricity is gradually replacing diesel because of its many advantages although there is scope for improvement in both its supply and management. The advent of electricity is therefore, a welcome feature in our rural energy scene.

Chemical fertilisers can be replaced either completely or partially by sludge from bio-gas plants. It has been suggested here that the use of heavy agricultural machinery particularly the oil-consuming ones should be strongly discouraged. In view of the abundant supply of labour, these machines are unnecessary and wasteful.

The main problem with these commercial energy sources is that they are beyond the reach of people below the poverty line and the small and marginal farmers. It has been suggested here that in addition to adopting cost reduction measures, the State should take initiative in the supply of critical inputs at a low price for the benefit of the weaker sections. Although in the beginning this will be more in the nature of social welfare, this will be a wise long-term investment.

In industry, electricity is the main source of energy for small-scale industries and there is a large scope for developing this sector. For village and cottage industries human and animal labour will continue to dominate until vigorous R&D and extension efforts make these industries amenable to mechanisation.

Rural transport is predominantly based on bullock carts and bicycles. For long distance travel, trains and buses are available. At the present time rural transport requirements are adequately met and there is little need and scope for oil consuming motorised vehicles. □

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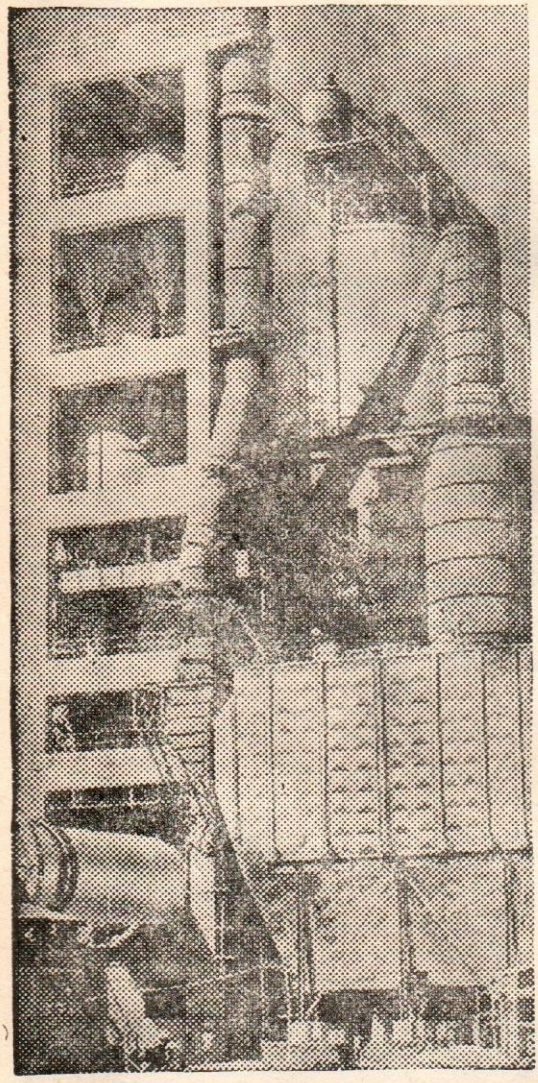

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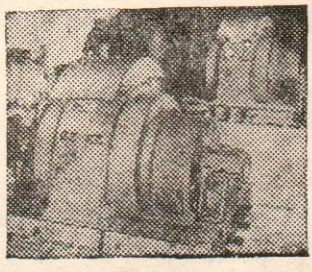

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Towards Self-Sustaining Rural Institutions: The Congo Experience

Hartmut Schneider*

INTRODUCTION

Rural institutions have been singled out as a major factor for determining linkages between social and economic aspects in rural development.[1] Since no single type of institution is likely to satisfy requirements in different situations, various essential elements of the creation and operation of rural institutions were identified, with a view to bringing about rural development in a form socially acceptable and self-sustaining in the long run. These elements have been formulated as hypotheses which were tested during a visit by the author to the Rural Development Project (PDR) in the Popular Republic of the Congo in October/November 1977.[2] But beyond the analysis of this particular case, the paper aims at drawing more general conclusions with regard to the promotion of rural development through institution-building.

I. PROFILE OF PROJECT PDR

The project was created in September 1970. The general objective was to improve the standard of living of the rural populations by:

(a) increasing agricultural output,

(b) creating the institutional structure necessary for rural development, and

(c) by contributing to an increase in employment opportunities.

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1. See H. Schneider, "Linkages Between Social and Economic Aspects in Rural Development and their Implications for Project Design and Implemetation", "Experiences in Rural Development", Occasional Paper No. 1, *OECD Development Centre*, April 1977.
2. The acronym PDR is currently used for the "*Project de Development Rural de la Region du Pool et du Plateau de Koukouya* (UNDP/ILO Project PRC 68/507).

The institutional aspects which are part of the overall objective are discussed in this paper and reference is made to the other aspects to the extent it is necessary to explain or support the institutional output by putting them into their real-world environment It is recognised, of course, that institution-building is not a final but an intermediate objective and it should, therefore, not be considered in isolation.

Institutional structures of technical, social and economic nature were foreseen in the work-plan of the project to assure the perpetuity of the development activities. They were considered as the framework within which training, extension, mobilisation[3] and support activities were to take place.

These activities are actually applied to the following fields:

—plant production (including mechanisation).

—animal husbandry

—pisciculture

—handicrafts

—water works

—co-operative movement

—agricultural credit

—functional alphabetisation

—women and family's promotion

—ruralisation of schools.

The area of operation of the project coincides, for its greatest part, with the Fifth Agricultural Region of the Country which is divided into nine regions. The co-director of the project is also the director of the agricultural region and the staff of the region is seconded to the PDR. Thus, PDR is, in fact, a para-statal body with the main characteristic of a better and more comprehensive resource endow-

3. The French term "animation" is difficult to translate since it reflects a specific concept. This concept might be expressed by the term "mobilisation".

ment (in terms of personnel, vehicles and operational funds) than the corresponding governmental bodies in other regions which lack the integration function of the PDR.

II. FARMERS' ASSOCIATIONS: BACKGROUND AND HISTORICAL DEVELOPMENT

Farmers in the project area have traditionally been working collectively for specific purposes. A survey conducted in 1971 in the district of Kinkala to prepare alphabetisation of activities showed that 40 percent of the adult population included in the survey participated in some kind of collective work association. About 93 percent of these associations were promoted by religious groups who also received the income from the work. The other associations were organised for the direct benefit of village communities. The work of the associations comprised 55 percent for cultivation of a collective field, and 33 percent for construction of houses. The activity of the remaining 12 percent was not given. It is against this background that the development of (pre-cooperative) associations by the PDR must be seen.

By July 1977, 162 officially-recognised associations with a total of 3,342 members had been created with the support of the PDR. The associations promoted by the PDR did not always replace the already-existing associations but were created in addition to them. An important difference between the new associations and the traditional ones is that the latter were, to some extent, obligatory (social pressure) whereas the new ones were created wholly on a voluntary basis. The perusal of project-related documents showed that in the village Mayanou there were even three associations co-existing: the "Luyalu" working in the field for the party for one day every two weeks; the "Dibundu" working for the Church at irregular intervals and the association promoted by the PDR working for one day per week in the collective fields of cassava and pineapple and in pisciculture.

With the introduction of formal statutes and the training of village leaders in cooperative affairs, the project laid a more-reliable basis for regular collective work and the application of democratic principles within the association.

The few field visits made in October 1977, revealed that at least the spirit of the statutes was alive and that farmers were informed and actually helped to exercise of their rights within the associations. On the other hand, certain rules of the statutes had not been applied yet. For example, no case could be found where the provisions of Article 25 of the statutes about the use of the net surplus of the association had been followed, i.e., allocation of the net surplus to different funds to be created by the Association.

Different Perceptions of Farmers' Association

The farmers' associations are basically part-time production cooperatives. Their functioning can be viewed from different angles. From an institutional point of view, they are ideally seen as the local level institutions which, with the help of higher level (District, Region, Central Government) institutions, bring about the desired mobilisation of resources and social change.

From the point of view of the project, and by the same token of the Government, farmers' associations are seen, among others, as convenient target groups for services provided by the project. No doubt, extension services can be offered more economically to groups of people than to individuals. In fact, the traditional production pattern, the distances involved and the difficulties of communication make it virtually impossible for extension agents to contact individual producers systematically, whereas they can be contacted relatively easily when working together on a collective field, fish pond or an animal shed during one or two predetermined days of the week. Analogous arguments apply for the delivery and follow-up of other services such as agricultural credit, training, alphabetisation, women and family welfare. While this point of view is very rational and legitimate, it also carries the danger of dominating the perception the villagers may have of their associations.

If villagers see their associations only, or above all, as a means of attracting services and obtaining gifts (for example, WFP food supplies), the associations will live an artificial life as long as the outside support is maintained and appreciated. Once the outside support is discontinued, the association breaks up quietly and gradually. This was

experienced in a number of associations supported by the PDR when WFP food supplies discontinued. It is not the intenlion here to argue against WFP food supplies in general but to emphasise the need for a careful dosage accompanied by complementary measures of mobilisation which should convince the villagers of the intrinsic values of the associations and equip the people to become less and less dependent on outside support.

Support Components

The PDR is contributing to the strengthening of associations in various ways. The first and most important contribution seems to be *training* in various fields and at all the stages of the life of an association. Training activities are directed to all the members of the association as well as to some select members for specific functions within the association. Training prepares the ground for the start-up of an association and for its successful operation.

Members of an association choose some among them to receive training as "mobilisers" in a specific field (e. g., co-operative management, production, alphabetisation, women and family welfare). On return to their villages they work within the association like everybody else, not as a civil servant, and contribute towards self-reliance of the association. This kind of training is offered by the project but there may be questions of its intensity, its systematic organisation for all potential beneficiaries and its follow-up. The aim is to equip the farmers to fulfil, at the level of the village or association, the role of the extension agents who are neither sufficient in number nor are mobile so as to cover all villages systematically.

With regard to other services offered by the PDR to the associations *agricultural credit* plays an important role. It has been created completely by the project and helps to overcome the resource constraints faced by the farmers. The way it is attributed (in kind against collective guarantee and upon advice of the technical extension agent) explains its success and high repayment rates of over 90 percent.

Success of the project can be seen in the field of *functional alphabetisation*. One hundred and thirteen (113) alphabetisation centres existed in

1977, staffed with voluntary mobilisers trained by the project. Fifty six (56) of these mobilisers have been nominated by the government as assistant primary school teachers and appointed to schools outside the project region. Consequently the project needs to continue its training effort in this field to fill the posts left vacant in the alphabetisation centres.

With the functional alphabetisation, the project reaches audlts in evening classes, generally organised twice a week. Since the moblisers who hold the classes often also hold a function in the associations (secretary, treasurer or president), a link exists between the alphabetisation and the promotion of the co-operative movement.

Through *ruralisation of education* (i. e., training of school teachers in plant production and animal husbandry, and the creation of school gardens) the PDR prepares the younger generation for a dynamic rural environment.

Women and family welfare is another component of the PDR. Although it does not operate directly to support productive activities of the associations, it plays a potentially-important role for the use of new products introduced by the project (e. g., rabbits) or for the use of additional income for social purposes.

The technical support provided by the project through training and extension services has economic and social effects beyond the mere creation of rural associations. The extent and quality of these effects will decide about the viability of the new institutional structures in the long run.

Resource Mobilisation

The pooling of manpower and material resources through a farmers' association, for example, for the digging of fish ponds and their operation, bring about the creation of real capital and income in the hands of a group. Without an association, this capital and income would either not be created at all or certainly to a lesser extent, with a higher concentration of wealth, in a few hands. Furthermore the continuity of any group effort would be very doubtful without an association.

The association is in a position to mobilise the otherwise underutilised resources (water, land and labour) and to assure a fair distribution of the wealth thus created. It is noteworthy that the income created through such new undertakings is partly being distributed in kind, for example, fish for self-consumption, and partly saved. Proceeds from the sales of the association's production are generally saved until an occasion arises for which the money is considered worth spending by the assembly of the association. This can be a reinvestment in a productive activity, in a social service, i. e., health post. The savings are also used as a kind of social security fund from which members will receive support in case of death or other distress.

Another aspect of additional resource mobilisation through the associations has to do with the heavier involvement of the men in modern agricultural activities compared to the employment patterns in traditional agriculture. Traditionally, the main work of men in agriculture consisted of land clearing whereas women did the cultivating and harvesting jobs. With the increased incomes accruing from modern agricultural production promoted by the PDR, such as vegetable and fruit production, men are also becoming interested in the cultivation work. Thus additional labour is being mobilised by the associations.

III. GENERAL HYPOTHESES ABOUT RURAL INSTITUTIONS AND THEIR TESTING IN THE CASE OF PDR

Rural institutions at different levels, but with particular emphasis on the local level, have been identified in a review of experience as a major factor determining the distribution of wealth in rural development activities. In their structure and modes of operation, rural institutions embody linkages between economic and social aspects of rural development. However, it would be unrealistic to search for an ideal type of institution or set of institutions which would best embody these linkages. What is really reflected in this preoccupation with the linkages between economic and social aspects of rural development is the aim of self-sustained rural development which is defined as a multi-dimensional aim including economic and social aspects. Therefore, the aim here is to determine elements of institutional set-ups which would be conducive to self-sustained rural development, given a sufficient local resource base. With this aim in mind, a short review

of experience led to the following hypotheses which shall be tested for their validity and completeness in the case of the PDR.

If these hypotheses are fufilled by the institutional structure of the PDR and if the list of hypotheses is necessary and sufficient for rural institutions to bring about self-sustained rural development, the PDR could be considered as an institutional example in the sense of containing all the necessary elements for successful rural development. On the other hand, it may be possible to identify elements in the PDR approaches which prevent it from leading to truly self-sustained rural development. These elements may or may not be contained in the hypotheses as formulated above. In the second case, there would be reason to amend our list of hypotheses accordingly.

The hypotheses are grouped in a way which reflects areas of concern (such as creation, operation and support), but they are not necessarily dependent on each other within a group. They are formulated in general terms in order to be applicable in widely-different situations. This makes it difficult to test them in a very straightforward manner. But this lack of clear-cut answers also seems to reflect the general state of knowledge with regard to institutional adequacy in rural development.

1. Hypotheses with Regard to Creation of Institutions

Any new village-level institution should :

(a) be set up only after analysis of existing structures (communities, associations, etc.) and should,

(b) as far as possible, incorporate existing structures, and

(c) aim at a relatively homogeneous membership population.

If new institutions are supposed to change the local power structure, strong central backing will be necessary.

Discussion :

(a) No formal and systematic survey of existing socio-economic structures was made before the creation of the associations. The village

level analysis *(étude du milieu)*, which was done in every case by the officials of PDR, was generally limited to the land tenure problem and to technical aspects, for example for the creation of fish ponds. The land tenure problem, i.e., obtaining the land necessary for the activities of the association, was mostly solved by the people themselves, either by paying some money to the traditional land-holder *(chef de terre)*, or by including him as a member, or even president, of the association. In some cases, where the traditional land-holder was reluctant to give up land, the local administrative and political power *(chef du village)* put pressure on him.

(b) As mentioned in section II, farmers in the project area have traditionally been working collectively for specific purposes. The associations promoted by the PDR could, therefore, be built on existing behavioural patterns without upsetting traditional structures.

(c) With regard to the homogeneity of the membership population, no hard data are available to confirm or reject the hypothesis. But in discussions, and during visits to a few associations, the impression prevailed that economic, religious and ethnic differences within the population are negligible for our purposes and do not have any major impact on the participation pattern of the farmers in the associations. We can, therefore, consider the hypothesis of a homogeneous membership population as fulfilled.

This conclusion applies also to the hypothesis (b) with regard to the creation of the associations and of the project structure itself, and, to a lesser extent, to hypothesis (a) because of the lack of systematic analysis at the outset.

2. Hypotheses with Regard to Operation of Institutions

The organisation of participative institutions of the rural population should include at least the following elements :

(a) effective two-way communication conducive to decision-making, and including solid outside relations;

(b) self identification of the population with at least part of the institutional set-up (as against the "us-them" syndrome);

(c) a resource base including local contributions which ought to be, but are not necessarily, voluntary.

Discussion :

(a) Communication within the association takes place in quasi daily face-to face contacts and formally in the general assemblies where all members participate in decision-making. According to the statutes, a general assembly must be held at least every three months. In reality general assemblies are often held once or twice a month. Relations with the outside exist on different levels and in different fields. Each association is part of a union on the district level. These district unions are in turn grouped in a regional union which is at present located at the PDR headquarters. The unions participate in the committee distributing agricultural credit, and they are the voice with which the farmers can speak to Government on the different levels. With regard to technical matters (animal husbandry, crop production, pisciculture, alphabetisation, women and family promotion) the associations are in contact with the technician of the zone, the district, and in special cases, with those of the region. Technicians in different fields are there to serve, above all, the associations. But in reality, the contacts of the farmers with the technicians are often not as frequent as it would appear desirable. For example, it happens that an association asks for the visit of a technician who follows the request only after considerable time, may be for the lack of means for transport, or for lack of motivation. Associations located close to the PDR headquarters benefit from a high frequency of contacts with the technicians, but this seems to make them more dependent.

(b) The associations manage their own affairs, elect their officials and replace them in case of poor performance or abuse. They can fix rules about fines for the defaulting members. On the other hand, they seem to look much more towards the PDR than towards their union, or themselves, to solve any problem which arises. In this sense, the self-identification has been achieved only partly.

(c) The contributions of the members to their association are made in money (entrance fee, share and annual contribution) and in labour. The value of the share increases as the association accumulates real assets and financial means resulting from its activities.

On the whole, the hypothesis (c) seems to be fulfilled entirely, whereas hypotheses (a) and (b) are so only to a certain degree which is not considered satisfactory in all cases.

3. Hypotheses with Regard to Support of Institutions

Special units (staffed with a multi-disciplinary team of motivators), rather than traditional administrative channels, should provide support to the community initially and gradually phase out or change emphasis as self-reliance of the the local community increases.

Discussion :

As outlined in section I, the traditional technical services of the agricultural region, i.e., crop production and animal husbandry, are integrated into the PDR together with new services for pisciculture, co-operative movement, agricultural credit, alphabetisation and women and family promotion. These services exist at the level of the region and of the districts. But these services are not organised into multi-disciplinary teams although technicians from different services sometimes visit associations together to make better use of the limited means of transport. At the level of the zone there is often only a technician of crop production who has also some knowledge in the other fields but who will call in his specialist colleagues for matters concerning their respective fields. In the present situation, the problem seems not to be the way in which the different specialists collaborate but the fact that they reach the associations rather rarely and in an un-systematic way.

The kind of support provided changes with the problems faced by the associations. But since the support is not offered in a sufficiently systematic way, it cannot be oriented towards a phasing out or a chage in emphasis.

The PDR has neither special multi-disciplinary units nor does it work through traditional channels. It, therefore, occupies an intermediate position with regard to the postulate contained in the first part of our hypothesis. With regard to phasing out or change in emphasis. no formal arrangements are being made but in reality the actual

development of support activities may sometimes satisfy our hypothesis.

4. Hypotheses with Regard to Activities of Rural Institutions

(a) The set of institutions should combine production support and social activities in a way which reflect felt-needs.

(b) Appropriate education and training should enhance the self-reliance of the rural population.

Discussion:

(a) The set of institutions comprises, in our case, the associations and their unions on the one hand, and the PDR with its different services on the other hand. Although this set covers production, production support and sccial activities, the coverage is not complete and the activities are not always carried out in a way which would reflect felt-needs.

First, very essential activities, such as road construction and maintenaace, are not integrated into the set of rural development institutions. Though the need for better road infrastructure has been expressed repeatedly over the years, and through different channels, the very difficult conditions of transport have not been improved. Secondly, with regard to activities which are integrated, the problem is that the activities are not always carried out as desired. Here again, the reasons differ but they include lack of means, organisation and motivation of those involved in the activities. In other words, the different activities do not seem to be sufficiently controlled by the people to reflect their needs to a greater extent.

(b) Appropriate education and training are part of the project activities and have certainly a positive impact on increasing self-reliance of the rural population.

Although we have not been able to develop an indicator for increasing self-reliance in this concrete case, and measure its change over time or in a cross section analysis, the *second hypothesis* (b) can be considered as largely fulfilled. The first one (a), on the contrary, is not being fulfilled to a satisfactory level.

5. Hypothesis with Regard to the Poverty Orientation

The set of institutions that may be created should function in such a way as to give the poorer sections of the population a fair chance to participate effectively (if necessary, discriminate in favour of the poor).

Discussion:

This hypothesis was formulated in view of situations of considerable inequality in resource endowment where the better-off tend to dominate rural institutions and either block the access for the poorer people or exploit them. But as already mentioned, inequalities are not great in the project area and there is, therefore, insufficient scope to introduce a special orientation towards the poorer sections of the population. Our last hypothesis is, therefore, not applicable. Perhaps, it could be reformulated with regard to young people who are facing special problems in many cases with regard to their initiation into rural life. This is a serious problem also in the project area.

IV. AMENDMENT TO THE HYPOTHESES

We have seen that "creating the institutional structure necessary for rural development" has been one of the intermediate objectives of the PDR from the outset. One could then ask what kind of rural development is aimed at in this particular case. We did not pursue this question but assumed that self-sustained rural development would be considered as a major objective. Our hypotheses were meant to describe the elements of the creation and functioning of rural institutions which, altogether, would bring about self-sustained rural development. We had then to ask the question whether, and to what extent, our hypotheses have been fulfilled.

Now, with the results of this examination in mind, one can speculate about the PDR's posssiblities to fulfil our hypotheses in the future to a greater extent. One can also speculate about the adequacy of our hypotheses. The first question shall be dealt with in section V and we concentrate for the moment on the second question.

The hypotheses with regard to the support (3) and to the activites (4) of

rural institutions appeared to be the most difficult to fulfil. This may be becase they put too much emphasis on the results (self-reliance and satisfaction of felt needs) and are not explict enough about the means which should be used to achieve the desired results. The review of the performance of the PDR with regard to these hypotheses has, in fact, pointed at operational problems such as lack of means of transport, poor organisation and motivation. It seems that among these, motivation is the most important factor. With a strong motivation, most of the organisational and transport problems could be overcome, but better transport and orgainsation would achieve little without stronger motivation.

It is suggested here, (and this can be seen as an amendment to the hypotheses) that the support of the rural institutions, and consequently, of the pepole, should be brought closer to the clients, both geographically and, above all, socially. The support units should be located in the villages and/or not further than, say, a half day away from their clients by the means of transport currently available (foot or bicycle in the area of the PDR). The support services should be provided by people stemming from the immediate area where they are working. They should live in the same area and receive some material contribution from their clients. In addition, they should have their own income trom activities similar to those of their clients if the income from support services is considered insufficent. This means the support service "agents" ("mobilisers") who would not be civil servants, should be truly rural people and be dependent on and integrated into the rural social and economic environment. This new type of support agent is not meant to replace the Government extension agent but rather to fill the gap which generally exists between the rural people and the extensionists. Therefore, the following *additional hypothesis* is proposed:

> Mobilisers are necessary who are socially, economically and geographically integrated into the village or area where they are working.

To achieve a better reflection of felt-needs in the activities of the various insritutions, the rural people should, through their representaives also have a voice in those institutions which operate on the regional or national level (e.g.,) transport and health services). Furthemore, the activities on the local level should be open to the population in a way which would allow for local initiatives and a local resource contribution

which would necessarily have to be matched by a central contribution within certain limits.

V. CONCLUSIONS

This paper did not deal exclusively with the case of the PDR, but attempted to examine general hypotheses about rural institutions, using the PDR as an example.

A first general remark concerns the concept of integrated rural development—spatial integration of different, more or less directly inter-related activities. In the case of PDR, the different activities are to a large extent, integrated into the project and, thus, centrally co-ordinated. But integration in project headquarters is not tantamount to integration on the village level. Getting acceptance and co-operation of the rural people of any new activity, and a lasting local contribution may be considered as the proof of *social integration* of any rural development activity. Social integration is an essential part of self-sustained rural development and something difficult to achieve because it means the establishment of a climate of confidence at the village level, on-going dialogue and inputs into concrete activities (e.g., training investment, extension). The impression prevails that social integration can more easily be achieved by small projects than by big ones. This has to be kept in mind when designing rural development policies and projects. While PDR has been successful in mobilising rural people in farmers' asscoiations, its size and approach as a para-govenmental body makes it very difficult to achieve full social integration.

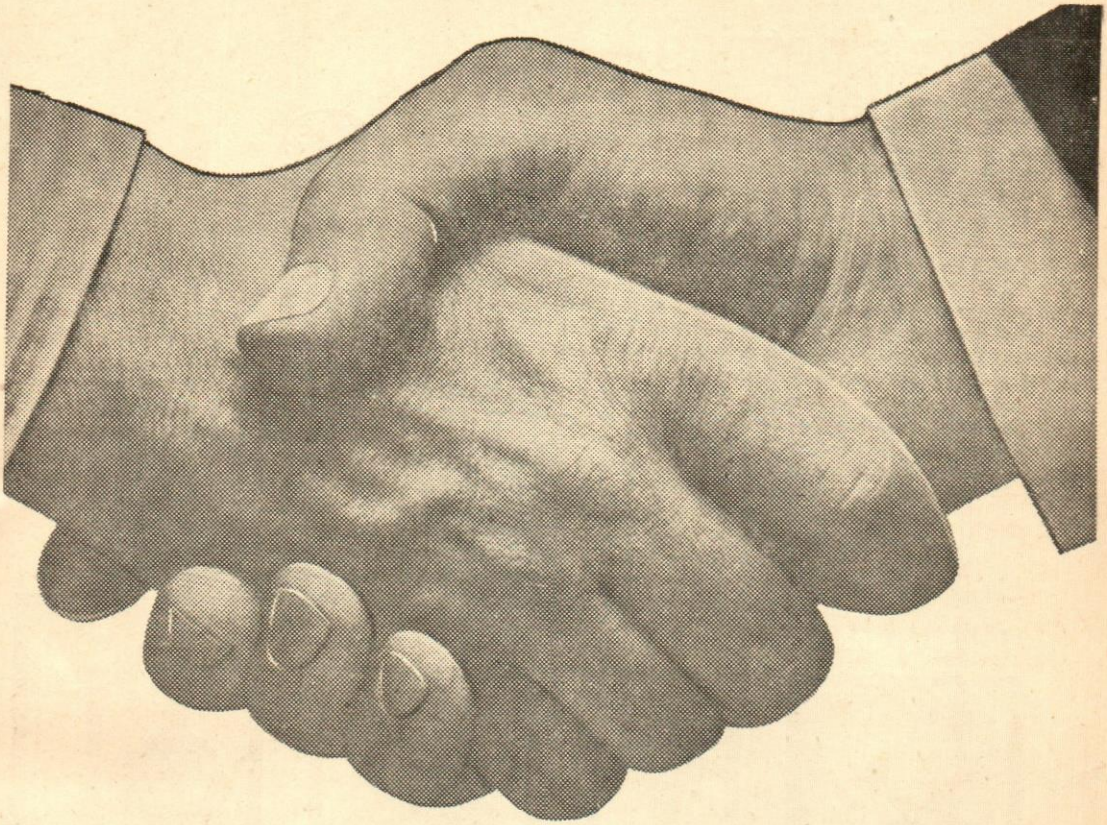
Rural development in general and the creation of viable institutional structures at the village level in particular, need more time than often assumed because they have to do with large numbers of individuals who want to be listened to and to be convinced. Institution-building, while necessary to give the desired social dimension to rural development, remains hollow if it is not built around socially and economically meaningful activities which may need simultaneous support in a starting phase. This makes institution-building projects complex and contributes to the long time-span involved. Undue time pressure to show results leads inevitably to the creation of structures which may be viable in the climate of intensive care of a project but not under normal conditions prevailing in rural areas without a project.

The following conclusions bear important implications for rural development planning in general, and for aid agencies in particular, who are increasingly committed to support rural development activities.

(1) As to the size and ambition of rural development projects, smaller and less ambitious projects seem preferable to bigger projects. But this is not an argument in favour of pilot projects with high-intensity resource inputs. Project should start out small to facilitate social integration and to avoid creation of a heavy and costly administrative machine which the Government will feel obliged to maintain after the discontinuation of foreign support althogh the means will generally be lacking to operate the machine efficiently. It is not excluded, however, that rural development projects grow, or, even better, are replicated elsewhere when the social integration has been achieved or appears possible.

(2) The time span of a few years for rural development projects puts undue pressure on the people working in the project, particularly if it is a big one. Though phases of, say, two years, may be useful to plan a project and review it from time to time, it seems unrealistic for most rural development projects to think in terms of less than 8 to 10 years. A way of limiting the risk of such a long-term engagement is to build into the project, right from the beginning, a monitoring component which provides, periodically the information needed to steer the project in the desired direction.

(3) The kind of low-key approach to rural development which is suggested here has also implications for the type of assistance to be provided from outside. High intensity of foreign expertise will generally be too expensive, at least on a full-time basis, and not really adapted to work over long periods on the local level. The availability and training of nationals, who are not only qualified but are also motivated to work in the rural areas, is of great importance. In many cases, the question should be asked whether bilaterally—or multilaterally—supplied "experts" are at all suitable for the operation of a rural development project. Expatriate staff from non-governmental organisations who do not have the status of "experts" may be more appropriate to implement, together with local people, of course, a low-key approach to rural development. □



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Book Reviews

Rural Development in Action

Uma Kant Srivastava and P. S. George

Somaiya Publications Pvt. Ltd., Bombay, 1977, pp. 265, Rs. 45.00

Reviewed by S. D. Thapar*

To outside authoritarian societies, economic planning makes sense if it helps direct people's pent-up energies to do something for themselves in a meaningful way. The macro plans, howsoever essential to build the infrastructure necessary for development, miss the vital element of growth, namely, motivation of man. It is precisely for this reason that currently micro-level planning has received its due recognition. But then there is sometimes confusion as regards the planning and implementing agencies; more so on the part of academicians who are interested in the excellence of documents and the enunciation of management. Should the people (through their respective bodies at the micro level or the local voluntary bodies) themselves prepare the plan or some government department, or special office created for it or a lower level administrative set-up, do it ? Again who should implement the plan ? The people's own institutions or the government ? The degree of official intervention is another matter under consideration.

The book under review has given answers to all these questions while evaluating the performance of a voluntary body working in the rural areas of Maharashtra. The Bharatiya Agro-Industries Foundation (BAIF), Urli Kanchan, in a decade of its existence has dispelled all fears regarding planning and execution capabilities of selected voluntary groups. What is most important is their commitment to the rural population. This evaluation has been done by the staff members of the Institute of Management, Ahmedabad. They have employed all possible tools applicable to the situation. The results are encouraging in every respect including the area of the development team.

The activities of BAIF that have come under close examination are the lift irrigation programme, the cattle development programme, the joint cooperative farming society and the tractor hiring unit. In every case the criterion of cost-benefit has been applied. Since complete

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details of each exercise are given, this can serve as operational guideline to any researcher doing a similar work.

The utility of this report could have increased if the authors had described the impact of individual programmes on the economy of the area. That might have called for an economic base line of the defined area in which these programmes are located. This is essential for manpower planning—the neglected sector of most plans in the country.

The conclusions reached by the author are sound. "Development plans which do not attempt to provide a harmonious blending of needs and resources are often likely to end up in failure". And who can better assess the local needs than the local planning agency who understands the people's susceptibilities ! Any outside planning agency must operate through local volunteers. Of course, it must have available to it the services of technical persons who can evaluate local resources of men and material, prepare technically-sound plans and supervise execution of programmes.

The book stresses rightly on the involvement of the population in development tasks. "Often planners feel that plans are meant to fulfill the needs of the beneficiaries which the latter may not perceive. This attitude on part of the planners creates an attitude of non-belonging among the beneficiaries". This obviously should be avoided. A little cost by way of a little imperfection entering into the growth path is well justified. By involving the people, you have built the man, the sum total aim, objective and end of all developmental efforts. The report clearly states, "It is worthwhile for the planners to involve the beneficiaries in the planning process. Though this might lengthen the planning process, it is very desirable for ensuring a proper implementation of the plans".

The question that arises is whether the government—may be, at the state or even the district or block level—can involve the beneficiaries in planning. Experience till date says no. The little work done in the initial days of community development programme in this country stands evidence. The little initiative, the spirit of self-help that the people had, instead of being strengthened, got largely diluted. The poor people stopped thinking for themselves, the community

spirit got dissipated and the common man in the rural areas entered deeper into the region of privation.

Of course, one has to be judicious about the choice of organisaton to plan and implement. "It may be desirable to analyse the type of organisation suitable for different areas on a case by case basis, rather than make generalisations for the country as a whole. In areas where a successful Voluntary agency is functioning, the entire development scheme can be entrusted to this agency". Then there are voluntary agencies—good, bad and in-between. While the good ones should be encouraged in every respect, efforts should go on to improve the standard of competence and commitment to the cause by others. This is a difficult task, but then there is no other way to rural development. □

Integrated Approach to Rural Development with Social Justice

K.D. Gangrade (Edited); National Service Scheme Unit, Delhi, pp. ii+78.

Reviewed by K.S.V. Menon*

The National Service Scheme Unit of the Delhi School of Social Work had organised a conference in January 1977 to discuss the concept and different aspects of integrated rural development. The book under review contains the background papers and proceedings of the event.

The conference identified the following major issues for discussion: (i) to attempt a clarification of the concept of integrated approach to rural development with social justice: (ii) to examine how the student community and educational institutions could contribute in this task; (iii) to examine how rural institutions themselves could be strengthened

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so that they could play effective role in process of rural development; and (iv) to find ways and means of increased participation by voluntary organisations in various programmes.

A perusal of the proceedings of the conference seems to suggest that these aims set before themselves by organisers have, by and large, been realised. Some of the major conclusions further substantiate the point. For instance, there was a consensus of opinion among the participants that "development is meaningful only if it is linked with social justice". The integrated rural development could be brought about by the maximum reliance on local resources and by a co-ordinated support on the part of all institutions and agencies, govermental and voluntary, working in the region.

Similarly, educational institutions and the student youth have a definite role to play in the task of rural development. There is need for a close link between educational institutions and development departments for a meaningful involvement of the student youth in the programme. Its essential prerequisite is the participation by the people in developing their own life and resources.

In his key note address, Shri Tarlok Singh discusses various strategies adopted in the past, ultimately leading to the acceptance of the idea of integrated rural development. Many will share his view that if the latter concept were to achieve mature formulation, its scope, modes of implemetation and impact would differ according to the stage of development and the condition and requirements of the rural economy and of society. He has done well to outline a workable scheme of national and state planning priorities in terms of which integrated rural development could be undertaken successfully.

Dr. Ram Das, in his paper on 'Role of Voluntary Agencies in Rural Development', traces their evolution, pinpoints the part played by them and sketches a new strategy to break fresh grounds "if they (voluntary agencies) were to continue to play the role of pioneers and innovators as in the past". There is no doubt that better result can be obtained if the government and voluntary agencies work hand in hand complementing and supplementing the efforts of one another, thereby ensuring a more rapid social and economic transformation of the countryside and projecting new lines of action.

Most of the suggestions made and ideas aired, though not entirely novel, should be further examined so as to comprehend their operational relevance and implications from different angles—administrative, financial and organisational. In fine, the publication throws up a number of challenging problems and indicates promising opportunities in the field of rural development. □

Idle Labour in Village India

Kanta Ahuja

Manohar Publications, New Delhi, 1978, pp. 160, Rs. 50.00

Reviewed by J. D. Verma*

Agriculture as a profession in India has always been regarded as a vocation which could not provide adequate work to keep agricultural working classes busy throughout the year. Various reasons have been given for this state of affairs, major among them being the uncertainity of rainfall, absence of artificial means of irrigation, the climatic conditions which do not permit to have more than one crop, not to speak of three crops as is possible in some of the advanced countries of the world, etc. The Royal Commission on Indian agriculture and various other learned authors on the subject had estimated that a worker in the Indian agriculture finds job only for 180 days in a year. It has, therefore, always been recommended that efforts should be made to establish cottage and village industries so that the working class in agriculture can not only keep themselves busy for the rest of the year but also supplement their income. As it is, the productivity of soil in India would not enable a worker to earn in 180 days as much as would sustain him and his family for the whole of the year. Thanks to the Khadi & Village Industries Commission, the All India Handicrafts Board and, of late, the Small Industries Development Organisation of the government of India which have been preparing special schemes for the benefit of people in the rural areas to start handicrafts,

*Director, Small Industries Development Organisation, New Delhi.

village and small scale industries and thus avail of the surplus time which, in any case, is there so far as the agricultural profession is concerned. This apart, the disguised unemployment in Indian agriculture is well known. This is partly because all the members of the family of an agriculturist cannot find gainful employment in an enterprise other than agriculture. The holdings are small and many a time uneconomic; the capital employed on these holdings consists of primitive tools and implements of cultivation; the seeds used are not always of the best quality; and above all, the dependence on rainfall not only keeps the productivity of the soil low but also restricts the cultivator's desire to resort to extensive methods of cultivation.

Hence the attempt made by the author to determine and quantify the idleness of labour in village India is, undoubtedly, a useful exercise, which brings out not only the factual proof of the aforesaid characteristics of the Indian agriculture but also poses certain problems for the administrators and planners to think about providing full employment opportunities to the Indian agricultural working class concerned. In the same context, conclusions arrived at in the book can help the administrators and planners to devise suitable plan of action in their attempt to attain full employment in the country—an aim which may be or never be achieved.

With the introduction of the subject, the author has herself posed various questions, such as—What are the various forms of under-utilisation of the agricultural working class ? What factors determine labour rules for the individual household ? How big is the size of the unemployment ? Is it increasing ? What is necessary for mobilising the vast labour potentials, etc.

Obviously, as intended, she does not endeavor to provide answer to all these questions. However, with the help of intensive village level study of a few villages in Rajasthan, attempt has been made to assess the labour time disposition. The study has also focussed on the conceptual problems of measurement of unemployment and surplus labour. For the latter, different criteria have been used. These include, extent of poverty, time available for the work, availability of the work, etc. It further proceeds to assess the size of household unemployment and correlate it with different variables. A chapter

has also been devoted to estimate marginal productiviy of labour.

Based thereon, yet another criterion has been defined to estimate indirectly the quantum of surplus labour. Rightly so, for this purpose, time and work involved in maintenance of the livestocks by an agriculturist's family have also been assessed. Likewise, the man-hours (working) for female and male labour have also been standardised so as to minimise the chances of wrong calculations on this account. All these have, no doubt, brought to the fore various forms of unemployment including disguised unemployment in the areas covered for the study. An attempt has also been made to enunciate and evaluate the effect of rural employment policies and programmes which are being followed by the State Government both within its own programme as also that of the Central Government. In this context, the author has rightly drawn attention to the weakness of the administrative machinery which is charged with the responsibilities of implementing the aforesaid employment programmes in the rural areas. Many a time, the administrative machinery designated to do the job under this programme is drawn from among the people who lack in necessary academic qualifications and professsional experience.

It is indeed an appreciable attempt made by the author in analysing the results obtained from various criteria she has followed to assess the quantum of idle labour in the villages selected for study. In view of the fact that nature plays a dominant role in Indian agriculture as perhaps in other parts of the world and each village has got its own unique characteristic which may not be found even in a neighbouring village, it is not sure if the results obtainable in the villages selected for the study are applicable to other parts of the State, let alone the country. Nevertheless, different criteria used in the study will be helpful in bringing about uniformity of the problem as that of suggested solution. □

The Rural Elite in an Indian State : A Case Study of Rajasthan

Iqbal Narain, K.C. Pande & M.L. Sharma

Manohar Book Service, New Delhi, 1976, pp. 236, Rs. 50.00

Reviewed by C.V. Rao*

The literature on the subject of rurai development, its administration, planning, etc., has been growing at a faster pace than the actual process of development. The book under review is one such study conducted by a team of political scientists, who have tried to identify the *rural elite* in one Indian State, Rajasthan. This problem is quite interesting, as it is this class which has, in the past, provided the leadership to village/block/district/state level administration. The success or failure of raising the levels of living of the rural poor can be gauged from the type of leadership that has emerged in the past.

Being a case study, the findings can be regarded as more closer to reality. But, as usual, the constraints of poor responses from the respondents and paucity of time and funds, has somewhat driven the researchers away from the reality. Nevertheless, whatever conclusions have been drawn, can be of interest to the readers, and of course, provide some useful data for future researchers to base their own studies.

"The objectives of panchayati raj are democratisation, development and social change; and the institutional leadership under its aegis forms the nucleus of a new emerging rural elite in India. It is only natural to expect this new elite to justify itself as the end-generating catalyst of a new transformation in terms of the objectives of the panchayati raj. It is, therefore, relevant to enquire who are the elites in the changing social mileu, in what way they acquire power, and with what motives they weild it...the primary objectives of the study are to discover to what extent the emerging elite differs from the traditional elite; to what extent it can be acted as an agent of democratisation, development and social change" (page 1). This, in a nutshell is all about the study and its working hypothesis.

*Associate Editor (PRODUCTIVITY).

It is well known that the rural elite, by and large, is either a rich landlord, or a priest or belongs to a higher caste. In either case, he is economically well of, socially well placed and politically has linkages with leaders at higher levels. The new emerging rural elite has slightly varied norms, values, educational background and behaviour and, above all, belongs to middle caste. This class has come to share power with upper caste(s). However, rural elites from both classes are more power-oriented and less development-oriented. Power, whether it be economic or political, is likeable and, therefore, elites have tried to keep themselves in power.

With this as a general background, the study addresses itself to the following: (a) emerging rural elite is not different from the traditional rural elite; (b) the elite is civic-amenities-oriented rather than production-oriented; (c) the rural elite is more interested in politics than in the fulfillment of developmental obligations; (d) there exists a gap between the elite and the citizens in terms of levels of political consciousness and economic status; (e) the emerging rural elite in Rajasthan is unsuited to be a catalytic agent of social change.

These hypotheses are in relation to the panchayati raj institutions. The authors have rightly pointed out that hypothesis (a) is valid. Srinivas's contention that the *dominant caste* is still more important than the *dominant individual* is not wholly correct, as, it is seen in the present day context that the emerging rural elite belong to the middle castes and have better educational background. Since they are participating in larger number than before in village administration, it would be proper to infer that the dominant individual matters and not the dominant caste. However, it may be possible that in some parts of the country, perhaps, it is the dominant caste which is still ruling the villages. In the overall analysis, it can be safely inferred that educational and generating factors play more conjunctional than exclusive role and socio-economic factors have a greater weightage than the rest.

In regard to hypothesis (b), it would be sufficient to say that the rural areas are marginally developed. The rural elite are, at best, looking into the civic-amenities requirements of the rural poor, but, are not interested in developing the production processes or improving the skills of the rural artisans. This is because if the production processes are

given due encouragement there is every possibility that the rural poor would command some economic power at a later stage, and thereby threaten the position or the rural elites on the political front too. This corroborates the hypothesis (e) (mentioned above), that the emerging rural elite by temper and trend is unsuited for acting as a catalytic agent for social change.

To understand the influence of the rural elite on the local politics, one has to ascertain the backing of the citizens and the extent to which he can develop political linkages with district and state level elites. In addition to factors like honesty, judiciousness, impartiality, etc , it is the former (to have accessibility to district and state level elites or having affiliations with political parties) which limits or extends an elite's domain of influence. It has also been found that as rural elites move from lower to higher level positions, the role of the social factors diminish and that of political factors increase. With regard to the patterns of communications, though the citizens can exchange information and discuss matters of importance at *chopals*, etc., the rural elite have contacts with political parties and district and state level elites and, therefore, have accessibility to more information than the rest of them. With the result, they are more informed.

This is all in a capsule form what the study throws light on. The question arises whether the rural elite can still be regarded as a catalytic agent of social change. Can the panchayati raj institutions still be meaningful in the present day, when there is acute struggle for power at various levels of administration?

If the rural elite have to perform their role, what is important is that they should be involved in the planning process to a much greater extent than before, and it should be left to them for implementing the plans laid down. This, in turn, would help in realising the benefits of the developmental efforts undertaken by them in tune with the central and state plans. □

Towards Modernization : A Study of Peasantry in Rural Delhi

Dr (Mrs) Sumati Mulay and Dr G.L. Ray

National Publishing House, Delhi, 1973, Pages xii+159, Price Rs 35.00

Reviewed by Harkirat Singh*

This book contains the thesis of Dr G.L. Ray based on a study of the Kanjhawala Block of rural Delhi conducted under the guidance of the senior author.

As the authors themselves concede, "it is difficult to draw any generalisation on the basis of a limited study". The study is, therefore, essentially indicative, and that too in relation to a rural community subject to special influences from the capital city of Delhi.

The present efforts towards rural development lay emphasis on a careful assessment of the human and natural rural resource endowments and their adoption to the production process. While modernisation, to an extent, would be inevitable for the success of these efforts, it remains to be seen whether urbanisation as a means of modernisation, as advocated in the study, can deliver the goods.

*Public Relations Officer, National Productivity Council, New Delhi.

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Index to Advertisers

All India Handicrafts Board	704
Bata	508
Bharat Carbon & Ribbon Mfg. Co. Ltd.	543
Bharat Heavy Electricals Ltd.	686
Dalmia Cement (Bharat) Ltd.	684
Fertiliser Corpn. of India	745
Gujarat State Fertilisers Co. Ltd.	520
Hindustan Insecticides Ltd.	745
Hindustan Machine Tools	632
Indian Overseas Bank	604
Kerala Agro Machinery Corpn.	530
Kirloskar Electric Co.	564
Management and Labour Studies	744
National Fertilisers Ltd.	684
National Research Development Corpn.	703
National Savings Organisation	544
National Small Industries Corpn.	731
New Bank of India Ltd.	578
Punjab & Sind Bank Ltd.	685
Richardson & Cruddas Ltd	618
Rural Electrification Corpn.	683
Shri Ram Chemicals	49
State Bank of India	746
The Effective Executive	73
West Coast Paper Mills	55