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PRODUCTIVITY

CONTENTS

Productivity and Economic Growth

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Production and productivity are the two significant elements of the process of economic growth. Increase in production, however, should not be achieved, regardless of the expenses on the inputs. Mere increase in production is not a sufficient condition of economic growth; it must be accompanied by reduction in the cost of production through higher productivity. Continuous increase in productivity in industry and agriculture is an essential factor for stepping up the rate of economic growth.

THE process of economic growth is so complex that it would be inappropriate to identify one single factor as the causative force. It is, therefore, necessary to take a pluralist view of the causes of economic growth and the means of promoting it.

There are, however, two unmistakable elements of the process of economic growth which stand out as of particular significance because of their peculiar characteristic of being both a cause as well as a consequence of economic growth. The two elements are production and productivity. Evidently these two elements are interrelated aspects of a basically single phenomenon which consists of the activity of creating economic values.

Every kind of economic system, be it based on the principles of free enterprise, or the philosophy of dialectical determinism, or the concept of mixed economy or the theory of indirect regulation and management of key forces in the economy, is concerned with production of wealth. An economy which has stopped production of wealth would be committing suicide and an economy which is unable to achieve a surplus of production over consumption will die a slow but sure death.

A growing economy must, therefore, ensure a surplus of production over consumption and if the assumption is that it has also to ensure a rising standard of living which means a rising rate of consumption, then the economy must be able to achieve a rising rate of production.

To increase total production would not normally be difficult if this was to be done at any cost, that is regardless of the expenses on the inputs which are necessary to secure a higher output. The problem is really of increasing the output consistently with less than proportionate increase in the costs of production. In other words, mere increase in production is not a sufficient condition of economic growth. Increase in production must be accompanied by reduction in the cost of production of every additional unit. The increase in production must be economical. This means securing higher Productivity.

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The point could be illustrated with an example. Suppose an economy produces 100 units of a commodity at a cost of Rs. 1000. The economy may succeed in doubling the output to produce 200 units. In the process the cost incurred may be higher than, equal to, or less than Rs. 2000. If the cost is higher than Rs. 2000 the activity has proved to be uneconomical. In normal circumstances the society would not approve of such a result and would discontinue or reorganise the activity. If the cost is equal to Rs. 2000, the economy has not secured a net gain. Although it secured a doubling of the output it also doubled the cost of production or of the inputs and thereby neutralised the advantage of the rise in production.

If the economy succeeds in increasing the output from 100 to 200 units and if the cost increases from Rs. 1000 to say Rs. 1800, the economy would secure a net gain of the value of Rs. 200 or Rs 2 per unit of output. This saving of resources of the value of Rs. 200 could now be released for extension of the existing activity or creation of new ones. This would then be the foundation of economic growth. This would provide resource for capital formation, be it in financial or physical terms. Such capital, when invested in economically feasible project would serve as the instrument of securing further economic growth.

In order to secure the formation of capital at an increasing rate, increase in production and productivity has to be achieved both at the micro or unit level as well as at the macro or national level.

Factual studies pertaining to the Indian economy in respect of increase in production and productivity at the micro level are far and few between. At the macro level some of the trends have received attention, but the data in aggregation is not always comparable over periods of time or competent for reliable analysis.

If, however, we take the two major sectors of the economy, namely agriculture and industry, and examine the trends in production and productivity in these sectors it would be possible to get a clue or two to identifying the direction in which the national economy will have to move in order to ensure its continuous growth.

The Index of agricultural production with 1949-50 as the base year shows a growth in total production of about 60% in approximately 20 years while agricultural productivity shows a rise of only 26% over the same period. The increase in agricultural output has no doubt been welcome and necessary; it is, however, evident that in coming years considerable emphasis will have to be placed on improving the productivity of agriculture which in turn will provide a more enduring base for economic growth.

The index of industrial production shows a slightly better position. With 1960 as the base year industrial production has registered an increase of about 60% over a period of ten years and about 100% over a period of twenty years. No reliable computations have been made of the increase in productivity of the industrial sector, but estimates indicate that there has been about 40% increase in productivity. There are two features of the situation which are specially encouraging. First, the output of basic industries has registered a more than 100% rise in a period of ten years. Since basic industries produce capital in physical terms, the relatively high rate of capital formation lays the foundation of future growth. Secondly, it is evident that it might be relatively easier to extend the application of productivity techniques in industry than in agriculture.

If we wish, as a nation, to step up the rate of economic growth, continuously increasing productivity in industry and agriculture would undoubtedly be a major instrumentality of doing so. The actual process of spreading awareness of the advantages of increasing productivity and of training and educating the concerned 'factors of production' particularly managements and labour as well as land-owners and land-tillers is like many constructive activities, a 'not-so-spectacular' an activity. But like all constructive and nation-building efforts it can yield solid and sound results of enduring value. The link between economic growth and productivity needs, however, to be constantly highlighted so that the nation is able to set its bearings right on the path of economic progress. ●●●

Productivity Policies and Economic Development in India

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Performance of the Indian economy since the country adopted the process of planned economic development has been reasonably satisfactory. Judged by actual achievements in levels of productivity or by growth of production potential, the economy has taken rapid strides. Implementation of the new strategy introduced in late sixties promises a breakthrough in agriculture. Remarkable progress has also been achieved in industrial development in terms of production and productivity, as well as in its structure. A fair measure of self-reliance has been attained in certain key items.

The progress, however, can be sustained and improved only if we adopt productivity increasing and cost reducing techniques and eliminate the shortages of basic inputs. Much, however, remains to be done to realise economic goals. More vigorous efforts are needed to increase output in key areas. There is no reason why we should not look forward to a more promising trend in productivity in future.

INDIA has a large reservoir of manpower consisting of over two hundred million men and women who are able and willing to contribute their energy to the development of Indian Economy. She has also a rich endowment of natural resources which could be profitably utilised for raising the output of goods and services needed to sustain the people on rising standards of living. Next to United States and Soviet Russia, she possesses the largest iron and coal resources[1]. Her potential water power resources are again the third largest in the world. It is, indeed, ironical that in spite of the large potential of resources both human and natural, it continues to remain in the group of underdeveloped countries.[2]

It was, however, realised by the Indian planners, right on the eve of the First Five-Year Plan, that the key to solving the problem of India's poverty lies in raising the levels of productivity. In common parlance, increase in productivity means a rise in output per unit of labour. In a more comprehensive sense, however, a successful productivity policy implies higher ratio of output to labour as well as of the other scarce inputs. In other words, it is clearly admitted that significant advances in the economy are not possible without maximum economy in the utilisation of scarce resources.

Plan Strategy and Productivity

The basic strategy adopted in plans to raise productivity and living standards in India is to provide the workers with more machines and equipment of superior quality, larger doses of mechanical energy and improved technology and develop an institutional structure that motivates them to put in the best of their efforts in the building up of Indian economy and society. Since, at the beginning of the era of planning in India,

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1 Strausz-Hupe, Robert: *The Balance of Tomorrow* (1945)

2 Economic Survey of Asia and Far East-1949

capital goods were in extreme short supply, it was decided to build up within the economy not merely the infrastructure in terms of irrigation, power, transport, education etc., but also a large capacity to manufacture intermediate capital goods like steel, cement, aluminium and heavy engineering goods. The amount of capital needed to produce an extra unit of output in these industries is generally higher compared with that in the consumer goods industries; the higher priority accorded to the former in the basic strategy of the Second and Third Plan implied lower rates of increase in final output in the initial stages. However, once the output of capital goods started flowing in at an increasing rate, productivity in consumer goods sectors would also rise, leading to accelerated growth of the economy.

Productivity and Levels of Living

While the basic strategy in plans was directed towards securing a rise in the rate of economic growth over a period of time, it is satisfying to note that the achievements realised even in the initial periods were by no means insignificant.

Prior to 1951, national income was rising at the rate of 1.25% which was just offset by the growth of population. The plans, however, achieved a perceptible acceleration. During the first fourteen years, national income at constant prices, showed an annual increase of 3.8%. Adjusting for the rising rate of population growth during this period, the rate of increase in per capita terms would work out as 1.8%. True, this was subject to a wide margin of fluctuations inherent in an economy as overwhlelmingly dependent on agriculture as that of India. In fact, the two consecutive droughts following the year 1965 took the economy considerably off the track and it is only during the last three years that it is picking up again, promising soon to overshoot the trend line observed in the preceding period.

The limitations of rise in per capita income as a measure of improving the lot of the common man are too obvious to be recapitulated here. We, therefore, turn to more concrete and direct indicators of changes in the living standards of the people at large, as presented in Table 1. There is a positive turn in the trend in respect of the most important item of consumption, namely foodgrains. While, before the plans, food production was barely rising at the rate of 0.5% per annum which was generally lower than the rate of increase in population, between 1950-51 and 1964-65, the annual increase in food output was about 3% (compound) and was significantly higher than the population growth during the same period. Per capita availability of cereals and pulses increased from 394 grams per day in 1950-51 to 476 grams in 1964-65. As already pointed out, availability was considerably depressed by two consecutive droughts, but since then it has shown substantial improvement and is almost hitting in 1970-71 the peak record of the bumper year 1964-65.

An obvious achievement from the point of view of well-being is the significant increase in the expectation of life at birth from 35 years in 1950-51 to the current level of more than 52 years. A good part of it is no doubt due to the shortcuts to mortality control made possible by advances made in the field of medicine and public health. The continued decline in mortality in the face of fluctuations in agriculture, however, speaks of a substantial improvement in the efficiency of the organised distribution system by the State. Credit may also be given to the large infrastructure built for the progressive eradication of various epidemic and endemic diseases. Success in health programmes has no doubt accelerated the growth of population and to that extent depressed the rise in per capita availability of the essentials of life. It is, however, indispensable for progress of any sort in two ways: 1) it raises the proportion of children born that survives to productive ages and starts yielding economic returns and; 2) increased probability of survival of children is a necessary condition for the ultimate success of any programme of population control. Conscious of the gravity of the population problem, the State has progressively increased expenditure on family planning programmes from a mere Rs. 65 lakhs in the First Plan to over Rs. 300 crores in the Fourth Plan.

Substantial progress in the quality of human

Table 1

Levels of Living : India

Variables	Unit of Measurement	1950—51	1955—56	1960—61	1964—65	1968—69
1. Per capita Net National Product at 1960-61 prices	Rupees	247.5	267.8	293.6	315.6	324.4[a]
revised series	,,	..	..	306.7	333.6	319.3
2. Net availability of Cereals & Pulses.[b] Per caput per day	Grms	394.0	429.5	466.8	475.9	438.0
3. Net Production of Food Grains[b]	Million tonnes	48.06	60.56	71.77	78.19	82.26
4. Cotton Cloth: per caput Availability Metres	Metres	11.0	14.4	13.8	15.1	14.1
5. Enrolment Ratios:	Percentage to total population in corresponding age group					
Classes I to V		42.6	52.8	62.4	75.5c	77.3
Classes VI to VIII		12.7	16.5	22.5	30.2c	32.3
Classes IX to XI		5.3	7.4	10.6	15.8c	19.3
University classes		0.8	1.3	1.7	2.3c	2.9
6. Doctors		59338	70152	75959	97728c	110684c

a=1967--68 b=Years are 1951, 1956, 1961, 1965 and 1969 c=1965-66

Sources : 1. Economic Survey, Government of India, 1969-70.
2. Basic Stastistics relating to Indian Economy, 1950-51, to 1968-69. Planning Commission, Dec. 69.
3. Fourth Five Year Plan, 1969-74.

life is also made possible by rapid expansion in the facilities of schooling for children. the proportion in schools in the age group 6-11 rising from 42.6% in 1950-51 to over 75% in 1968-69, and in age group 11-14 rising from 12.7 % to 32% during the same period. The stock of matriculates and graduates is rising at the phenomenal rate of over 6% per annum.

Output of essential consumer goods in the industrial sector has been rising from year to year, but the magnitude of increase in per capita terms has not been significantly high since it was partly offset by the accelerated population growth. Thus, per capita avilability of an essential item like cloth rose from 11 metres in 1951 to 15 metre in 1964-65, but was only 13.5 metres in 1969-70. However, it is interesting to note that while the output of cotton textiles in the organised sector declined from 4665 million metres in 1955-56 to about 4300 million metres in 1968-69, that of the decentralised sector more than doubled during the same period from about 1600 million metres to 3600 million metres. This is important both because the output of this sector goes largely into the consumption of the poor and because it is a source of substantial employment to workers in manufacturing industries.

Growth in Production Potential and Productivity

A review of the various indicators of the levels of living suggests that the performance of the Indian economy during the last eighteen years has not been unsatisfactory, though it has failed to make a substantial dent in the problem of poverty, both because we had started at a very low level and also because the rising rate of population growth cut into a part of the benefits that could have otherwise accrued in per capita terms. Judged, however, by the growth of productivity raising assets, the record of the Indian economy appears to be fairly encouraging.

The pre-requisite of increase in productivity is a progressive step-up in the stock of capital that

complements labour. It is satisfying to note that the rate of investment in the economy rose from about 5.5% in 1950-51 to 11% at the end of the Second Plan and 14% at the end of the Third Plan. A part of the increase was no doubt due to increasing inflow of foreign funds, but the increase in ratio of domestic savings to national income is also not insignificant, considering that the level in 1965-66 (10.5%) was about double that in 1950-51. The rise in domestic savings was partly made possible by the steady effort of the government which contributed to raise the proportion of tax revenue to national income from about 7% in the early fifties to around 14% by the end of the Third Plan.

The rise in domestic savings would have been larger, were it not for the mounting non-developmental expenditure caused mainly by the increase in dearness allowance sanctioned to neutralise the rise in cost of living. However, the drought and the recession led to a significant fall in tax revenues and the rising prices further pulled down the rate of private as well as public savings to a combined total of a mere 8% in 1967-68. The position turned for the better in the following year when domestic savings increased to 8.8% and investment was above 11%.

It is expected that with the economic recovery and renewed efforts for additional resource mobilisation, it will be possible to step-up the average rate of saving in the economy to 13.2% by the end of the Fourth Plan, as indicated in the Plan document. In view of the slackening pace of net external assistance, the rate of net investment is estimated at only 14.5%, just a little higher than the peak of the Third Plan. More important than the increase in the magnitude of investment is the record of achievement in terms of productivity-raising equipment, technology, attitudes and institutions which is reviewed in what follows.

Productivity Policies and Growth of Agriculture

As already observed, the three plans relied heavily on industry, power and transport for building up the production potential of the economy. Agriculture claimed roughly one-fifth of the total resources during the period 1950-51 to 1968-69. Nevertheless the growth

Table 2

Potential Resources for Raising Agricultural Production Potential : India

Variables	Unit of Measurement	1950—51	1955—56	1960—61	1964—65	1968—69
1. a) Gross Area Sown	Thousand Hectares	131893	147311	152716	158878	156638a
b) Net Area Sown	—do—	118746	129156	133157	137862	137030a
2. a) Gross Irrigated Area	—do—	22563	25642	27941	30620	32754a
b) Net Irrigated Area	—do—	20853	22758	24634	26507	27514a
3. Production of Fertilisers:						
a) Nitrogenous Fertilisers (N)'000 Tonnes		11[b]	82c	152[d]	237	541
b) Phosphatic Fertilisers (P_2O_5)		16[b]	18c	72[d]	133	216
4. Area under High Yielding Variables	Million Hectares	—	—	—	—	9·2
5. Yield per hectare	1949—50 to 1951-52=100		107.4	117.5	120.5	131.8

a = 1966-67 b = 1951-52 c = 1956-57 d = 1961-62

Sources: 1. Economic Survey, Government of India, 1969-70.
2. Basic Statistics relating to Indian Economy, 1950-61, to 1968-69, Planning Commission, Dec., 1969.
3. Fourth Five Year Plan, 1969-74.

of resource potential in agriculture built up during the period is striking. Several measures taken to raise production as well as productivity in agriculture need special mention. The decade 1951 to 1961 saw for the first time a reversal of the trend of declining cultivated area per worker in agriculture. Since 1960-61, the gains in acreage have been comparatively limited. However, the scope for productivity increase is being continuously enlarged by the increase inwater supply and other complementary inputs as well as progress in technology and the enlightened attitudes of the farmers. The net achievement relating to agricultural productivity may be easily noted from Table No. 2 which reveals about 21% increase in yield per acre by 1964-65 and over 31% by 1968-69.

More promising results are expected from the implementation of the new strategy implied in the composite programme of fertiliser, water, and high-yielding seed varieties. The area under high-yielding varieties which were introduced towards the end of the Third Plan, had risen from 1.8 million hectares in 1966-67 to 9.3 million hectares in 1968-69 and is as high as 14 million hectares in 1970-71. The programme is expected to double productivity on the lands covered by it. Remarkable success has already been achieved in the implementation of this programme in wheat growing areas. The new rice, however, still presents somewhat complex problems relating to water management and control of pests and diseases. Other crops which are included in the programme are maize, jowar and bajra. Serious attention is also being given to dry farming techniques which are directed to evolve new crop varieties and agronomic practices that would raise the yield in areas with limited water supply.

A striking turn in the Fourth Plan is to divert the benefits of the new technology and increased productivity to the small but potentially viable farmers by setting up a small farmer's development agency in 45 selected districts which "will identify the problem of small farmers in its area, prepare appropriate programmes, help to ensure availablility of inputs, services and credit and evaluate the programme from time to time."

The basic strategy adopted in the Plans to raise Productivity and living standards in India is to provide the workers with more machines and equipment of superior quality, larger doses of mechanical energy and improved technology and developing an institutional structure that motivates them to put in their best efforts in building up of Indian economy.

Organising new institutions and cultivating more rational attitudes among farmers rank as high in the cumulative growth of productivity in agriculture as the availability of new technology and modern inputs. Mention may be made in particular of the educative role of the community development programme which covered virtually the entire rural population by 1968-69. The real benefits of this programme may be seen from the response of the farmers to the new strategy in agriculture in several parts of the country, as is evident from the progressive adoption of the high-yielding varieties, consumption of nitrogenous and phosphatic fertilisers which multiplied five to six times between 1960-61 and 1968-69, demand for tractors which trebled in this period, and for electric pumpsets which increased by more than five times.

The role of institutions again becomes evident when we observe that membership of primary co-operative societies increased from about 14 million in 1960-61 to 53 million in 1966-67 and loans advanced by these societies rose by almost nine times from Rs. 86 crores in 1950-51 to Rs. 758 crores in 1966-67. In addition to co-operatives, the nationalised banks are also expected to act in a big way in financing agriculture and

mopping up rural surpluses in the form of deposits.

Productivity Policies and Industrial Development

While formulating the Second Plan it was clearly recognised that industrialisation with particular emphasis on heavy industries was an inevitable strategy for securing a sustained rise in productivity and levels of living. This was sought to be implemented through a progressive step-up in investment in industry which, as will be seen from Table No. 3, rose from an annual average of Rs. 180 crores in the First Plan to Rs. 630 crores in the Second and Rs. 840 crores in the Third Plan (at 1967-68 prices). By the last year of the Third Plan, it exceeded Rs. 1000 crores. The pace somewhat slackened in the two years of recession. Although it started picking up by 1968-69 the magnitude was still only Rs. 823 crores. Since the main emphasis was on basic and capital goods industries which required heavy investments, involved long gestation periods and also entailed grave risks, the public sector had to play a progressively increasing role in the process of industrialisation, its share being a little less than three-fifths in the total investment in organised industry and mines.

The basic strategy of Indian planning is clearly reflected in the output of organised industry which shows an average increase of 7% to 8% during the first three plans. Net output per worker in organised industries showed a trend rate of about 5% increase per annum between 1950-51 and 1964-65. It showed a decline during the recession and although we are now well on the way to economic recovery, the rate of increase in the aggregate output of the organised industry hardly exceeds 6%.

A significant feature of the industrial development of India since 1957 is the shift towards production of the basic and capital goods industries. As is evident from Table 4 sizeable increases have been obtained in the production of steel, aluminium, cement, heavy chemicals, and engineering industries. The output of finished steel rose from 1.3 million tonnes in 1955-56 to 4.7 million tonnes in 1968-69 and that of cement rose from 4.7 million tonnes to 12.2 million tonnes. Production of aluminium increased about 18 times, rising from 4.7 million tonnes in 1955-56 to 12.2 million tonnes in 1968-69. In 1955-56, the output of machine tools was only Rs. 8 million; it touched the peak of Rs. 354 million in 1966-67 but declined to Rs. 247 million in 1968-69. The gross value of the output of cotton textiles, sugar and cement machinery increased from Rs. 46 million in 1955-56 to Rs. 342 million in 1965-66. Output of machinery of all kinds except electrical machines increased about six times. Manufacture of transport equipment doubled during the same period. The recession took a heavy toll of these industries, particularly machine-tools and cotton textile machinery, railway wagons and automobiles.

The whole group of chemical industries as well as electrical machinery and appliances re-

Table 3

Total Investment by Sectors : 1951-52 to 1968-69 : India

Rs. Crores at 1967-68 prices

Period	Agriculture including irrigation and Flood control	Power	Industry	Transport & Communication	Social Services	Total
First Plan : 1951-52 to 1955-56	1625	537	900	1162	1971	6195
Second Plan : 1956-57 to 1960-61	1985	780	3182	2381	2631	10959
Third Plan : 1961-62 to 1965-66	2794	1810	4397	3331	3936	16268
Next Three Years : 1966-67 to 1968-69	1928	1208	2389	1461	2788	9774

Source : Planning Commission Perspective Planning Division, New Delhi.
Estimates of capital output ratio for the Indian Economy : 1950-51 to 1973-74.

Table 4

Production of Selected Industries: India

	Industry	Unit of Measurement	1950—51	1955—56	1960—61	1965—66	1968—69
1.	Finished Steel	Million tonnes	1.04	1.30	2.39	4.51	4.70
2.	Aluminium	'000 tonnes	4.0	7.4	18.3	62.1	125.3
3.	Cement	Million tonnes	2.7	4.7	8.0	10.8	12.2
4.	Sulphuric Acid	'000 tonnes	101	107	368	662	1024
5.	Machine Tools	Million Rupees	3	8	70	294	247
6.	Cotton, Sugar and Cement Machinery	Million Rupees	—	46	154	342	327
7.	Railway Wagons	'000 numbers	2.9	15.3	11.9	33.5	16.5
8.	Diesel Engines	'000 numbers	5.5	10.4	44.7	93.1	121.5
9.	Automobiles	'000 numbers	16.5	25.3	55.0	70.7	79.2
10.	Power Transformers	'000 K. V. a.	179	625	1413	4458	4729
11.	Electric Motors	'000 H.P.	99	272	728	1753	1861
12.	Electricity Generated	Billion Kwh	5.3	8.8	17.0	32.0	44.9

Source : Economic Survey, Government of India, 1969-70.

corded continued progress over the entire period, the levels attained in 1968 being respectively three and five times those existing in 1956. Actual increase in production could have been still higher, were it not for the high rates of capacity under-utilisation, the level of potential utilisation being 80% in all manufacturing industries and as low as 61% in capital goods industries in 1969.*

Changes in the structure of industrial output bring out clearly the productivity raising potential of the Indian economy. The share of consumer goods in value added in manufacturing industry fell from nearly two-thirds in 1950-51 to one-third by 1966-67. Correspondingly, the combined share of intermediate goods and machinery nearly doubled, rising from 32% in 1950-51 to over 64% by 1966-67. Such structural changes clearly imply the strengthening of the base for a sustained rise in industrial production and productivity by increasing the volume and quality of equipment per worker in industry.

An important factor contributing to the growth potential in both agriculture and industry is the progressive step-up in power and transport, annual investment (at 1967-68 prices) in these two sectors rising respectively from about Rs. 100 crores and Rs. 230 crores in the first plan to Rs. 150 crores and Rs. 470 crores in the second plan, and Rs. 300 crores and Rs. 600 crores in the third plan. In the three annual plans, however, the average investment in power and transport was Rs. 400 crores and Rs. 480 crores respectively. The rise in the magnitudes of investment is clearly reflected in the physical achievements in both power and transport which showed a remarkable increase from plan to plan. Thus, electricity generation rose from 5.3 billion Kwh in 1950-51 to 17 billion Kwh in 1960-61, 32 billion Kwh in 1965-66, and 45 billion Kwh in 1968-69. This makes possible rapid substitution of mechanical power for human labour, and in consequence, a substantial increase in productivity.

Another factor of equal significance is the rapid increase in transport facilities of all kinds. Thus, goods transport by railways increased (in millions) from about 44000 net ton km in 1950-51 to about 88000 net ton km in 1960-61 and 125000 net ton km. in 1968-69. Passenger traffic (in million km.) increased during the same period from 67000 in 1950-51 to 78000 in 1960-61 and 107000 in 1968-69. Road transport developed even faster, the volume of goods traffic carried by road between 1950-51 and 1965-66 rose about

*Index of potential, production and potential utilisation for manufacturing industries in India during 1969 — Reserve Bank of India Bulletin, Nov. 1970

Table 5

Percentage Share of Domestic Production in Total Estimated Supplies: India

Commodity	1950-51	1955-56	1960-61	1965-66	1968-69
Food Grains	94.1	98.3	95.3	90.5	93.5
Sugar Mill Machinery	—	4.8	80.7	99.2	96.2
Textile Machinery	—	32.4	30.9	43.2	47.9
Machine Tools - Metal working	10.2	15.2	35.2	38.2	37.9
Iron & Steel	74.8	60.1	64.3	83.3	90.7
Aluminium	27.2	31.5	41.9	74.9	92.8

Source : Economic Survey, Government of India, 1969—70.

six times and passenger traffic nearly three and a half times. A limited increase of 18% to 20% in both the categories, was recorded even during the next three years of economic stagnation. Spectacular advances are also noted in shipping and air transport.

Substantial progress may also be noted in the building up of technical manpower needed to exploit the production potential of the economy. The stock of engineers is estimated to have increased from 58,000 in 1960-61 to 134,000 in 1968-69 and of diploma holders from 75,000 in 1960-61 to 198,000 in 1968-69. It is, indeed, ironical that while we talked all the time of promoting technical education, engineers who form one of the groups with highest level of technical training faced acute unemployment in the late Sixties. This was partly due to recession caused by forces some of which were beyond control, but it may also be partly attributed to faulty man-power planning.

Fortunately, the number of unemployed engineers is now declining and a new scheme to train them in the art of management and entrepreneurship, combined with all the facilities that are being extended to them for setting up small industries, should soon take care of their problem. The rate of utilisation, no doubt, touched rather low levels during the years of recession i.e. 1966-67 and 1967-68, but since then we have already turned on the course of economic recovery. The situation now seems to be improving except in the case of matriculates and graduates with liberal education whose problem is complicated both by the slow rate of economic growth and by faulty educational planning.

Productivity Growth and Economic Distance Between India and U.S.A.

It may be of interest to examine how far the economic position of India has changed in relation to United States—the most developed country—during the period of the Plans. The economy went off the rails in the three years beginning 1965-66 for reasons largely beyond the control of planners. We, therefore, take into consideration the period 1950-51 to 1964-65, and measure the time in which we can eliminate economic distance between India and U.S.A. if the rising trends in productivity in India during the 14 years under consideration are maintained over time.

It may be easily seen from Table No. 6 that per capita income in U.S.A. was more than 31 times that in India in 1950-51. The disparity was even higher in respect of per capita industrial production, the per capita level in U.S.A. being about 87 times than in India. The position was relatively less unsatisfactory in respect of social services. Thus the doctor-population ratio in U.S.A. was 8 times that in India. School enrolment ratio in U.S.A. was roughly 4 times both at the first and at the second level. The disparity, however, would be greater if adjustment is made for the superior

Table 6

Levels of Living: India and USA: 1951 & 1964

Indicator	*Unit of Measurement*	*Year*	*India*	*USA*	*USA Index (India =100)*	*Year*	*India*	*USA*	*USA Index (India =100)*
Income per Capita	Rupees	1951	275	8853	3445	1964	334	12863	3851
Industrial Production per capita	Rupees	1951	42	3639	8664	1964	73	4624	6334
Health									
Persons per Physician	Persons	1960	6000	750	12	1965	4830	670	13.9
School Enrolment Ratios:	Percentage	1950				1963			
First Level			21	88	419		40	70	175
Second Level			14	60	428		34	109	321
Both Levels			19	80	421		38	30	210

Source : Computations based on following publications of United Nations from 1951 to 1966.

1. Year Book of National Accounts Statistics, U.N.
2. Demographic Year Book, U.N.
3. Statistical Year Book, U.N.

quality of medical and school services in the United States.

It appears disquietening to note that economic distance between USA and India became wider by 1964-65, the ratio of the per capita income in USA to that in India rising to 38.5. However, if we consider industrial production and social services, we notice perceptible improvement in the relative position of the Indian economy. Thus the ratio between industrial product per capita in USA and that in India fell from about 87 in 1950-51 to 63 in 1964-65. Similarly, the doctor-population ratio went down from 8 to 7. Again school enrolment ratio at the first level was only 1.75 times, and that at the second level about 3.2 times in 1963 compared with roughly 4 times in 1951.

More interesting results follow from a comparison of various indicators of production potential in the two economies. Thus, installed capacity of electrical energy per head in USA was 84 times that in India in 1951, but the ratio fell to 69 by 1964. More marked relative improvement is observed in respect of coal and crude petroleum, the ratios having dropped from 35 to 18, and from 2803 to 426 respectively. The relative record of the Indian economy seems to be equally satisfactory in regard to the output of such intermediate commodities as pig iron, crude steel, aluminium, sulphuric acid, and nitrogenous fertilisers, which are all vital for raising the productivity of the economy, the respective ratios of the USA to the Indian level having declined from about 83, 146, 458, 30, 261, and 118 in 1951 to 29, 48, 100, 17, 77, and 46 in 1964. The relative position of India in the manufacture of machinery is still very unsatisfactory, the ratio between the per capita output of machines in USA to that of India being as high as 286 in 1964. However, it records perceptible progress compared with 1950 when the USA ratio was as high as 985.

Overall productivity in organised industry in India follows closely the trend in USA, the ratio of value added per person in the two countries being 17.1 in 1951 and 16.7 in 1964. It may be mentioned here, that our relative record would have been much better but for the substantial overstaffing of the industrial units and unfavourable climate of industrial relations.

It may be of interest to estimate the time that India may take to reach the USA levels of living and production, if she just maintains the annual trend of growth rate that she had attained bet-

Table 7

Per Capita Levels of Production: India and USA: 1951 & 1964

Indicators	*Unit of Measurement*	*Year*	*India*	*USA*	*USA Index (India =100)*	*Year*	*India*	*USA*	*USA Index (India =100)*
Electricity Energy : Installed Capacity	Watts	1951	6.9	581.9	8433	1964	18	1252	6956
Coal	Kg.	1951	96	3356	3496	1964	131	2367	1807
Crude Petroleum	Kg.	1951	0.7	1962.3	280328	1964	4.6	1960.0	42609
Pig Iron	Kg.	1951	5.1	424.7	8327	1964	14.2	415	2922
Crude Steel	Kg.	1951	4.2	616.1	14669	1964	12.6	600	4762
Aluminium	Gms	1951	10.7	4904.0	45832	1964	0.12	12.05	10041
Cement	Kg.	1951	8.9	270.2	3036	1964	20.4	339	1662
Sulphuric Acid	Kg.	1951	0.3	78.4	26133	1964	1·4	108.2	7728
Nitrogenous Fertiliser	Kg.	1951-52	0.06	7.08	11800	1964	0.5	23.2	4640
General Machinery*	Rs.	1950	1.09	1073.35	98472	1964	5.3	1515.0	28584
Manf. Value Added per person employed*	Rs.	1950	2111	36115	1711	1964	3570	59512	1667

*at 1960 prices.

Source : Computation based on following publications of various years from 1951 to 1966.

1. Statistical Year Book, U.N.
2. Demographic Year Book, U.N.
3. Statistical Abstract of the United States
4. Statistical Abstract of the Indian Union

ween 1950-51 and 1964-65. The estimated growth rates† are given in Table Nos 8. & 9. To make the figures comparable we have presented the time distance in per capita terms which requires adjusting the population growth rates from the rate of increase in income and output. We make here two alternative assumptions regarding population growth: (1) that population would continue to grow at the same rate as in the period 1950-51 and 1964-65 i. e., 2.1 %; and (2) that the population will grow at the rate of 1.7 % per annum as implied in the projections given in the final Fourth Five Year Plan (1969-74) document. It appears from Table No. 10 that it will take India 190 years to reach the level of per capita income in USA, if there is no change in the rate of population growth, but only 158 years if the decline in the rate of population growth assumed in the plan projections is realised.

A study by A.G. Majumdar on behalf of the Economic and Research Foundation estimates the economic distance between India and USA to be 218 years.‡ This is significantly longer than the corresponding estimate given above. The difference is due to the choice of a terminal year (1967) in Majumdar's study which is known to be particularly bad, falling in the midst of recession and drought. Our terminal year 1964-65 errs on the other side but our estimate of growth rate is not disturbed by it since it is obtained by fitting a trend line and not by mere linear interpolation.

The economic distance between India and USA becomes significantly shorter if we take into account the possible decline in the rate of population growth expected to follow the vigorous family planning drive launched by the Government. It is important to note that the time

†Growth rates are estimated by setting a semi-log regression equation $Y = ab^t$, where Y denotes output of various goods and services, 'a' is a constant and (b-1) the annual rate of growth. It measures the trend rate and is not much biased by the choice of initial and terminal year.

‡Economic and Scientific Research Foundation, New Delhi : A study of the Economic Distance, Between India and other countries.

Table 8

Rate of Change of Levels of Living : India under two different rates of growth of population

Indicator	*Annual Change Rates corresponding to different rates of change of population* I	II
Per Capita Income	0.0193	0.0233
Per Capita Industrial Product	0.0439	0.0479
Health: Persons per Physician	0.0080	0.0118
School Enrolment Ratio :		
First Level	0.0526	0.0566
Second Level	0.0685	0.0726
Both Levels	0.0535	0.0576

I. Growth Rate of Population of India : 1951 through 1964 : 0.0209

II. Growth Rate of Population of India : 2000 over 1964 (based on Planning Commission Estimate for Population for 2000) 0.0170

Source : Computations based on following publications of United Nations from 1951 to 1966:

1. Year Book of National Accounts Statistics, U.N.
2. Demographic Year Book, U.N.
3. Statistical Year Book, U.N.

required to reach the USA level of industrial production per head is only 96 years, if there is no change in population growth, and 88 years if the assumed decline in the rate of population growth comes out to be true.

Two facts clearly emerge from a perusal of these figures. First, that the rate of increase in industrial production in India has been comparatively high, and if our performance in other branches of production improves to the same extent, we can drastically reduce the period required to attain the USA level. Secondly, while reduction in population growth gives an obvious advantage and reduces the time required to attain the USA levels in per capita terms, the difference made by the change in this variable falls significantly with an acceleration in the rate of economic growth.

As is evident from the Table No. 10, we are considerably behind the USA in health services. In regard to education facilities, however, if the

Table 9

Rate of Change of Per Capita Production : India

Indicator	*Annual change rate corresponding to different change rate of population* I	II
Electrical Energy: Installed Capacity	0.0738	0.0779
Coal	0.0314	0.0353
Crude Petroleum	0.1316	0.1359
Pig Iron	0.1018	0.1060
Crude Steel	0.1020	0.1062
Aluminium	0.2231	0.2278
Cement	0·0696	0.0737
Sulphuric Acid	0.1394	0.1438
Nitrogenous Fertilisers	0.1177	0.1220
General Machinery	0.1779	0.1824
Manf. value added per person employed	0.0497	

I. Growth rate of population of India, 1951 through 1964 : 0.0209

II. Growth Rate of population of India, 2000 over 1964 (based on Planning Commission Estimate for 2000) : 0.0170.

Source : Computation based on the following publications of various years from 1951 to 1966:

1. Statistical Year Book, U.N.
2. Demographic Year Book, U.N.
3. Statistical Abstract of the United States
4. Statistical Abstract of the Indian Union

Table 10

Levels of Living : Estimated 'TIME' for India to reach USA level

Indicator	*I*	*II*
Per Capita Income	190	158
Per Capita Industrial Product	96	88
Health : Persons per Physician	246	166
School Enrolment Ratio :		
First Level	10	10
Second Level	17	16
Both Levels	14	13

Source : Computations based on data in Tables 6 and 8.

progress in school enrolement ratio experienced in the past continues in the future, we will take only ten years to attain the USA standard in respect of the first level and 16 to 17 years in respect of the second level.

A close scrutiny of the data presented in Table No. 11 reveals that in respect of items like electricity, petroleum, steel etc., which are vital for raising productivity levels in the economy, India's performance has been much better compared with that in respect of total production, or for that matter, even industrial production. Thus, if we leave out coal, the output per head of all the important items would reach the USA level in a period ranging from 22 years to 56 years if we just succeed in maintaining the past trend of growth. Evidently, acceleration in growth will reduce this period still further. Our relative success in reaching closer to the levels of USA economy around 1964 compared with that around 1951 in respect of the basic and intermediate goods, relative to that in respect of overall production per head, is clearly implied in the strategy of economic development which aimed at acceleration of output in areas that strengthen the base for the sustained growth of the economy. Our record is also not unsatisfactory if we take the productivity trend in organised industry as a whole. It is evident that a mere continuation of the productivity trend in the past would take us to the USA level in 58 years. But productivity is bound to increase at a faster rate as accelerated growth of the basic and heavy industry provides an increasing flow of complementary equipment and materials per worker. In course of time, therefore, the production of final goods will also get accelerated and the actual time during which we attain the USA level may turn out to be much less than what is implied in the past trends of the increase in per capita income.

A Critical Review of Strategy and Policy of Indian Economic Development

While the performance of the Indian economy since the beginning of the First Plan is reasonably

Table 11

Per Capita Level of Production : Estimated 'TIME' for India to reach USA level

Indicators	*Time for reaching USA level corresponding to two different rates of growth*	
	I	*II*
Electrical Energy	59	56
Coal	93	83
Crude Petroleum	48	47
Pig Iron	34	33
Crude Steel	39	37
Aluminium	22	22
Cement	41	39
Sulphuric Acid	33	32
Nitrogenous Fertilisers	34	33
General Machinery	34	34
Manf. value added per person employed	58	

Source : Computation based on data in Tables 7 and 9.

satisfactory, whether judged by actual achievements in levels of productivity and living standards or by the growth of production potential, a review of the policy and strategy shows the directions in which further efforts must be put in. Agricultural output grew in the plan period at a rate much higher than that preceding it. The progress in per capita terms especially in regard to availability of goods is however, not encouraging. This is only partly due to the rapid growth of population. Much higher rates of increase in agricultural production could be obtained if we had devoted relatively more funds to agriculture, encouraged simultaneously both major and minor irrigation works, stimulated their fuller utilisation and planned for a much earlier implementation of the new strategy which was introduced in the late sixties and promises a breakthrough in agriculture in the next few years. What we can, however, still claim on the positive side is the change in the whole outlook of farmers big and small—realised through the vast network of institutions of the cooperatives, community development blocks and education, in general. Perhaps the new strategy had to wait for such basic changes before it could make a substantial dent in the problem of agricultural backwardness.

In any case, programmes of agricultural development find their due place in the Fourth Plan and the realisation of the target of 4 to 5% increase in agricultural production will soon correct the imbalance between agriculture and industry.

The main reliance for accelerated economic development was placed on heavy industry. The Second and the Third Plan provided for progressive increase in investment in basic and capital goods industries and for an increasing role of the public sector in the setting up of such industries. All this has strengthened and developed the base for accelerated development of the industry and the economy.

As already observed, we have achieved remarkable progress in industry, in terms of production and productivity as well as in its structure. We have already attained a fair measure of self-reliance in respect of certain key items like aluminium, sugar mill machinery and number of heavy chemicals. Much, however, remains to be done to realise adequate domestic production of a number of items like steel, fertiliser, pesticides, pump-sets and other agricultural machinery which would contribute to high rates of increase in agricultural production. More vigorous efforts are needed to increase the output of steel, cement, coal and machine tools, which will step up the rate of industrialisation. The low level of potential utilisation ratio in manufacturing industries, particularly those relating to capital goods, however, reflects on the strategy and policy of industrial development in India. In a casual way, one may attribute it to inadequate attention given to the problem of inter-industry balance and consistency. The crux of the problem, however, lies in the slackening pace of investment in the economy since 1968-69.

Installation of large capacity in basic and capital goods industry in anticipation of future rise in demand constituted the very essence of industrial strategy in India and its proper utilisation evidently required a rising rate of investment. This, however, has not been possible, partly due to the temporary set-back caused by the Indo-Pakistan war and the two consecutive droughts. However, the trouble is more than temporary and may be partly attributed to low rates of return in industry, particularly those set up in the public sector. Bureaucratic control over public enterprises, over-staffing, undue concessions to workers, over-ambitious programmes of social overheads, defective price policy and, above all, the absence of any cost-benefit calculus to establish industrial priorities—all these appear to account for the low rate of return in industry.

However, aware of these limitations, the government has proposed to adopt the principle of 'joint sector' that provides for a 'better mix in a mixed economy', combining efficient management of the private sector with more resources and also of its vigilance to ensure that the structure of output conforms *in fact* to the plan priorities.

A striking achievement of Indian planning is the progress in import substitution in several key industries as indicated in Table No. 5. It, however appears that in some industries substitution of indigenous manufacture for imports may involve use of resources whose value (measured in terms of opportunity cost) exceeds the amount of foreign exchange saved even if the latter is measured in terms of shadow rate (which, in the present balance of payments situation, would imply higher rate, i. e. more rupees per unit of foreign currency than the officially determined rate of exchange). But there is a welcome exchange in the trade policy of the new Government. The decision to import steel worth 150 crores in the current year and also equipment for expediting the work in Bokaro is commedable insofar as it indicates that the fetish of import substitution is being replaced by rational economic calculus.

First, to take the advantage of trade with other countries we are now exploring the possibility of pushing up our exports particularly of the non-traditional items, perhaps a little beyond the target of seven per cent increase set in the Fourth Plan. Already we have achieved in recent years, high rates of growth of non-traditional exports of manufactures. Thus from 1955-56 to 1969-70, the dollar value of these exports increased by 21 % per annum, so that their share in the total volume of export increased from 15.0% in 1965-66 to 39% in 1969-70. The progress, however, can be maintained in the future only if we adopt productivity-increasing and cost-reducing techniques, eliminate the shortage of basic inputs like steel and coal, and simultaneously contain the growth of domestic demand by appropriate fiscal and monetary measures.

It is often pointed out that the weakest element in our planning strategy is our inability to exploit our most precious asset, the large reservoir of manpower which today comprises as many as 220 million workers. The lapse appears particularly serious when we note that a large volume of national resources has been invested in the building up of educated stock and technical expertise which remains unemployed or underutilised. Little is known about the precise magnitude of open unemployment in the Indian economy, particularly in the sense in which it appears in other industrialised economies. On a more rational view, however, it would appear that the menace of unemployment in this sense is a myth so far as the vast rural labour force and the self-employed sections of the urban workforce are concerned. Undoubtedly there is a good deal of disguised unemployment and underemployment in both rural and urban areas, but the analysis of trends in the structure of employment shows that it is changing in the more productive directions.

The 1961 census indicated that the dependence on cultivation proper decreased for the first time since the beginnirg of this century, from 67% in 1951 to 65% in 1961, that the proportion of agricultural labourers to all agricultural workers showed a marginal decline and the total output in agriculture increased at a rate which was almost double the growth of the work-force dependent on agriculture. In manufacturing industries, there was a relative shift in employment towards more productive and more paying basic and capital goods industries. Among services, again, though the overall share in workforce remained constant, there were structural shifts in the direction of more remunerative areas of rail and road transport, and public educational and health services which were neutralised by a relative decline in the overcrowded and low paying branches like small retail trade and personal services.

All these changes lead to the broad inference that there was general improvement in the employment situation between 1951 and 1961, even though the possibility of deterioration in some regions of the country is not ruled out. We do not have comprehensive statistics on employment after 1961. However, data covered by employment market information indicates that between 1961 and 1966 employment in the organised sector was growing at a rate of 5% per annum. The rate of increase in the labour force during this period was only 2.3%. The higher relative growth of employment in the organised sector implies a rise in its share and, therefore, a qualitative improvement in employment. The

pace has, however, considerably slackened since 1966 but this is mainly due to the temporary setback to the economy caused by the droughts and the recession. The problem may have assumed serious proportions for the educated component of the labour force. N.S.S. 21st round (July 1966-June 1967), however reports that only 3.25% of this section was unemployed. This is, of course, lower than the estimate obtained from the live registers of the employment exchanges, but the latter cannot be put to much meaningful use, considering that they contain a substantial proportion of those who are already employed and registered for the sake of further improvement in employment prospects.

While no firm conclusion is possible in the absence of reliable statistics and one cannot take a very complacent view about the employment of educated stock, a solution through accelerated development of the economy and proper educational planning may not be beyond our reach.

On balance, the future is not as gloomy as painted by many critics of Indian planning. Much credit can be claimed for building up not only those industries which will provide basic materials and equipment for the growth of output and productivity in both agriculture and industry but also for development of indigenous technical know-how and skill which would enable us ultimately to dispense with external assistance in many ways.

With appropriate plan exercises, as already done for the Fourth Plan, idle capacity in most industries will be eliminated and with appropriate price policies, based more on commercial principles than on a cost-plus basis, a rational scheme of subsidies and taxes to secure conformity in the pattern of industrial growth to plan priorities and targets, adequate steps to mobilise investible surpluses from agriculture—all these will raise the much needed saving potential which will give a boost to Indian economy. At the same time adequate fiscal and monetary measures must be devised to attain price stability at a suitable level without which income distribution is distorted, budgetary surpluses are reduced and dis-incentive effects on private savings and accumulation arise on account of continued erosion in the value of money.

The recent rise in the export of engineering goods and other non-traditional items promises a gradual improvement in the balance of payments position and availability of foreign exchange. Given the scope for raising financial and foreign exchange resources and the rate of investment, the enormous volume of production capacities already built up in key branches of the economy, a large body of technical know-how, and a network of State and cooperative institutions, further step-up in industrial production may be soon in sight. Again the new strategy in agriculture is already contributing to a progressive increase in the supply of food and raw materials. Given adequate increase in the supply of wage, goods, equipment and materials per worker, there is no reason why we should not look forward to a still more promising trend in productivity in the future. All the same, we will fail to reap the full benefits of our productivity policies until the workers and their unions do not develop a more rational attitude which helps us eliminate over-staffing and prevent demand for wage increases not justified by rise in productivity and, above all, the people themselves have a general awakening not only regarding the need to live better but also the urge for making maximum contribution, they can, to the advancement of the national economy. ●●●

"India has an important role to play in the next stage of history that is unfolding..... It is our economic capability, political unity and social justice that will decide our future",

—V V Giri, President of India.

Management Dynamics and Productivity

J Prasad* & Pritam Singh*

Improving productivity is an important function of management. Management provides mental attitude and a decision-making framework for increased industrial efficiency and productivity. The major task before the management in an enterprise is to induce, direct and guide productivity consciousness and activity. Profitability and increased productivity are the most essential requirements for survival and growth of an enterprise; the success of management can be judged by the economic performance and increased productivity. Modern organisations aim at providing conditions necessary for the man to produce abundantly and to live securely.

PRODUCTIVITY is essentially a business proposition. It calls for a subtle combination and blending of all the skills inherent in labour, capital and management. It emphasises the need for being economical, avoiding waste, lightening the burden of work and trying to wrest more from a given set of men, materials and machines. It demands a change and evolution in the operational functions and organisational set up. It indicates how far an organisation has been economically viable, and measures the competence of management in planning, coordinating and integrating a number of components or sub-systems into one organic structure with a view to obtaining the maximum return. It also defines the effectiveness with which the resources of an industrial enterprise are utilised, and in its final analysis it pinpoints the fact that improvement of productivity is an important function of management.

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Productivity—A Management Function

Management needs to be concerned with this business proposition because at least average productivity and efficiency are essential for the prosperity and survival of an enterprise under a competitive situation. These goals are achieved only when the management concerns itself with the direction and control of the various activities and synchronizes the various parts of an industrial enterprise to make them work together.

Management is, thus, a comprehensive and pervading activity. It has stemmed primarily from the growth in size and complexity of industrial enterprises since the industrial revolution. As Drucker has observed: "The emergence of management as an essential, distinct and leading institution is a pivotal event in social history."[1] It has in fact become indispensable, because it provides a mental

1. Drucker, P.F.: "The Practice of Management", Harper & Brothers, N.Y. 1954 pp. 3-4.

attitude and problem-solving or decision-making framework for increased industrial efficiency and productivity. Management has actually of moved into the affairs of men as a means maximising the total productivity of labour, land and capital. It has virtually become a vitalising factor which, through the processes of planning, organisation, control and communication in a dynamic man-machine system, coordinates various activities in order to meet the overall objectives of the organisation.

In recent years, with the progress of mechanisation and automation, the problems of organisation and administration of a large-scale plant have become more complicated. A new system of industrial dynamics has been evolved to resolve the problems arising from the interaction between the flow of information, materials, manpower, capital equipment and money. As these flows are the vital determining forces of the industry's growth and prosperity, they have provided a single framework for integrating the functional areas of management.[2] Under this concept of industrial dynamics, management has emerged as an effective science to organize and systematically manage the interacting and diverse forces in an industry.

As productivity increase depends more and more on the proper and efficient fuctioning of management, it has adopted new managerial, organizational and human relationships and has developed a number of tools of analysis and sophisticated techniques to make an intergrated approach to large-scale, complex problems of the plant. Today, it encompasses almost all the administrative and functional activities in the organisation, viz. production planning and control, research and development, accounting and capital investment, and has thus become its composite affair.

It would be obvious from the above that management has come to be recognised as a distinct and identifiable discipline. Its aim is to achieve established objectives by emphasising the most efficient utilization of human effort and facilitating resources. It now expresses a new philosophy and reflects the growing application of a new approach known as the 'systems' approach to organisational behaviour. This modern approach views the organization as a conglomerate of inter-related sub-systems (units or departments) that help the organisation achieve its general mission[3]. The systems approach views the organisation or enterprise as a unified whole and emphasises the need for its application as a means of increasing productivity and developing manpower effectiveness. With a view to achieving these objectives this approach also emphasises the integration of the employees into the organisation, to a substantial degree, satisfies the employee's need for ego reinforcement and provides an opportunity for his self-fulfilment.

New Management Philosophy

The modern concept of management which provides a mental attitude and a problem-solving framework for increased industrial efficiency and productivity is a product of the sequence of events and their most stimulating companion concepts. The most stimulating companion concepts which have generated the cumulative forces for the management movement and practices have been the concepts of division of labour, a factory system and the mass-production technology. New concepts pertaining to social, economic and technological change and changes in political and economic climate also have had their impact on management thought. They have, from time to time, created the need for a different type of management philosophy. How this transition in management philosophy and management function took place is worth exploring.

A brief review of the sequence of events which stimulated the need for evolving a systematic and scientific way of thinking about management would reveal how one-man management

2. Forrester, J.W.: Industrial Dynamics, MIT Press, Cambridge, Mass., and John Wiley & Sons Inc., N.Y., 1961, p. 13.

3. Sloan, Stanley and Johnson, Alton C.: "New Context of Personnel Appraisal", *Harward Business Review* Nov.—Dec. 1968 p. 15.

with the growth of complex man-machine systems, hastened to its decline and obsolescence.

The spark which was struck for the management movement by the concepts of division of labour and specialisation later on developed into a kindling force when the great mechanical innovations translated the old concepts of production processes into useful forces for the material betterment of men, and increased productivity. Technological improvements furthered diversification of products within an enterprise and the decentralisation of production operations which demanded skills, knowledge and attitudes beyond those possessed by untrained owner-managers. It was realized that someone in some manner must mesh and utilize the divided efforts of the people in a factory system and must find proper methods for augmenting human effort with technological aids. An awareness thus appeared of the need for employing managers and administrators in the economy which reflected shift of control from ownership. However, when industrial organisations increased in size, managerial problems appeared which could not be solved without planning systematic relationships of work methods and effective organisation. One-man management of an enterprise was found inadequate. Consequently, the authoritarian type of management faded with the expanding scope of the managerial function.

Influence of Mass Production Technology

The mass production technology which followed innovations of mechanical devices and the first blooming of technology enunciated a principle of organising people to work together. It brought wholesale changes in the managerial, organisational and human relationships with a view to motivating workers to participate in the management movement for increased productivity. The mass-production principle—a principle[4] of human organisation—caused upsurges in the beliefs, values, livelihood and the mode of living of the people. New spectra of social and economic values undermined and exploded the traditional ego-centred 'acqusitive motives' of the owner-manager of the past. Social and economic thinkers advocated the cause of workers. The very mechanism of the process of mass production united, organised and disciplined the working class and became a powerful force for the displacement of the capitalist entrepreneur by professional corporate managers who 'exercise power without property'. Modern industrialism which revolutionised the instruments and mode of production brought a change in the relations of production and with them the whole relations of society. It gradually became a dynamic force and had a widespread influence over all man's activities. Having made man free from the drudgery of survival, it concerned itself with the efficient adaptation of technological innovations for the service of mankind.[5] It did not only condition productive processes and forces, but also the social, economic and political structure, and thereby determined the future ideas and institutions of men.

The development of productive forces, and the advancement of science and technology are thus directly interwoven in the material activity of men. The direct efflux of material behaviour of the working groups engaged in the production of their means of subsistence indirectly moulded and shaped the ideological reflexes and echoes of the life process of active men. The old concepts of industry, enterprise, organisation, and management underwent a revolutionary change so as to subserve the community as a whole by achieving certain objectives, such as optimum productivity and satisfactory profits to owners, increased wages to workers, and greater human satisfaction.

As a result of the internal dynamics of the human society "Industry which in the era of Industrial Revolution was narrowed to mean 'manufacturing' has now come to mean an assemblage of people, materials, machines and other resources geared to certain task accomplishments through a series of interactions and integrated into a social system".[6]

4. Drucker, P.F.: 'The New Society', Harper Torch Books, N.Y. 1962, p. 4

5. Lehrer, R.N.: "The Management of Improvement", Reinhold Publishing Corporation, N.Y. 1965 p. 16.

6. Johnson, R.A., Kast, F.A., and Rosenzweig, J.E.: "The Theory and Management of Systems", McGraw Hill Book Co., Inc., N.Y. 1963, pp. 54-55

It is now conceived in terms of 'creative accomplishment' and fulfilment of certain social and economic objectives—cheap and efficient production and a growing national income to improve the general living standards of the people. It has generated certain forces for the development of material premises of an industrial system, a new social order, a plant community and a new industrial society. It has evolved its own cultural patterns, values, norms, traditions and methods of action. It has established certain inter-relationships between man-machine systems and has fostered a new organisational system—a system of consciously coordinated activities or forces of two or more persons.[7]

Social Orientation

Modern industry thus tends to have a broad vision and a social outlook. It is now organised as a social unit on cooperative lines,[8] and the sub-systems existing in it are coordinated and integrated by the decision-making or problem-solving mechanism in such a way that not only individual genius but, more important, the cumulative capacities of the people get an opportunity for flourishing. This process of coordination and integration, on which a cohesive environment for improving productivity depends, demands a very high—an almost unprecedentedly high—degree of imaginative and intellectual ability.[9] This demand is the pivotal force for the emergence of professional management which is the guiding intelligence—the brain of the enterprise and is responsible for improvement in the performance of an industry.

The modern enterprise—a large mass-production plant—employing thousands of people and altogether organized on entirely different technological, social and economic principles and managed by professionals without a stake in ownership,[10] does not bear any resemblance to its forerunners in which the mass-production principle was regarded generally as a mere technique. The traditional or classical theory did not give sufficient emphasis to the problem of inter-relationships or integration of various activities. On the contrary modern organisation theory treats an industrial enterprise as a unified system of mutually dependent parts and variables. This new integrative approach to the organisational behaviour has brought a revolutionary change in the concept of industrial enterprise and its socio-economic goals. The enterprise or the organisation of work on the mass-production principle has emerged as a social system within the broader, more inclusive system of society.

The management's task in an enterprise is to induce, direct and guide productive consciousness and activity among people.

It is in this institution that men, materials, machines and other resources are combined into an efficient, effective and viable process of production. In order to stimulate this social institution to discharge its economic and social functions efficiently and effectively, organising or managing function has assumed new responsibilities. As the binding agent, its primary responsibility is now supposed to maintain an organisational equilibrium in a changing environment. To discharge this responsibility, it brings separate and divergent human and material resources together through its 'fusion process' which means coordinating and integrating various variables and elements operating in the enterprise. It makes them work in harmoney with each other to accomplish a number of goals.

It may further be mentioned in this connection that as the enterprise is a man-made

7. Johnson, Richard A., Kast, Fremont A., and Rosenzweig James E.: "The Theory and Management of Systems"—McGraw Hill Book Co., Inc., New York 1963 pp. 54-55.

8. Bernard, Chester I.: "The Functions of the Executive" Cambridge Harvard University Press 1958, p. 73.

9. Drucker, P.F.: "The New Society", Harper Torch Books, New York 1962 p. 25.

10. Ibid p. 2

system conditioned by its environment, it is no longer viewed as a conglomeration of separate elements but as a coordinated whole. The modern organisation theory also views the modern enterprise as a part of a larger environmental system, and not merely as a man-machine system. As this theory has developed from the traditional and human relations models of organizational behaviour, it is an amalgam of those two old 'concepts' and provides a basis for an integrated systematic organisational model.

Though like traditional organisation theory, it accepts the existence of parts and segments or operational units, yet it is more concerned with their integration rather than with their separation. Similarly, for developing man-power effectiveness and increasing productivity, it fully accepts the efficacy of human motivations, aspirations and desires, but it does not agree with the approach of human relations theory of interjecting motivational forces back into the mechanistic traditional models. As an individual stands as an integral part of an enterprise, the modern 'systems' approach to management emphasises the integration of the employee into the organisation by creating an organisational environment which may satisfy his need for ego-reinforcement and provide him an opportunity to achieve his personal goals in consonance with those of the organisation. This new approach of personnel planning has been found more conducive to producitvity increase, and, as such, Blake and Mouton has suggested, 'one pole of management is the concern for production while the other pole is the concern for people."[11] The management's task in an enterprise is, therefore, to induce, direct and guide productive consciousness and activity among people.

A further analysis of the 'Systems' approach to organisational behaviour discounts the notion of an 'Omnipotent' managership—manager who commands, decides, criticises and praises. It also proportionately discounts control over the employed with such a characteristic as the maintenance of a structure of information flow and communication growth and viability of the enterprise, and effective decision-making processes. Thus the modern organisation aims at providing conditions necessary for men to produce abundantly and to live securely.

The above characterisation of management thus makes it clear that it is not only a specific organ of an enterprise but also that of a society. It is responsible to help in shaping the economic environment in which it operates. In its narrow sense, though it is charged with the responsibility of the economic performance of an industrial enterprise, it is nonetheless responsible for making the community's resources more productive. As a matter of fact, it is required to work within a broader framework of national objectives and formulate certain policies in conformity with the national goals. Its job is largely that of projecting the future onto the present within the perspective planning of the country's economic development. Its economic responsibilities, as a trustee of society's human and non-human resources, are to conserve and use them in the best possible manner for organised economic and industrial advancement. The success of management lies in its creativity. Its success is measured by the economic performance and increased productivity of the enterprise. Management and enterprise fail, if they fail to provide adequate economic results.

Focus on Organisational Effectiveness

The whole philosophy of management thus now focusses its attention on increasing organisational effectivencess. "It is not enough to hold an enterprise at current level of income. Management must make it grow, for when the overall economy is expanding staying the same size can mean gradual extinction for a company."[12] It means that the affairs of an organisation must be managed effectively, because it would help it in improving its economic performance and serving the community's interest by supplying both goods and services

11. Blake, R.R., and Mouton, J.S.: "The Management Grid", Gulf Publishing House, Houston, Texas, 1964.

12. Marrow, A.J.: "Making Managment Human", McGraw Hill Book Co., Inc., New York, 1957 p. 12.

most wanted by it. Management through its creative efforts should, therefore, act to make the desired results come to pass. It should work as a coordinating agency in the array of various production factors, and managing by objectives and managing through re-planning help the enterprise grow and prosper.

Inter-relation Between Productivity and Profitability

In view of the aforesaid, management may be regarded as a dynamic life-giving force to an enterprise. It creates conditions for its profitability and increased productivity which are the most essential requirements for the survival of an enterprise. Increased productivity is its economic function and it is a necessity for its expansion. Profitability is its sovereign criterion; it is the yardstick of its economic performance. It is the expression of both its responsibility to itself and to the society. Profitability and increased productivity are, in fact, the two essentials of an industrial enterprise. They are inter-related and interdependent. They are obviously important to the management's day-to-day operation, and as such, are the fundamental criteria for its success.

"Productivity", as March and Simon have remarked, "is one of the fundamental secondary criteria (after profit) for" the success of management. Management, through its three specifics —(i) managing the business, (ii) managing the managers, and (iii) managing the worker and work—carries out its prime responsibility of improving productivity and effectiveness of the organisation.[13] Management cannot separate these factors in its daily decisions and each management decision affects all the three areas and has its impact on organisational effectiveness or productivity of the enterprise. These two aspects are, in fact, vitally affected by the organisational equilibrium which an efficient and effective management should maintain in an enterprise. "If top management is unbalanced, has an unbalanced interest in either engineering or manufacturing or marketing or whatever it may be, the organisation itself is going to be swayed in that particular direction, or that particular segment of the enterprise and this is not healthy for the enterprise as a whole". Management must, therefore, establish yardstick for itself to measure its impact on economic performance and productivity of an industrial enterprise. It is only when overall productivity is improved, the industrial enterprise gets an adequate and satisfactory return on its capital investment as 'profit'. It then finds itself capable to protect itself against the threat of dislocation to the survival and stability of the enterprise.

Success of management lies in its creativity. Its success is measured by the economic performance and increased productivity of the enterprise

'Profitability' is rather the most powerful motivational factor in any business or industrial organisation. Organisation is one that has been conceived for the purpose of making profit. Profits are mandatory, because they provide a means of existence to any given enterprise and motivate a business or industry to provide goods and services to the community. Profitability is thus imperative not only to keep any enterprise alive but, in the net, a powerful instrument for the growth of an enterprise. The enterprise does neither exist in an isolation, nor does it function in a vacuum. In a society which is dynamic, vigorous, forward-looking, adaptive and progressive, the profitability of an enterprise would tend to enlarge its vision and social outlook and improve its effectiveness. Though it is true that it has to operate within the general beliefs and accepted codes and norms of the society, yet profitability cannot be set aside as a material proposition. Peter F. Drucker says in this

13. March, J.G., and Simon, H.A.: "Organizations", Graduate School of Industrial Administration, Institute of Technology, 1966, p. 47.

connection: "The demands of economic performance which society makes on the enterprise are identical with the demand of enterprise's self-interest, the avoidance of loss—that is, operation at a surplus of current production over current cost, adequate to cover the risks of future."[14] This shows that for its survival the enterprise must earn a reasonable or satisfactory profit. It is hoped that it would not only provide a secure level of earnings to the stock-holders and workers, but would also leave adequate revenues for the requisite investments for a maximum rate of growth.

Profitability is, thus, an objective necessity. It is rather a gear to industrial production and industrial economy. It provides coverage against (i) the current costs of the enterprise, i.e. the cost of doing business; (ii) its future costs, i.e. the costs of staying in business; (iii) its contribution to society in respect to the future costs of the less successful enterprises, and (iv) its share in the social burden of non-economic services.[15] Besides covering these various risks and costs, a satisfactory return on capital is also justified for developing progressive and advanced manufacturing processes, for improving product designs and for meeting the various costs for satisfying social and group needs. These investments eventually result in a further growth of enterprise. Management with its creative abilities must, therefore, plan, carry through and initiate changes to bring a reasonable return to the enterprise, so that it may serve its social objectives.

It is the concept of profitability that stirs and motivates an enterprise to step up the rate of productivity. It means that the industrial system which operates on the basic and primary rationale of profitability is capable of sustaining the changes which are required to be introduced into the system for increasing productivity and improving economic performance. In a broader sense the problem of raising productivity is the problem of making use of the resources more rationally, effectively and efficiently to make them produce as much wealth as possible at the lowest possible cost. Increased productivity is, thus, itself a genuine surplus which is the bye-product of economic performance, because it results from the use of the released resources to turn out more of the same commodity. As productivity aims at a greater balancing out of all factors for reducing the production cost with or without an increase in the output, it tends to increase the margin of profit of the enterprise. The enterprise then utilises the profit resulting from increased productivity for raising wages and distributes a part of it to shareholders. Whatever may be the form of redistribution of released capital resources and profits, it would mean making the benefits of increased productivity available to the economy as a whole. Lower prices, higher wages, higher profits and greater revenues to the state—all are the resultant effects of productivity mechanism. Increased productivity, as such, is a genuine surplus. It is a return of capital. If there is no surplus, it would mean that the enterprise has failed to meet the demands of economic performance which society makes on it.

"Productivity gains, however, are not just a matter of capital investment".[16] In a Stanford Research Study conducted recently, it has been pointed out that productivity was purely and simply a matter of managerial skills and basic planning for utilisation of various resources, including capital and capital equipment. Productivity is, in fact, vitally affected by the organisational structure. Unclear organisation, unscientific and outmoded management practices waste time, resources and efforts, and thereby adversely affect productivity and profitability of an industrial enterprise.

Dynamic Role of Management

In the foregoing discussion, the premise on which the whole framework of management concept has been built relates to integration and coordination of the various elements, variables and sub-systems in an enterprise. In view

14. Drucker, P.F.: "The New Society", Harper Torch Books, New York 1962, p. 63.

15. Ibid p. 61.

16. Roberts, William E.: "Theory and Philosophy of Management", Industrial Times, July 15, 1961.

of the fact that risk-taking constitutes the basic function of an enterprise for improving the productivity and profitability, simply synchronization of various functions may not be presumed to be the only function of management. Management has, therefore, emerged as an innovating entrepreneur and combines in itself both the entrepreneurial and managerial elements. As a matter of fact, management is now viewed as a 'catalytic agent of change', because in the present era of technological progress and dynamic changes in the environment, management cannot keep itself aloof. The composite forces released by technological innovations in production techniques and environments called for a change in the managerial function. Management is now required not only to adapt itself to new conditions but also to create new conditions for keeping the organisation alert and adaptive.

Management has thus lately been more concerned with the 'management of change'. It now assimilates in itself new values of trust, risk-taking, individuality and openness. It assumes a dynamic role of a creative or innovation-producing apparatus. As an innovating entrepreneur, it makes a purposeful, organised, rational and logical approach to the processes of 'problem solving', 'production thinking and 'operational creativity' for increasing industrial efficiency, productivity and profitability.

In its new dynamic role management now also institutes 'new combinations' of knowledge, techniques, skills, organisational schemes and policies to increase organisational effectiveness. It initiates and fosters a purposeful activity to maintain and organise a productivity conscious enterprise for the production of economic goods and services. Now, its decision-making process involves a multi-dimensional approach to the various problems. These problems are related to new products, new methods of production, development of new markets, utilisation of new resources and new form of organisation. Management, in order to be effective, perceives problems in right perspective, sets the stage for their solutions, initiates and fosters changes in the organisational structure, takes effective steps to translate technological possibility into technological reality. It then critically reviews and modifies the management practices relating to production planning, programming, pricing, budgeting, value analysis, quality control, materials handling, inventory control, plant layout, etc. to improve the operational efficiency of an enterprise. Unlike the owner-manager-entrepreneur of the nineteenth and early twentieth century, the modern management which has come to be recognised as an organisational entrepreneur covers various areas such as market standing, innovation and skill of guiding physical and financial resources. In addition to these, by assimilating socio-economic upsurges and 'needs' dimension it also covers the areas of employee-planning and human relations with a view to improving worker performance and motivating people to give their best.

It is thus obvious that management's style has undergone a constant change in response to the changing needs and expectations of the employees, the nature of the job and the character of the organisation. The need for scientific and technological innovations, adaptability to changing conditions, flexibility in dealing with novel problems, rapid acceptance of new ideas, has broadened the scope and dimensions of modern management. The traditional organisational model with emphasis on scientific management has been replaced by an innovative and creative type of organization. In an age of change, "since individuals differ in their needs and expectations, and since jobs and organizations differ in their character (and culture or atmosphere), there may be a need (for a management) to employ many styles in organisation". It means that management must be sensitive and responsive to the needs of both individuals and organisation. It must also be able to adopt behaviour appropriate to the individual employee's and the organisation's present level of growth in such a way as to encourage their continued development. This requires an appropriate choice of leadership behaviour based on various levels of employee needs and expectations and conditions of the job. It is only when the three factors—employee needs, style demands of the job, and the leadership style—are compatible, job performance or labour productivity improves and organisational effectiveness is achieved.

achieved through special measures, in addition to the Industrial Management Training Courses conducted by the SSIDO at present. It is appropriate that the entrepreneurs and managers of small scale industries should be taken in groups on study visits to better-organised industrial units both in the large and the small scale sectors in the country as well as to industrially-advanced countries such as Japan.

Modernisation of orgnisational structure of small scale industries is an equally-important factor. Large scale undertakings, in view of their relatively large resources and organisational abilities, can adjust and re-adjust themselves to changes occuring in the economy, but small scale enterprises are not generally able to make such adjustments in view of lack of resources and poor management. The programme of modernisation, therefore, visualises to encourage small scale enterprises to work in an integrated and cooperative manner, so that they may pool their resources and talent and thereby achieve large scale economies. It further provides for encouragement to be given to small scale enterprises for joining into groups to undertake such activities as marketing, in both domestic and export markets, purchase and distribution of raw materials, assembly of complete product by obtaining components, etc., from outside. It also provides for stimulating cooperative activities of small scale enterprises by facilitating the establishment of functional industrial estates.

Modernisation of equipment, as mentioned above, is an obvious element of the programme and has engaged considerable attention of expert committees appointed from time to time. A special mention is to be made of the Nawalkar Committee on Modernisation of Small Industries which went into the degree of obsolescence in five selected industries namely, machine tools, domestic electrical appliances, foundry and re-rolling, automobile parts and accessories and hosiery.

According to the findings of the Committee, the obsolescence of machinery ranges between 25% to 70% in machine tool units, 40% to 60% in auto parts, 35% to 50% in foundry and re-rolling, 25% to 40% in domestic electrical appliances and 25% to 35% in hosiery units. The Committee has, on the basis of 25% renewal rate, estimated that a sum of Rs. 25 crores will be required for replacing obsolete machinery by modern ones in the five selected industries. The needed finance on modernisation of equipment is proposed to be channelised through the existing financial institutions, i. e. NSIC, State Financial Corporations, State Bank of India and other commercial banks. It is felt that with the modernisation programme in hand, the additional investment in plant and machinery during the Fourth-Plan period will be of the order of Rs. 145 crores. It may not be possible to indicate the exact proportions in which the additional amounts will be apportioned as between these agencies but the amount will need be financed by these institutions as an additional item of responsibility on their part.

Technical Inventions/Innovations

Technical innovations have been encouraged for promotion of modernisation of plant and equipment in all the developing countries at different stages of their industrial development. Their extent and institutional forms have been varying among these countries according to their respective conditions. These have been facilitated in some of these countries by some private parties, too, which have been providing all sorts of assistance to the technocrats for evolution of new methods/techniques for production designs, etc. These innovations have also been facilitated through financial and non-financial incentives in such developing countries as China (Taiwan), Republic of Korea, etc.

In India, the promotion of technological innovations/inventions was taken up on an institutional basis only in 1960, when the Government set up the Inventions Promotion Board, charged with the responsibility of inculcating inventive faculty among industries and independent workers, artisans, technicians, etc. The Board worked out two schemes—one for the individual investors and the other for industrial units—of awards and financial assistance, for devising new technical methods and/or components as an aid to import substitution.

Under the first scheme, the Board provides awards ranging from Rs. 500 to Rs. 25,000, besides gold, silver, bronze shields and certificates of merit to those whose inventions are accepted to be serving the purpose in view. It also sanctions financial grants to the prospective individuals/ organisations for working on useful ideas leading to inventions. Till April 1970, the Board granted 239 awards totaling Rs. 2.28 lakhs and gave grants to the extent of Rs. 5.5 lakhs for the development of 309 innovations. The Board's activities under this scheme have resulted in the total annual saving of Rs. 6 crores in foreign exchange to the country.

Under its second scheme, the Board has advised industrial units to set up technical cells of their own personnel and to receive suggestions from their workers for new innovations or improvements in products, processes, machinery, equipment, etc. After the Board is satisfied with the technical feasibility and commercial viability of the suggestions forwarded by industrial units, it provides the requisite financial assistance for the development of such suggestions. The Board also arranges facilities for designing, fabrication, testing etc., needed for the purpose in case the same are not available with the selected industrial units.

State Invention Advisory Committees

The State Invention Advisory Committees set up in a number of States under chairmanship of their respective State Directors of Industries, also contribute towards the promotion of technical inventions and innovations in the small scale sector in particular. Such committees already work in Andhra Pradesh, Goa, Kerala, Tamil Nadu, Punjab, Rajasthan, U.P. and West Bengal. The Inventions Promotion Board has decided in one of its recent meetings to have small State-level standing committees to receive applications, process the cases at their own end and forward them with necessary recommendations to it. These committees will also undertake the programme of disseminating information and knowledge about the Board's activities to all the interested persons in their respective areas.

Technical innovations have been encourged for promotion of modernisation of plant and equipment in all developing countries at different stages of their industrial development.

The Board is further considering, among other proposals, to utilise the institution of industrial estates for harnessing industrial talent in the country. These estates are the concentration of workers, artisans and technicians who can work on ideas leading to inventions and innovations. The Board has already initiated this work in the Industrial Estate, Okhla, New Delhi, and has established contacts with various firms and their personnel with a view to identifying the areas of promotion of inventions and the type of assistance they would like to have from it. The Board proposes to undertake similar programmes in other industrial estates as well in cooperation with the State Directors of Industries.

Low cost automation is a device accepted for modernisation of small and medium scale sectors in both developed and developing countries.

Modernisation of small scale industries in respect of their plant and equipment and management, promotion of technical inventions and innovations and introduction of low-cost automation are the important means accepted for stepping up productivity in the small scale industries.

Low-Cost Automation

Low-cost automation is a device accepted for modernisation of small and medium scale sectors in both developed and developing countries. In U.K., it has already been propagated amongst the small and medium scale industries and encouraging results are reported to have been achieved in terms of modernisation of plant and equipment in these industries. The ECAFE Secretariat has also decided to hold roving seminars for imparting training to the owners and operatives of such of the small-scale industries in developing countries, in which the techniques of low-cost automation have got potential for modernisation of processes.

Advocates of low-cost automation are convinced that its introduction will not reduce employment opportunities, particularly if its application is properly phased and that its application will prove an effective factor for accelerating the pace of industrialisation in the country. Low-cost automation components are said to be relatively complicated and an average electrical and electronic technician should be able to cope with the installation, maintenance and repair of such components in his charge.

Since the introduction of low-cost automation presupposes a fair degree of mechanisation already existing in the small scale sector, it will be necessary to phase out the programme of low-cost automation in selected industries only. Small scale industries in India are at varying levels of mechanisation. In a particular small scale industry, it may be found that there is a large non-mechanised or un-organised sector along with the semi-mechanised sector and also a fairly mechanised sector. Even in the semi-mechanised and mechanised sectors there is a large quantum of obsolete machinery in use. As such, it will be desirable to make a beginning of this programme with respect to export-oriented units in small industries sector, which are by and large supposed to be fairly mechanised. Other small scale industries suitable for introduction of low-cost automation will be those manufacturing products needing a high degree of precision such as electronics, precision instruments, etc., both for domestic and export markets.

Conclusion

Modernisation of small scale industries in respect of their plant and equipment and management, promotion of technical inventions and innovations and, lastly, the exploration of possibilities for introduction of low-cost automation are the important means accepted for stepping up productivity in the small scale sector. Since these industries are expected to play a prominent role in augmenting the supplies of consumer goods and producer goods of relatively less complex nature during the Fourth Plan period, their productivity should receive top-most priority in our planning efforts. Moreover, the restoration of buyer's market conditions in a number of product fields and the increasing consumer preferences for quality products are the important considerations for formulating and implementing the productivity programmes at the industry and the enterprise levels in the country. ●●●

World Economic and Social Developments*

In 1969, the world gross domestic product, the total output of goods and services, was 2.7 times the level of 1950. World industrial production expanded by 114 per cent over the 1958-1969 period. World exports in 1970 reached a new all-time high of $ 311, 000 million, a 14 per cent increase over 1969. The world produced 4 per cent less wheat in 1969 than in 1968 although there was an increase in the population of 2 per cent. By mid 1969, the population of the world was estimated to be 3,561 million with Asia having 2,009 million persons or more than half of the world total. The annual growth rate for the period 1960-1969 was 2.0 per cent, a rate which, if continued, will double the world's population by the year 2004. The Soviet Union continued to be the largest book publisher in the world. Almost half of the 181,280 000 passenger motor vehicles on the road were in the United States. In 1969 Sweden had the highest newspaper circulation and the largest number of television receivers per 1,000 inhabitants. Citizens of Ireland consumed the most calories per capita per day—3,450. The lowest figure, 1,720 calories, was recorded for inhabitants of Haiti. These facts are among the major world wide and regional economic and social trends revealed by the United Nations Statistical Year Book, 1970.

THE recently-released United Nations Statistical Year Book, 1970, reveals very interesting facts. The Year Book is prepared by the UN Statistical Office with the cooperation of statistical authorities of more than 150 countries and territories and with the help of UN specialised agencies and other inter-governmental bodies. Statistics are grouped into 27 categories and provide information in fields such as population, agriculture, land, industry, mining and quarrying, world trade, energy, finance, consumption health, housing, education and, culture.

Population

The world's population is reported to have reached 3,561 million by mid-1969. In the 1960 decade, the population of the world increased by 579 million—some 40 million more persons than the total population of India, the second largest country in the world on the basis of population. The annual average growth rate over the period 1960-1969 was 2.0 per cent, a rate which, if continued, will double the world's population by the year 2004.

The distribution of the world's people and the annual rates of population increase, according to mid-1969 estimates were as given in the table on the next page.

In 1969, seven countries had populations of more than 100 million each. These are China (Mainland): 740 million; India: 537 million; the Soviet Union: 241 million; United States: 203 million; Indonesia: 116 million; Pakistan: 112 million; and Japan: 102 million.

Of the major countries of the world, the highest average annual rates of population

*Based on United Nations Statistical Year Book 1970.

	Population in millions	Percentage of world total	Annual rate of increase 1960-1969
World	3,561	100.0	2.0
Africa	335	9.4	2.5
Northern America	224	6.3	1.4
Latin America	275	7.7	2.9
Asia	2,009	56.4	2.2
Europe	458	12.9	0.9
Oceania	19	0.5	2.1
Soviet Union	240	6.8	1.3

increase during the period 1963-1969 are found in El Salvador, Nicaragua and Libya, i.e., .37 per cent. In the same period, the Dominican Republic and Jordan had rates of 3.6 per cent per annum. Rates of 3.5 per cent are shown for Venezuela, Iraq, the Philippines and Mexico. At the other end of the scale, almost all the countries of Europe show rates of increase of one per cent or less per annum. With a one per cent rate of increase, the population of a country would double in approximately 70 years. Rates at or near zero are reported only for Hungary, German Democratic Republic, Scotland and Malta. The rate of increase shown for the United States is 1.2 per cent per annum.

Industrial Production

World industrial production, i.e., output of mining, manufacturing, electricity, gas and water, expanded by 114 per cent over the 1958-1969 period. During the same period, the market economies as a whole expanded their output by 99 per cent, all developed market economies by 97 per cent, while all developing market economies by 120 per cent. The centrally planned economies showed a 157 per cent growth in their industrial output.

The following table summaries changes in the shares in world industrial production:

Economies and Regions	1958	1963	1969
World industrial production —total	100	100	100
Centrally planned economies	25.5	28.4	30.7
Market economies	74.5	71.6	69.3
Developed Market Economies	67.1	64.2	61.7
North America	36.9	34.3	31.8
Europe	25.7	24.3	22.3
European Economic Community	14.1	13.7	12.9
Developing Market Economies	7.4	7.4	7.6
Asia	2.8	2.9	3.0
Central and South America	4.1	3.8	3.6

Among the major industrial countries, the following percentage increases were registered in the 1958-1969 period: Japan: 372; Soviet Union: 157; Italy: 133; Federal Republic of Germany: 97; Canada: 95; United States: 85; France: 76; and United Kingdom: 46.

Labour Productivity

The gains in *labour productivity* for the 1958-1968 period were determined as 48 per cent for the centrally planned economies, 70 per cent for the developed market economies and as 37 per cent for the developing market economies, taking into consideration the increase in the level of employment of 42 per cent in centrally planned economies, 18 per cent in developed market economies and 41 per cent in developing market economies.

Agriculture

In 1969, the farmers throughout the world harvested record crops of barley, cotton, maize, rice, oats and soyabean. New records were also set in the world output of some commodities such as cocoa, coffee, eggs, milk, sugar and meat, but the production of potatoes, tobacco, wheat and wool and some other products dropped below that of earlier years.

World wheat production showed a drop in 1969 to 317,902,000 metric tons from 332,695,000 in 1968 (a decrease in production of 4 per cent). Among the largest producers only India, Turkey and Canada showed increases in production over the 1968 firgure (13 per cent, 10 per cent and 5 per cent, respectively), while the following countries showed a decline in production: Australia (26.8 per cent), Soviet Union (14 per cent), United States (7 per cent), and France (3 per cent).

World agricultural output increased by 15 per cent in total volume from 1963-1969 and by 2 per cent per capita. Although the total agricultural output rate of increase was the same as that for 1968, the total per capita, output was 2 per cent lower than that for 1968.

International Trade

World exports in 1970 reached a new all-time high of $311,000 million with a 14 per cent increase over 1969, or the greatest annual increase during the last 15 years, an increase matched only by that of 1969. Of this total, the market economies accounted for $276,000 million, compared with 243,000 million in 1969. The total for the developing countries in 1970 was $53,000 million; for the developed countries, $223,000 million.

In 1969, exports of all developing countries were estimated at $49,000 million, of which 45 per cent was shared by Asia; 27 per cent by Latin America; 23 per cent by Africa; and 5 per cent by the rest of the developing countries.

The exports of developed countries in 1969 were estimated at $194,000 million, of which 61 per cent was shared by Western Europe; 27 per cent by North America; 8 per cent by Japan; and 4 per cent by the rest of the developed countries.

Energy Production

Energy production in the Yearbook is classified by main sources—coal, crude petroleum, and gas among others. All sources of energy are compared in terms of their equivalent in metric tons of coal. Along with the increase in industrial activity, the consumption of energy has increased throughout the world.

The largest part of this increase is due primarily to the growing use of petroleum fuels and gas. Oil dominated the world energy balance for the third year, and in 1969, *natural gas met 20 per cent* of the world's fuel requirements, *liquid fuels 42 per cent and solid fuel 36 per cent.*

In 1969, the United States consumed 10.8 metric tons of coal equivalent for every citizen, making it the leading consumer of energy. Canada was next, burning 8.8 metric tons per person. Metric ton usage per person in other countries included: Czechoslovakia: 6.1; Sweden: 5.8; German Democratic Republic: 5.7; Belgium: 5.4; Australia: 5.2; United Kingdom: 5.1; Denmark: 5.1; Federal Republic of Germany: 4.9; Netherlands: 4.7; Norway: 4.4 Soviet Union: 4.2; and Poland: 4.1. But most countries still consume considerably less than the world average of 1.8 metric tons of coal equivalent per capita.

The developing countries, with a combined population more than twice as large as that of the developed countries, consumed only one-seventh of the total world energy in 1969.

Mining

The 1969 coal production is given as 2,064 million metric tons with reserves of 6,641,460 million metric tons; lignite production 765 million metric tons with reserves of 2,041,405 million metric tons; natural gas 980,000 million cubic metres with reserves of 37,125,000 million cubic metres; crude petroleum 2,072 million metric tons with reserves of 73,062 million metric tons.

Transport

Motor Vehicles: In 1969 there were 181 million passenger motor vehicles in use in the world, 11 million more than in 1968 (a 6.5 per cent increase). Almost half of the passenger

motor vehicles in the world are in the United States, where the number of cars on the roads has increased by around three million each year from 1961 to 1969. In 1961 there were 63 million cars in use in the United States and by 1969 the figure had risen to 87 million.

Railway Traffic: World railway traffic reached a new high of 4,793 thousand million net ton-kilometers. Almost half of the freight traffic (2,366) originated in the Soviet Union. There has been a steady decline in the railway traffic passenger-kilometers in the United States every year from 1961 to 1969 (32,683 to 19,568 million passenger-kilometers). In the Soviet Union the trend is the opposite where passenger-kolometers have increased during the same period (176,300 to 261,283 million passenger-kilometers).

Merchant Shipping: The world's merchant shipping fleets continued to expand and reached over 227 million gross registered tons in 1960 (an increase of 7 per cent over 1968). Liberia, Japan and the United Kingdom have the largest merchant shipping fleets registered (33, 27 and 26 million gross registered tons respectively).

Tourist Travel: In 1969, nearly all countries showed an increase in their tourist trade from abroad. The following countries reported the largest number of tourist arrivals in 1969 (in thousands): Canada (including approximately 23,000 thousand short-term visitors from the United States) : 36,228; Italy: 12,087; Spain: 21,682; United States: 12,347; France: 12,100; Austria: 7,841; and Federal Republic of Germany: 7,022. Decreases were recorded in a few countries, notably in Czechoslovakia, Iran, Israel, Jordan, Kuwait, Libya, Nigeria and Syria.

Civil Aviation: Civil aviation continued its rapid growth: 349 thousand million passenger-kilometers were flown in 1969 as well as 9.9 thousand million cargo ton-kilometers and 2.5 thousand million mail ton-kilometers. This was almost two and one-half times the 1963 level for passenger-kilometers and around three times the 1963 level for cargo and mail ton-kilometers.

Steel Prodution and Consumption

In 1969 the United States produced and also consumed the largest quantity of steel in the world. 128,151 (excluding steel for castings made in foundries not producing ingots) thousand metric tons were produced and 138,680 thousand metric tons were consumed. The Soviet Union was second, with their production reported at 110,328 and consumption at 104,921 followed by Japan 82,166 and 61,607 and Federal Republic of Germany 45,316 and 40,103. Countries with the highest per capita consumption were Sweden (711 kilogrammes), United States (682 kilogrammes), Federal Republic of Germany (659), Japan (603) and Czecholsovakia (594).

Housing

The housing data included in the year book show that most countries throughout the world have housing problems of one kind or another. Poor countries are more likely to have an outright shortage of dwellings with acute overcrowding in the limited supply available. More prosperous countries generally have an adequate supply but very often it includes large proportion of old housing lacking essential facilities.

In terms of occupancy levels, the Isle of Man reports an average of 0.5 persons per room or exactly two rooms per person. Belgium, the Channel Islands, England and Wales, Pitcairn Island and Luxembourg follow with averages of 0.6 persons per room or slightly less than two rooms per person.

At the other end of the density scale is the Central African Republic with a ratio of 3.4 persons per room, followed by Pakistan and Sikkim each with an average of 3.1. Overcrowding also appears to be a serious problem in parts of the Caribbean where Dominica, Grenada, St. Lucia and St. Vincent all report more than 50 per cent of their dwellings occupied at levels of three or more persons per room. In Mexico, Nicaragua and Paraguay, overcrowded conditions are also reported.

In dwelling construction, the Soviet Union led

all other countries by a comfortable margin with an output in 1969 of 2,231,000. The United States ranked second with a million and a half followed by Japan with 1,346,612. Unfortunately, countries with the highest rate of population growth and the worst housing conditions, in other words, those with the greatest need for an accelerated output of new dwellings, are generally those reporting the lowest construction levels.

Book Production

In 1969 the Soviet Union continued to be the largest book publisher in the world, with 74,611 titles. The United States was second with 62,083 titles, followed by the Federal Republic of Germany 33,454, United Kingdom 32,321 and Japan 31,009.

Daily Newspapers

In 1969, the highest newspaper circulation per 1,000 inhabitants was reported by Sweden (528 copies), the second highest was Japan (503), followed by United Kingdom (488) and Hong Kong (485).

Cinemas

During 1969 more people attended cinemas in the Soviet Union than in any other country in the world (4,655.9 million) the next highest attendance was reported by China (Mainland) (1960: 4,000.0), India (2,190.0) and the United States (1967: 1,300.0). The highest per inhabitant attendance was reported by China (Taiwan) (1967: 66), followed by Macau (1965: 30), Brunei (1967: 21), Hong Kong (21), Soviet Union (19) and United Arab Republic (1968: 19).

Old Pathologist's Advice to the Young Pathologist

'You're young' Pearson said, 'You're full of spice and vinegar—that's good. You know your stuff too. You're up to date—You know things that I never did, never will now. Take my advice and try to keep it that way. It'll be tough to do : make no mistakes about it. He waved towards the desk he had first vacated. 'You'll sit in that chair and the phone will ring, and it'll be the administrator, talking about budgets. Next minute one of the lab staff will want to quit ; and you'll have to smooth that out. And the doctors will come in, and they'll want this bit of information and that'. The old man smiled thinly. 'Then you'll get the salesman—the man with the unbreakable test tube and the burner that never goes out. And when you're through seeing him there'll be another and another and another until at the end of the day you'll wonder what happened to it and what you've accomplished, what you've achieved.

Pearson stopped and Coleman waited. He sensed that in his words the old pathologist was reliving a part of his own past. He went on "That's the way the next day can go, and the next and the one after that until you find a year has slipped by and another and another. And while you're doing all this you'll send other people on courses to hear about the new things in medicine—because you can't take time to go out yourself. And you'll quit investigation and research; and because you work so hard, you'll be tired at night, and you won't feel like reading text books. And then suddenly, one day, you'll find everything you knew is out of date. That's when it's too late to change."

Emotion-charged, the voice faltered. Pearson put a hand on Coleman's arm. He said imploringly. Listen to an old man who's been through it all, who made the mistake of falling behind. Don't let it happen to you !

Lock yourself in a cupboard if you have to ; Get away from the phone and the files and paper, and read and learn and listen and keep up to date. They can never touch you, never say "He's finished, all washed out; he belongs to yesterday", because you'll know as much as they do—and more. Because you'll have experience to go with it.....

The voice trailed off and Pearson turned away.

—From The Novel *"Final Diagnosis'* by Arthur Hailey

Appropriate Technology for Increased Productivity

Dr Ram K Vepa*

Developing countries in Afro-Asian region are faced with the urgent problem of providing increasing job opportunities. According to ILO estimates, more than 220 million people will seek jobs in developing countries in the seventies of which only 20 million are likely to be absorbed in the organised factory sector. In order to meet this situation, an important factor will be the type of technology to be adopted for industrial development in these countries. The requirement in most of the Afro-Asian countries is for a low-cost, low-volume technology. A technology which is not too capital-intensive and is economically efficient has to be devised and adopted. Particularly for developing rural economies, the concept of appropriate technology has to be given recognition in any scheme of rural industrialisation.

ONE of the biggest problems facing the developing countries in the Afro-Asian region is the pace of economic development in the entire region which has been somewhat tardy. Even more than the actual growth rate, the pattern of development is of special importance particularly in view of the urgent need to provide increased job opportunities in these countires. It has been estimated by the International Labour Office that in the seventies more than 220 million people will enter the labour force in the developing countries, of whom barely 20 million are likely to be absorbed in the organised factory sector. It is, therefore, specially important that schemes should be devised to provide gainful employment for the lamaining 200 million people, who will be rergely located in the rural and semi-urban areas.

An important and relevant point in this connection is the type of technology to be adopted for industrial development in these countries. All too often, in the past, technology for both the large and small industry has been adopted from that practised in the West. Such technology, however, has been developed on completely different assumptions where capital is available in abundance and labour is scarce. Further, most of these countries have attained the stage of mass-consumption and hence the magnitude of the domestic markets themselves is quite large. The affluent societies in these countries can, therefore, sustain a type of technology which is capital-intensive and geared to meet the consumption needs of the people of these countries.

In the Afro-Asian countries, however, completely different conditions exist. These may be broadly listed as follows:

Firstly, capital for industrial purposes is extremely scarce. Even though the improved agricultural practices are generating new sur-

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pluses in the agricultural sector, the bulk of this amount is being diverted to unporductive expenditure such as on jewellery or houses. Demand for consumer articles, however, is rising at a fast pace and it is estimated that in India alone during the Fourth Plan period the 'Green Revolution' would be responsible for additional incomes of the order of Rs. 20,000 million ($2.7 billion) much of which will be generated in the rural areas. This disparity between increased consumption and insufficiency of material goods is likely to produce a sense of frustration amongst the rural population and, in many cases, acts as a trigger for the migration to metropolitan areas leading to the creation of slums and other social evils in such areas.

Secondly, in most of the Afro-Asian countries the managerial skills available for operation of industrial enterprises are comparatively limited. Although there are some variations in this regard between countries such as Korea, Taiwan, India, Hong Kong and Singapore, it can be said that in most of the Afro-Asian countries, the skills available are not adequate for sustaining a complex industrial economy. Even in the technological field, the design capabilities are limited to comparatively fewer people who are thus in great demand, both in their own countries and abroad.

Thirdly, the single biggest problem, as has been mentioned above, which most of the countries of the region face is the need to provide employment opportunities to large masses of people. Although population control programmes are increasingly being adopted in most of these countries, the success of the health programmes, is generating, in the short run, what has been called a 'population explosion, which will bring in a large number of persons into the labour force in these countries. As has been stated earlier, barely 10% of these new entrants can be provided with occupations in the large-scale sector and there is need for undertaking activities which are labour-intensive so as to provide meaningful employment which will ensure reasonable income to the new labour.

The requirment in most of the Afro-Asian countries is for a low-cost, low-volume technology.

Fourthly, in most of these countries, there are a considerable number of persons who are engaged in traditional occupations which, for generations, have provided the infrastructure for the rural economy. These again can be divided into two categories: those who may be termed as rural artisans such as carpenter, blacksmith, potter, etc. and those who have developed traditional skills such as weavers, handicrafts workers, etc. These occupations provide employment and livelihood to a considerable number of people; in India alone, it is estimated that as many as 50 millions are dependent, either directly or indirectly, on such occupations. With increasing competition from the mass production industry, the ability of such persons to earn a living wage in the traditional occupations is becoming progressively less. The dispossessed artisans and craftsmen tend to become an increased burden on community unless suitable steps are taken to adopt revitalised technologies which would make their occupations economically more viable.

Fifthly, a considerable amount of raw materials are available in all the Afro-Asian countries which, however, are under-utilised from an industrial point of view. This is because western scientists are unfamiliar with such materials and even indigenous scientists are far too western-oriented to pay much attention to them. It is, however, being recognised that any scheme for the industrial growth of the rural areas must be based on full economic utilisation of such materials which would assure a better return to the producer as well as provide employment to large number of people.

Betterment of Results: A Challenge to Management

Jyotirmoy Banerjee*

The results of the past assume the form of a challenge for the future. The advancement of science and technology has brought about a renaissance in the way of life of the people, particularly in the later half of this century. Management Science has emerged out of the requirement of the progressive society to foster systematic and planned development of industries and to satisfy the increasing needs of the growing population. It is entrusted with the responsibility of making the resources productive and is being so utilized as to encompass every sub-system within the framework of an organisation. Complexities arising out of business expansion, increasing diversity of objectives, stochastic character of demands and the intricacies inherent in the application of latest management skills, are only a few challenges placed before the management desk. This paper seeks to present the different approaches with a view to solving such complex problems in the dynamic situations faced by management today for a better world tomorrow.

THE growing complexities and proliferation of operations in an industrial enterprise have burdened the management so heavily that sometimes it becomes difficult to find a true index of the results achieved. The many-faceted management pyramid is so interwoven that a single criterion is hard to rely upon; the management have, therefore, to depend on the probabilistic optimal solution under the dynamic situations.

Even today, results are defined in tangible forms, and guidelines are framed as regards the number, reasonability, adaptability, fairness and variations with time.[1] These are either related to the effects on sales volume or revenue; savings in resources or on profits; time and cost of feasible solution; customer satisfaction; or to information output.[2] Such criteria are linked with one or more of the corporate objectives of the company, like profitability, market position, product leadership, productivity, balance of short and long-range goals, personnel development, employee attitude and public responsibility.

A universally acceptable criterion is the customer satisfaction reflected in continuing and growing sales at profit to the producers. Some variations in this approach have of late been observed. Likert[3] introduced the concept of intervening variables, and considered the attitude, perspective and morale of the employees as equally important factors in management. Drucker,[4] on the other hand, has placed the organised economic performance as the primary criterion of test for every effective decision and action at all levels.

The present-day criterion of value requires consideration of many factors both tangible and intangible, so that the problem is viewed as an integrated whole. The multi-disciplinary approach has to be sought to frame constructive programmes for problem-solving, decision-making, feed-back and control functions. A basic analysis of the process of management itself would reveal the determining factors.

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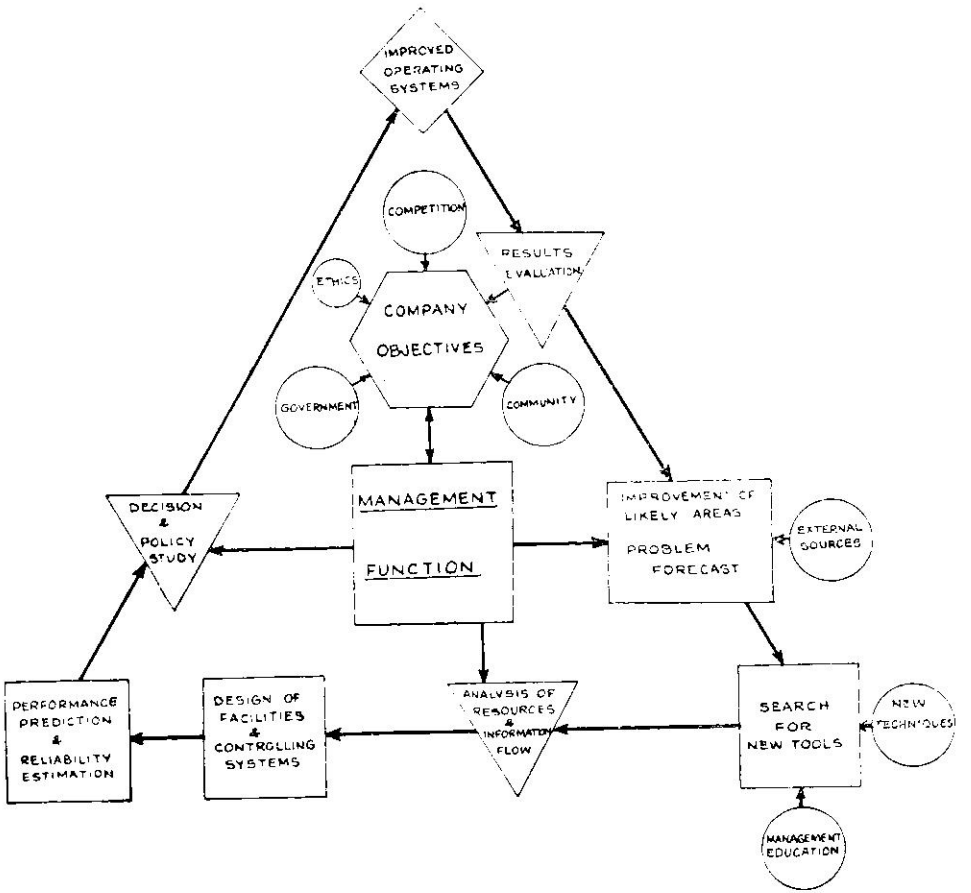

The Management Process

The anatomy of management is compared to the triangular framework of a bicycle which is made up of organisation, human relations and communications; with technical knowledge and skill as its power wheel and the administrative skill as the front or guidewheel. The management process is, on the other hand, said to be a combined pattern of mental action and human behaviour. The process is dynamic in the form of a rising spiral so that the completion of one cycle of activity marks the beginning of a new one in a higher plane. One such cycle of activity is depicted in the above figure.

The management function is centred round different activities which are being constantly improved by company objectives and policy decisions. For a particular plane of operating systems, the results are evaluated, likely areas of improvement identified and through the different techniques and information available, a new decision is taken in order to raise the system to a higher level of performance. This is the usual method followed for betterment of results through increasing development of factual and unbiased solutions based on evaluation, understanding and manipulation of sub-systems.

The other two trends relate to a diagnosis of the basic problems and design improvements or innovations in the man-machine system, and to a

gap' between the scientific discovery and its utilization in industry has been narrowed down considerably. R & D programmes can help the present product lines in their cost reduction, quality improvement and product diversification, or in the development of new product lines and market, in the long-range planning for major process breakthrough, or in providing technical service to sales or manufacturing by recurrent feedback of information for corrective action. The 'index of return', however, cannot be fully evaluated as the R & D activities are indirectly and distantly related to profits. Attempts have been made to judge the effectiveness through increased sales volume, new products demand, cost reduction of product line or increased return due to investment on R & D[14]. A survey by the National Science Foundation indicates that the percentage return on such investments is maximum in case of aircraft and electrical industries and minimum in food and primary metal industries.

Since World War II, the impact of operations research on every sphere of management activity is overwhelming. A host of such techniques have been developed and utilised[15], of which mention may be made of the simulation technique[16]. The symbolic systems simulation used for research on management control systems assumes three sub-systems or 'black boxes' within the large black box, namely the control, operations and environment[17]. The interrelations of these sub-systems can be simulated by the random process generator in a computer and the results predicted long before similar problems arise on the business arena.

Conclusion

The present knowledge and applied skills can be said to be only wayside stations on our path towards a better world. The complex management function still requires some impressive talents that make things work. Those who produce results are never questioned but those who do not, are never given an opportunity to explain. The boundary of uncertainty is still obscure and in spite of all the newly developed techniques it remains an eternal challenge to the management as to where results can be tamed through a set pattern of actions.

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Inventory Control

MC Bhandari*

Inventory control is one of the most fruitful exercises a firm, specially an industrial concern, can have. In view of the shortage of funds from which many of the Indian undertakings suffer, it is perhaps of even greater importance in India to adopt a well-thought inventory control, for the cost of funds locked up in unnecessary inventories or inventories which are not likely to be used for some time is not the interest payable but the opportunities foregone. Conceptually funds released from inventories may lead to a better debt-equity ratio which may enable the company to enjoy better and easier terms in the capital market. The improvement in this ratio may come about directly by paying off long-term loans or, better still, by undertaking profitable activities which are starved of funds, earning profits and thus building up better equity base. This incidentally is likely to lead to higher prices for the company's shares in the market even without the company paying any additional dividend—through higher earnings per share, investors being satisfied with lower yield and an expectation about bonus shares. One must not therefore think of the cost of carrying inventories only in terms of the interest payable.

In the developed countries where competition is stiff and margins low, any saving in costs or interest payment is welcome by itself. This is reflected by the anxiety of companies in these countries to husband cash and bank balances, cut down all delays between the time a customer sends his remittance and the time it is credited to the company's account. Inventory control remains, of course, a vital field for management's attention.

At the outset, however, it must be understood that inventory control can function properly only as an integrated part of the sales and production policies, both of which must themselves be fully coordinated in respect of the product to be produced and sold, the conditions attending production and those affecting sales. It does not take much time to come to the conclusion that greater the degree of simplification and standardisation, shorter will be the production run and lower will be the inventory of work in progress. But what the Sales Manager may have to say about simplification and standardisation must also be kept in mind. When Ford continued to resist the demand for change in the famous Model T, even after the Americans began to want something new and different in the line of cars, inventories of Model T, piled up. The Ford Motor Company could ultimately survive only when, along with other things, the market was paid adequate attention. The point that is being emphasised is that neither sales policy nor production policy can be thought of in isolation and certainly not inventory policy.

What is Inventory Contro ?

Behind the question of "Why are we always out of stock?" lies the dilemma of "attempting simultaneously (1) to meet the ever-increasing demands for improved customer service, (2) to maintain stable production operations, and (3) to keep the investment in inventories at a reasonable level".**

Inventory control means maintenance of stocks of finished goods and raw materials at

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** Principles of Inventory Management by Arthur Snyder p. 70 of Foundation for Financial Management by James Van Horne.

Inventory Control can function only as an integrated part of the sales and production policies.

such levels as will yield the best advantage for the firm in respect of production costs, sales and profit and cost of carrying inventories. Large stocks entail costs in respect of interest, obsolescence, godown rents, etc., but low stocks have the risk of interrupted production or lost sales. The costs of carrying large stocks and the risks of carrying low stocks have to be balanced.

Inventories chiefly consist of raw materials, work in process and finished goods. We shall consider these separately.

Raw Materials and Stores

The chief consideration is that there should be no interruption of output without locking up too much capital, considering the conditions of supply of the materials. Also, the price movements have to be considered. If price is expected to rise substantially, comparatively large stocks will be maintained; the price advantage will offset extra costs in the form of interest or storage costs. If there is likelihood of difficulty in getting supplies, stocks will be built up in advance.

The working of the control in respect of raw materials and stores involves consideration of:

(i) what to control;
(ii) when to buy; and
(iii) how much to buy.

Management should try to conserve its own time by selecting items which need a full system of control on the basis of ABC classification, which is now too well known to bear repetition. The only point that needs to be made is that classification should not be made merely on the basis of the investment involved but also on the basis of its essentiality for completing the production cycle. In one case, a small imported part, not costing much, made all the difference to the saleability abroad of the product almost wholly indigenous and its price. It is therefore important for the management to pay attention to such a part.

When to buy or the reorder point may be determined on the basis of the estimated lead time and the likely consumption during that period. Snyder, in the article mentioned previously, has given a mathematical formula for calculating the reorder point as follows :

$$OP = S\ (P - L) + FX\sqrt{SQ\ (P\text{-}L)}$$

where OP = reorder point
S = usage per month
L = lead time in months
Q = units required for each requisition
F = stock out acceptance factor
P = production or procurement cycle in months

(The stock out acceptance factor means the limit upto which the firm is prepared to have the risk of having no stocks. If 10% stockouts are acceptable the factor will be 0.10).

There is need to fix an upper limit or maximum stock in respect of all costly items so that investment in inventories of such items is kept under check.

The factors determining the maximum level of stocks of raw materials to be maintained will be the following:

(i) The requirement of materials in a month considering the production budget.
(ii) The conditions that govern the supply of materials—whether they are available throughout the year or only seasonally.
(iii) The movement of prices of materials from one period to another.
(iv) The amount of funds that can be spared for stocks of raw materials.
(v) Storage capacity that is available.
(vi) The economic order quantity.

(vii) The interest that will have to be paid and other storage expenses that have to be incurred on maintaining stocks.

The question of how much to buy or the economic order quantity (EOQ) is usually decided by the formula

$$EOQ = \sqrt{\frac{2CO}{I}}$$

where C=the consumption, in units, for the period concerned

O=cost in rupees, of placing one order, and receiving the goods; and

I=cost in rupees, of carrying one unit in stock for the period. It includes storage costs, the interest on the price paid for the unit and the possible deterioration in quality.

This formula makes one point clear. Should annual consumption double, the quantity to be ordered will not be doubled; the increase should be only the square root of the increase in consumption.

The limitation of working according to the above-mentioned formula will be immediately clear specially in India where "I" in any case goes on changing continuously since it depends on the price of the materials purchased. The top management can keep itself informed of the broad situation through the use of accounting ratios.

The ratio: $\frac{\text{stock on hand}}{\text{average monthly consumption}}$

will indicate in months the period for which the stock on hand will last. Comparison with the lead time will indicate whether there is over or under stocking. The ratio is better worked out separately for raw materials and each item of the chief stores and for other stores in general. Of course, in addition, action is necessary to keep track of slow-moving and obsolete items so that action is taken to dispose off the excess stock quickly.

Work in Progress

Work in process (or progress) is something which may not easily lend itself to any formulae.

There is need to fix an upper limit for stocks in respect of all costly items so that investment in inventories of such items is kept under check.

It is a necessity in all industrial concerns—the amount of the work in process depends on the length of the production cycle and there is always a certain level below which it cannot fall. But it would be surprising to most people if the actual work in process were to be compared with the permissible or unavoidable level. The industrial engineers should fix the number of hours work should remain at each machine or what may be termed as 'operation centre'. Top management should calculate one simple ratio for each "operation centre" or for each department, i.e.

$$\frac{\text{Time (in hours) work actually remained at the centre}}{\text{Permissible or unavoidable time (in hours)}}.$$

It will be a well-run concern where the ratio is not substantially above 1. A ratio of more than 1 will indicate that work is not being expedited enough.

Some of the common reasons for an undue increase in the volume of work are the following:

(i) Non-availability of some essential part, even though it is not costly;

(ii) Imperfect production planning;

(iii) Frequent interruption of the production process to complete some "urgent" work; and

(iv) Production of some part which is better bought from outside, considering the technical skills involved, etc.

There is no doubt that proper production planning, complete with the exact line for finishing each stage of work, allowing production to commence only at the right time and not earlier, will keep the work in progress at a reasonable level.

Proper production planning, complete with the exact time for finishing each stage of work, will keep the work in progress at a reasonable level.

In addition, management must pay attention to any possible simplification, standardisation and substitution. All these speed the production process and reduce the volume of work in process, in addition to bringing down costs.

Finished Goods

The size of inventory of finished goods should be such as will balance:

(i) the advantage to be obtained by maintaining large inventory in the form of profit gained on sales that would have been otherwise lost as also the advantage in the form of lower cost of production because of long uninterrupted production runs; and

(ii) the costs of carrying inventory in the form of godown rent, interest on investment in the inventory, deterioration in quality, etc.

The optimum size of inventory will naturally differ from concern to concern but the following may be listed as the chief factors that should be considered:-

(i) *The regularity of demand and the ease with which it can be forecast*: the possibility of orders that must be complied with promptly.

(ii) *The character of production*: in case of seasonal production or demand large inventories must be carried necessarily.

(iii) *The character of products and availability of proper storage space*: goods that do not keep for long cannot be stored in large quantities.

(iv) *Possibilities of storage in future*: in such a case large inventory is likely to be built up.

(v) *Possibility of a price rise*: in this case also large inventory is likely to be carried.

(vi) *The nature of goods*: goods which are likely to go out of fashion should not be kept in large quantities.

(vii) *Cost of retooling etc., if production is undertaken in batches*: if this cost is high, it may be desirable to carry rather large stocks since that will reduce the number of items retooling is required. The optimum size of a batch can be determined by the same formula as for EOQ if instead of the cost of placing one order, cost of retooling is substituted: This will obviously affect inventory levels.

From the above factors, it can be seen that some factors are inconsistent with the others and, therefore, the inventory policy must establish a desirable balance between them. One of the questions to be decided is whether finished goods inventories are to be allowed to fluctuate, keeping production at a stable level, or whether it is to be the other way round.

An over-all check is provided by the inventory turnover ratio worked out as cost of sales divided by average inventory carried. Any reduction in the ratio should be investigated.

Complicating Factors

In India, there are quite a few factors which may not allow a concern to follow a rational inventory policy. These are the following:

(i) *Rising Prices*: If a rise in price is expected, it is obviously desirable to build up stocks of raw materials and to have large stocks of finished goods—it pays to borrow money from

the bank but postpone sale of the goods as much as possible. This really makes a nonsense of the formulae given above.

(ii) *Shortages*: In a period of shortages, those who have stocks benefit immensely. Those whose scruples are not too many try to create a condition of shortage in order to force up prices, since the gain in that manner will be great. Also, when shortages develop, people try to acquire even more stocks than they need, thus making the shortage even more acute. This is very harmful to the country since that means idle capacity in case of those that have not and idle funds in the case of those that have.

(*iii*) *Liceneing*: When something is available only against a quota or a licence, people acquire whatever they can and this may lead to a situation of artificial shortage.

The three factors given above are beyond the control of an individual firm; only Governmental action can solve the problem. But if the psychology of shortages disappears, prices also may come under control and with stability of prices the most important incentive for having excessive stocks will disappear. Government policies are, therefore, a vital factor in respect of inventory control.

A Check List for Inventory Control

An answer to the questions mentioned below may keep the management's attention focussed on the question of inventories:

1. Has inventory usage been determined, and have the items been classified as fast-moving, slow-moving and obsolete?

Management must pay attention to any possible simplification, standardisation and substitution.

2. Have obsolete or excess stocks been disposed off?
3. Have reorder points and economic order quantites been established?
4. Is production planning in force? Are production plans issued regularly?
5. Is there a schedule covering all machine groups?
6. Is performance factor (or efficiency level) determined regularly?
7. Are progress meetings conducted at regular intervals ?
8. Are status reports timely and effective ?
9. Is the time-lag between the receipt of customers' orders and despatch of goods reasonable ?
10. Are stockout costs calculated regularly? Could the stockouts be avoided ? What would have been the cost of avoiding the stockout costs?
11. Is the inventory turnover ratio going up?
12. What would have happened if inventories of raw materials and finished goods were lower by 10%? 20%?

Braving obstacles and hardships is nobler than retreat to tranquility. The butterfly that hovers arouud the lamp until it dies is more admirable than the mole that lives in the dark tunnel.

—Kahlil Gibran

Tested Techniques of Cutting Costs

Brigadier SC Bhattacharya*

How a defence industry engaged in jobbing type of manufacturing could successfully initiate many cost control techniques, is eleborated in this article. Among the techniques that were adopted in reducing costs were: information network within the managerial staff, ABC analysis and visual indexing, better utilisation of machinery, defect analysis in preventive maintenance, value analysis and waste reduction. It was possible for the defence factory to reduce costs through a systematic programme covering all the manufacturing processes and the preventive maintenance system.

APHRA Behn said, "Money speaks sense in a language all nations understand." Engineers and technologists of the industrially-advanced nations have placed greatest emphasis on cost effectiveness for maximising profit. Industry must make profit to augment industrial and National economy and render service to the society. When Mr J. R. D. Tata asked a Minister in Singapore, "What restrictions do you impose on an industry?", promptly came the reply "only restriction is that you must make profit".

A Defence industry engaged in jobbing type of manufacture successfuly initiated many cost control techniques as management tools, a few of which are enumerated in this article.

Information System

An information network within the managerial staff and even the operative is an essential pre-requisite of all cost control measures. The best way to judge performance at any level is by comparative assessment of related facts and figures which must speak for itself. These ratios need to be flexible, workable and measurable. Above all, they must lead to corrective action. To put it in the words of a top executive, "I can only say two things; one is that the figures that go up to you must be submitted in a form that means something to you. If rows of beans mean more to you than statistics, get beans. I would also say that figures or graphs or whatever you demand, must be prepared from the instruments in current use. These figures cannot, of course, tell you everything. They are like the chart hanging behind a patient's bed in a hospital. They give a clue to his condition but they do not diagnose the cause."

The Defence industry in view adopted many "output" to "input" ratios as cost measuring parameters because ratios are the best means to assess cost effectiveness. By synthetic and analytical estimating, processing data, standard times and standard units, basic parameters were evolved. Some of the ratios introduced, particularly those of direct costs, are mentioned below:

(a) Direct labour expenses
Standard labour expenses

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(b) $\frac{\text{Wages of all types}}{\text{Cost of goods produced}}$

(c) $\frac{\text{Value of finished products}}{\text{Rated capacity in labour-hours}}$

(d) $\frac{\text{Total manufacturing cost}}{\text{Cost of manhours employed}}$

Inventory consumed not only substantial manpower but also considerable capital. Tendency of overstocking resulting from a fear of scarcity was curbed by closely watching inventory ratios such as:

(a) $\frac{\text{Cost of raw materials used}}{\text{Cost of raw materials in stock}}$

(b) $\frac{\text{Cost of raw materials used}}{\text{Cost of manhours utilised}}$

(c) $\frac{\text{Cost of raw materials used}}{\text{Total manufacturing and repair cost}}$

(d) $\frac{\text{Scrap cost}}{\text{Cost of output}}$

Gains From A-B-C Analysis and Visual Indexing

In industries, vast capital is 'stored' in the bins, much of which, if analysed periodically, say 6 months, will reveal the state of inventory management. Categorised as A-B-C-D, the periodical analysis revealed cost status of all serials, frequency of consumption and total inventory cost and also surplus items which were denoted by 'D' i.e. for disposal. The first two analyses made over a period of one year showed that 15% items costing Rs. 55,000 were 'D' items, 30% items valued at Rs. 170,500 were slow-moving (Category 'C') i.e. items which had only 1 or 2 issues during 2 years. 'D' items were promptly disposed off and 'C' items were ruthlessly eliminated, even at the risk of shortage up to a point. However, critical spares, though costly, were retained. The other gains derived from A-B-C analysis were fixation of safety stocks, reorder point and economic order quantity.

Visual indexing through binning techniques such as 2 bins or 3 bins system with indication of cost and stock status at each bin and visual cards kept in cabinets with coloured signals to indicate status such as A-B-C-D, V-E-D and F-N-S notations also simplified materials management. 2-bins or 3-bins for fast moving items helped in resorting to timely action to refill bins. Laying of stores category-wise and size-wise assisted in selection of alternatives without reference to documents. Such visual indexing systems-through card index cabinets, card notations at bin and size-wise binning enabled to limit stores to actual requirement, select alternatives, readily focussed management attention and installed dynamic control.

Another important element of cost control in stores section was reduction of serials. For example, there were a large number of abrasive wheels of various dimensions, grades and makes. By a survey and technical discretion, it resulted in a reduction of 25% serials and considerable rationalisation. Such rationalisation-survey on welding rods, hand tools, iron mongery, wires and cables, lubricants, rivets, cutting tools and many other expendible stores brought about considerable economy, ease in provisioning and accounting and saving in storage space.

Economics of Machinery Management

In a factory, more than 50% capital may be utilised on machinery. It is a pity that utilisation of machinery in industries vary from 30% to 60% with, of course, exceptions. The main reason for low utilisation is attributable to lack of balance between economic and technological factors both of which should be weighed up before arriving at a decision about machinery system for the products. For example, in one factory, a highly sophisticated electronically-controlled machine costing over Rs. 4 lakhs was installed but remained idle for want of adequate load. In another factory, Rs. 20 lakhs were invested on a forge shop whereas local forge shops had enough spare capacity to meet the factory's requirements.

The most important element considered on machine economics was return from the machine.

In purchasing a machine, the management used to consider the capital invested and the recurring and non-recurring expenses such as:

Non-recurring expenses	Recurring expenses:
Machine and its accessories	Operator and maintenance crew
Associated equipments	Spares, lubricants water etc.
Land and buildings	Power supply
Installation	Inspection
Power, water and plumbing	Insurance
Air-conditioning	Depreciation

It was found that a machine costing Rs. 1 lakh or so should at least fetch Rs. 50,000 a year.

After having examined the economics, management had to decide whether to purchase a machine or to make use of the market facilities. This decision was also dictated by the critical nature of the product for which one would not like to depend on other agencies. Decision to buy a machine was not viewed as an isolated purchase. A machine by itself may not be of any use. It must fit into a family of machines. Like human family, machine family has its characteristics like 'talent', speed, accuracy, reliability, versatility, and maintainability. It is no use buying an automatic machine where its speed and accuracy are no match to the others. In the country's struggle to acquire capital and foreign exchange for industry, planning and selection of machine should assume great importance. Economics in machinery management was given right emphasis it deserved and all purchases of new machines were subjected to scrutiny of economics and technical factors.

Defect Analysis in Preventing Maintenance

Breakdown of machines at a critical point of production and lack of vital spares are the two worst ills of industry both of which can be controlled by introducing defect analysis in preventive maintenance system. The aim of defect analysis was to forecast likely breakdown of a machine. It enabled the Plant Engineer to take advance provisioning of spares, focus attention to a sensitive part, and undertake corrective action before occurrence of defects on the basis of forecast.

The data on defects were laboriously plotted on visual index card. For this purpose, two forms were taken into use—one for defect-wise analysis and the other for machine-wise defect analysis. The latter was also intended to assess utility and economics of a machine and take decision for its discarding if found uneconomical. For example, if the coolant pump in a lathe got defective at 1,000, 2,500 and 3,200 machine hours, one could predict that this coolant pump might become defective at 4,300 machine-hours. This is illustrated below from actual entries in the form—

Defect	*Defect Code*	*Machine hours at which failed*				
Coolant Pump	A-2	1000	2000	3000	4000	5000
		•	•	•	+	

On this assessment, the Defect Analysis Cell sent a slip to the Repairs Section and Stores Section indicating to them the pattern of defects. The Repairs Section kept a watch on the coolant pump; the Stores Section provided for replacement. This system fitted into a well-integrated Preventive Maintenance System in the factory. Needless to say that the feed-back system, recording of data and analysis of defects have been the main activities in the system. By holding the two types of Defect Analysis Cards in a Cabinet and suitable signalling, the system worked very well. The economy achieved in the Defence factory by Preventive Maintenance System has been 10 to 30% of the total cost of plant maintenance.

Cost Reduction Through Value Analysis

Value analysis is also an effective cost reduction tool. It starts with an enquiry into the functional utility of an item, e.g., accessories of machines, cutting tools, hand tools, machine spares, materials, lubricant, etc., and then proceeds to measure its value or intrinsic worth in terms of the function to be performed. The next step is to investigate how the value can be improved either by obtaining better performance or by reducing cost or both. It is concerned with

the scrutiny of design, function and cost of any product, any stores item, any material or any services with the object of reducing costs. It requires a complete 'new look' into the product or process by somebody who is prepared to ask questions when it comes to the simplest statement made. Based on these themes, each product and cost-centres was subjected to scrutiny from which significant reduction in cost was effected.

A typical cost reduction study undertaken on preventive maintenance revealed that cost of maintenance to machines widely varied between the two shops. After value analysis, the wide gap between these two shops was reduced from 42 to 35 and 77 to 44 by standardising lubricants, tools and maintenance schedules as shown below:

Shops	*No of machines* A	*Av. total basic pay of workers per month* B	*Av. cost of expendable stores per month* C	*B+C* V	*After value analysis*	
Machine & Fitting shops	163	Rs 2636	Rs 4072	Rs 6708	42	35
Blacksmith	85	Rs 2536	Rs 4007	Rs 6543	77	44

Waste Reduction

In both repairs and manufacturing activities, waste reduction will lead to vast economy. The waste consciousness should permeate throughout the Organisation. A well-coordinated plan, practices and communication system are essential for waste reduction.

Before introduction of Cost Control Programme, in the Defence factory, raw materials accounted for nearly 50% of the total cost of manufacture and repairs. Waste due to scrap, defective processes and dimensional inaccuracy was effectively reduced. Waste of materials was attributed to many causes like wrong estimation, incorrect process, wrong sequence of processes, poor design, lack of skill, lack of knowledge, wrong choice of machine, bad design or use of tools, inadequate maintenance of machines, wrong communication, lack of adequate planning and poor lay-out.

Waste was largely controlled from initial stages of planning, viz. methodising, tooling and estimation. The economic batch and optimum materials required for the batch were determined with due regard to availability of manufacturing facilities in the shops and the following production control data were specified:—

(a) Actual weight of the component and total quantity for the batch.
(b) Weight of raw materials required for the batch.
(c) Anticipated waste of material per batch.

The actual waste could then be measured against the anticipated waste. A management information ratio $\frac{\text{Scrap}}{\text{Materials issued}} \times 100$ was prepared from factual data.

Waste was also estimated from the salvage yard. The quality control staff, after examining the scrap in the salvage yard, made a systematic analysis of the waste against the work orders, drawings and operation planning sheets and determined the root causes of waste. The Quality Engineer then intimated the Method Engineer along with his recommendations for corrective action.

The waste reduction programme must fall under a well-integrated procedure and management information system. To do so, the forms and charts that were taken into use are mentioned below :

(a) Waste Weekly Record (by each shop)
(b) Waste Reduction Analysis (by Quality Engineer)
(c) Operation Planning Sheet (by Methods Engineer)
(d) Waste Monthly Record (by each shop)
(e) Scrap Return (by IC Salvage)
(f) Waste Index Chart (maintained by Quality Engineer).

Conclusion

Since the Defence factory was organised for undertaking jobbing type of manufacture, reduction of cost by a systematic programme covering all the manufacturing processes and preventive maintenance system and even prevention of industrial accidents was of vital necessity. In launching Cost Control Programme, the first and foremost task was to create cost consciousness amongst all ranks through the mediums of training, planning procedures, controls and communication. It was also found that the cost could be reduced practically in all sections of the factory. By application of all these cost control measures, the cost of products became competitive within an amazingly short period.

Efficient Information and Control System for Increasing Productivity

HC Pande*

In order to raise productivity, people working in an industrial organisation have to find ways and means of reducing everything that goes in the cost of production. A manager's job is primarily to increase productivity. In doing so, he has to take decisions concerning different fields of management. For decision-making information is necessary. The various quantitative techniques of management like linear programming, queuing theory, operations research, PERT/CPM, and simulation techniques help the manager to take decisions based on data rather than relying upon casual judgment. More and more emphasis is now being given to introduction of better management information and control systems incorporating latest management techniques and tools.

MANAGEMENT'S responsibility is decision-making, laying down policy, organising, planning, directing, controlling, staffing, co-ordinating, communicating, motivating, evaluating, getting goods produced, and selling. Therefore, those officers of the organisation who come under the purview of the terms "Top Management", "Middle Management", and "Junior Management" levels, have to discharge duties in the above field. While discharging their duties they have to keep before them two points or factors as their guidelines. They are "time" and "cost". If the managers working in any undertaking are given the liberty not to worry about the time and cost for any function or operation, then any modern thinking or approach in the field of management is irrelevant.

A business/industrial organisation has two primary objectives before itself. The first one is 'profitability' in order that it could run and expand further. The second one is its 'continuity', so that the money invested in the organisation could be ploughed back. Therefore, the executives working in the organisation have to make every effort to see that these two primary objectives are fulfilled through their day-to-day actions. Not only the managers and the executives belonging to the management cadre have the responsibility of continuously trying to increase the productivity of the organisation, the other employees of the organisation also have the same responsibility.

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What is Productivity?

It will be worth-while examining in detail the meaning, implications and significance of the term "Productivity" which is usually talked of whenever either the workers are attending a course or the managers are attending a seminar. Let us examine what this term means, which has given birth to so many slogans, such as "Productivity is the key to prosperity".

Addressing a seminar organised for the trade union representatives of the Heavy Engineering

Corporation Ltd., at the Central Training Institute, Ranchi, the then Executive Director of the National Productivity Council had stated: "To produce more and more from less and less for more and more people is Productivity."

This definition appears all-pervasive and touches in depth every aspect of industrial activity. In order to raise productivity, people working in industrial organisations have to keep on finding ways and means of reducing everything that goes in the cost of production.

It will be seen, therefore, that an executive's/manager's job is primarily to increase productivity and for doing this, he has to take decision in different fields of management. The decisions in these fields which are taken by the executives determine the future course of action for the organisation over the short and long terms. Sometimes these decisions may be directed in physical and organisational areas—they may deal with financial planning, marketing, personnel as well as with the operating or production phase. More often than not decisions cut across these functional lines.

The sophistication of decision-making for a given area depends upon the level of knowledge within the area, and the complexities of the decision to be made. Sometimes the criteria and the values are clear and straight-forward, data readily obtainable, future values quite predictable and the risks fairly clear. In these instances, decision-making seems scientific, mathematical, almost automatic. But in many other cases, criteria and values are vague and often take several forms whose comparability is difficult to establish. Prediction of risk and future performance may be even more difficult. Then judgement is the device by which we can balance off conflicting values, assess risk, and finally select a course of action. At all times, however, decision-making is the attempt to choose those courses of action that have the greatest net desirability, in which attempt scientific methodology should be used to the maximum, and the judgement of the individuals to the minimum.

In order to raise productivity people working in industrial organisations have to keep on finding ways and means of reducing everything that goes in the cost of production.

Executive's Dilemma

An executive knows fully well that if he gets more time to take decision, he can take better decision, but he simultaneously knows that if he takes too long to take a decision, his decision, even though mature and taken after lot of deliberation, contemplation and studies, may not be of any use as the situation for which the decision was warranted had meanwhile changed. Therefore, the executive's dilemma is to take quick decision. The executives have, therefore, to be equipped to face this dilemma with the uptodate arsenel available in the management science.

After the noted economist, Adam Smith's book, "The Wealth of Nations" was published in the year 1776, which recognised that there existed a rationale for production, a number of people have devoted their considerable time and energy to find out ways and means to help the executives engaged in industrial management in taking decisions which will help in increasing the productivity of the organisation. Today, you come across different terms such as Management Service Group, Management Information and Control System, etc. which in fact are the outcome of vigorous studies made by a number of people who have worked in this field with the sole objective of finding out better methods through which the process of decision-making could be made simpler, easier and could be brought nearer to the optimum.

Fredrick Winslow Taylor, the father of scientific management, was convinced that management decisions could tend to be scientific

if they were based on the data which are collected about the past performance. His view was that decisions should be based on information rather than on casual judgement. Nothing should be left to the 'hunch' of the manager. It was in the beginning of the 20th century that this fact regarding decision-making was realised by the managers engaged in industrial enterprises in America, in England and in the European countries, and since then these managers and other people working in the field of management have been trying to find out ways and means of collecting information, compiling them and making them available to the executives for taking decision. Linear Programming, Queuing Theory, Operations Research, Bar Chart, PERT/CPM, Simo Chart and Simulation Techniques have, in fact, their roots in the sayings of Taylor that decisions must be based on data rather than relying upon casual judgement.

For decision-making, information is necessary. This information must be processed either by common sense or with the help of above-enumerated techniques in such a way that when they are finally put up to the executives the effort required for decision-making is reduced to the minimum. It is also essential that the processing must be fast, because as has already been pointed out the time-limit for making a decision in the industrial situation is always very short. This time-limit for processing the data and also for retrieving the data has led to the development of the field known as "Cybernatics and Systems Engineering", and the different generations of computers.

Need for Management Information and Control Systems

It will be seen, therefore, that every effort has been made and is being continuously made to devise better and better management information and control systems. It was Churchill, twice the Prime Minister of England, who had the habit of taking the dare-devil action of visiting the front lines during the war and at certain times engaging himself in collecting the information personally and ordering the course of action even at lower levels. At the close end of his life, while writing about the administrator's way of working, he says:

> "Those who are charged with the direction of supreme affairs must sit on the mountain top of control; they must never descend into the valley of direct physical and personal action."

It may not be always possible, neither advisable for the top executive and his colleagues to always sit in the ivory tower and control the affairs of the organisation from there. However, if an efficient management information system can be established, incorporating the latest management techniques and tools, it is possible for the organisational heads to control the affairs of the organisation in a better way sitting mostly in the ivory tower rather than running about different rooms and in the shop-floor interfering with the work of different people, firing people off-hand, criticising people without assigning reason and giving off-hand decision without the necessary and relevant information.

It may be argued that the distance between the top and the lower levels, if kept long, may lead to lack of motivation at the lower level. The author's experience is that in an organisation where an efficient management information system exists and where the lines of communication are not blocked, it is possible for the lower levels to communicate their achievement to the topmost level easily and efficiently, and it is simultaneously easy for the top managers to communicate their appreciation to the managers at lower level, thus generating enthusiasm and a high morale, in the lowest rung of the management cadres.

While talking about communication, it may be mentioned, one comes across people who, because of certain reasons, have developed an apathy and a distorted view regarding written communication. In my findings I have come to the conclusion that in a large organisation wherein the top executive has to deal with a number of subordinates thus increasing his span of control, written communication, used judiciously can allow him and his subordinates to function effectively. In Public Undertakings which are naturally huge in size and where every executive is accountable to the public at large and the parliament in particular, there is no escape from written communication.

While discussing about the duties and functions of the managers engaged in an industrial enterprise, it was highlighted that their primary duty is decision-making, Chester Bernard, the noted philosopher in the field of management, expresses the following view:

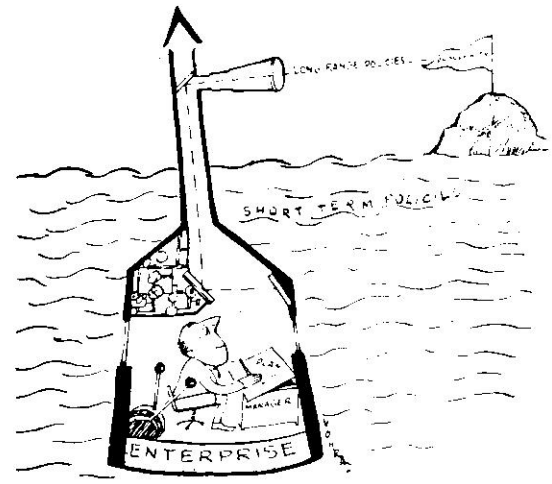
> "The fine art of executive decision consists in not deciding that are not now pertinent, in not deciding prematurely, in not making decisions that cannot be made effective and in not making decisions that others should make."

In order to be able to follow the advice of Chester Bernard, the top manager must set up an efficient information and control system in his organisation. Besides, he will also have set up departments which will use latest techniques of management, such as PERT, Linear Programming, etc. and process the data collected and present it in an understandable form to the executives. He will also have to devise methods by which the executives in his organisations are kept informed of the latest company procedures, estate rules and regulations, labour laws and enactments. He will have to devise a system by which the executives working in his organisation have the full knowledge of the areas in which they have to work, so that they do not trespass in the areas where others must make the decision. The managers who fail to keep constantly abreast of the latest information are handicapped while taking decisions in their day-to-day actions.

Today there is a human passion to collect and classify information, but although it is imperative for an industrial organisation to engage in this activity, there is a need for caution, and that is that while collecting information we must ensure fulfilment of the following condition:

The collection of right kind of facts in the proper amounts and with sense enough and experience enough to draw sound conclusions from the comparisons which these facts make possible.

We who are engaged in industrial undertakings where productivities of vital importance, information with 'validity' has to be collected.



To conclude with what John. J. Corson, a noted man in the field of management in U.S.A., has to say about the use of information in management:

> "Some years ago I saw John Barrymore play the role of a high-powered Government administrator. He portrayed the administrator as one having power and authority, who directed people unhesitatingly with short, inspired commands and in rapid succession, made momentous decisions without effort or apparent consideration. The movie created the impression that the administrator is a master-mind in a swivel chair who manages vast affairs by some congenital genius."

But is this version of the administrator an accurate one? It is accurate to indicate that during a day the man responsible for management of any unit is called upon to make decision promptly and definitely. Yet are these decisions founded upon some indefinable intuitive genius? Are they founded upon 'hunch'?

In many enterprises dependence on satistically-arrayed facts ceases and reliance upon 'hunch' commences. But there are in government, as in private enterprises, exception to this generalisation."

Gentlemen, we also must attempt to become exception to this generalisation. ●●●

Halo Effect in Personnel Assessment: A Factorial Approach

S Chatterji, Manjula Mukerjee & K P Bhattacharya*

Halo effect in supervisors' rating was investigated by designing two forms of rating scales covering five common characteristics: accuracy in work, speed of work, knowledge of job, carefulness and work organisation, and ability to work without constant supervision. Data were obtained from 43 supervisors on 62 subordinates, all performing computational work in a large organisation. High correlation was obtained ($P<.01$) between the two forms of ratings. Intercorrelations among the scores in both the forms were found to be highly significant. Centroid factor analysis for both the forms of rating shows that more than 90% of the communalities could be explained by the first factor; only one factor was found to be significant by Burt's formula and Humphrey's rule. It was observed that while rating their subordinates, the supervisors were expressing their overall impression, that is, the halo effect played its role. Some improvements are suggested to get rid of the halo effect.

SUPERVISOR'S rating is an important thing to the employee as well as to the employers. It is valuable to the employee because it regulates promotion to higher grades or increments in the service; it is of significance to the employer because its quality and accuracy promote the morale and motivation of the employee and can be of help in forming a group of satisfied and well-adjusted workers.

Proper assessment of the subordinates is a specialist's job. Moreover, when the ratee is to be assessed on the basis of separate traits, the complication of the tasks increases and special training is needed to rate accurately and independently. But most of the supervisors have to do this specialist's job occasionally, just on the basis of their experience though a high percentage of them do not go through any special training in this line.

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When a supervisor fails to observe simultaneously the weak as well as the strong points of his subordinates his rating becomes biased and he at the same time fails to place his men in proper positions where they can show better performance. This failure on the part of the supervisor is harmful both to the employee and to the employer.

At the time of rating, the supervisor is to see whether the individual concerned is properly matched to his present work or not; if he does so the next point is to decide whether he can be given more responsibility and hence promotion; if not, what are the other positions (if there is such a possibility) where he can be more appropriately placed. In order to analyse the characteristics of the worker in this way, the supervisor must rate the ratee on the basis of different traits.

The Study

It is clear from what has been already said

that though rating on different traits is rather a difficult job yet this has to be done to increase the efficiency of the rating. Therefore, the next question that crops up is whether usually the supervisors are able to discriminate the traits and to rate accordingly or not. The present study attempts to find out a means by which it may be possible to detect the existence of halo effect in rating due to which the supervisor fails to discriminate the traits and indicates the ratee to be either consistently good or bad in respect of all the traits.

Procedure

Two types of rating forms were devised: (i) a rating scale and (ii) a questionnaire, both of which covered the following five traits: (1) accuracy in work (2) speed of work (3) knowledge of job (4) carefulness and work organisation (5) ability to work without constant supervision.* In the rating scale the supervisors were to judge each worker working under them against each of the five traits mentioned above and score them out of 100. So in the rating scale, 500 was the maximum possible score that could be attained by an individual worker. In the questionnaire there were 46 statements* pertaining to all the five characteristics mentioned above. Three possible alternative responses were provided for each statement regarding the applicability of the statement to the worker under investigation: Yes (applicable), No (not applicable), and Does not arise.

In an earlier study (1) it was observed that the statements included in the questionnaire

* There were other two traits: (i) ability to learn new task and (ii) Attendance. These two traits were not considered, as the number of statements under these headings were negligible in the questionnaire.

had considerably high discriminating ability with reference to the traits covered by the rating. The distribution of statements with respect to the five traits mentioned earlier was as follows:

Table 1

Number of Statements under each of the Traits

Traits	Number of statements
1. Accuracy in work	11
2. Speed of Work	8
3. Knowledge of Job	12
4. Carefulness & Work Organisation	5
5. Ability to Work without constant supervision	10

Sample

In the present investigation, data were obtained from 43 supervisors of a large organisation. Each supervisor was requested to rate each of his subordinates twice, first by answering the questionnaire and then by assigning marks on the traits. All the workers under them were performing similar type of work. The number of workers under each supervisor varied from 1 to 7, the total number being 62.

Analysis

(*a*) *Relation between scores on rating scale and response given in the questionnaire*:

At first it was decided to investigate how far the scores on the rating scales were related to the responses given on the questionnaire. As the statements included in the questionnaire had positive discriminating ability (stated earlier), it was felt worthwhile to obtain combined scores on these traits separately by adding the responses given on the relevant questions in the questionnaire and then to correlate these scores with the corresponding rating on the five scales. The obtained correlations are presented in Table 2.

Table 2

Correlations Between the Ratings and the Total Scores Obtained from the Responses given to the Related Statements in the Questionnaire

Traits	Correlation* (N=62)
1. Accuracy in work	.76
2. Speed of work	.76
3. Knowledge of job	.74
4. Carefulness and work Organisation	.63
5. Ability to work without constant supervision	.66

*All the correlation coefficients are significant at the 5% level.

From the results presented in Table 2 it can be seen that the supervisors responded more or less consistently in both the methods of assessments. The correlations, however, varied from trait to trait. The coefficients obtained with the first three traits were high, but those for the last two traits were a bit low. It may be due to the fact that the raters might have objective proof regarding the ratees' performance with respect to these three traits and they could assess them more accurately whereas for the last two traits, as they had to use subjective judgement, the reliability of the measurement was affected and hence low correlations have been obtained.

(*b*) *Factor analysis of the ratings to investigate the halo effect if present*:

The inter-correlations among the ratings obtained on different traits were separately calculated for the questionnaire as well as for the rating scale. The values thus obtained are presented in Tables 3 and 4.

Tables 3 and 4 reveal that all the variables were highly related, i.e., there was a good degree of agreement between the ratings on any two traits. One point, however, to be pointed out here is that the values of the correlations were not so high in the case of questionnaire

Table 3

Inter-Correlations among the scores obtained on different traits on the basis of questionnaire (N=62)

	Traits	(1)	(2)	(3)	(4)	(5)
1.	Accuracy in work	—	.5191	.7039	.7803	.6754
2.	Speed of work	.5191	—	.6040	.5791	.5551
3.	Knowledge of job	.7039	.6040	—	.6962	.7714
4.	Carefulness & work organisation	.7803	.5791	.6962	—	.6862
5.	Ability to work without constant supervision	.6754	.5551	.7714	.6862	—

All the correlations were significant at the 1% level.

as those in the rating scale. In order to investigate how many common factors were underlying the measures on different traits, the two inter-correlation matrices were factorially analysed by using Centroid method. The first three factor loadings, the communalities and the amount of the total communalities explained by each of these factors are shown in Tables 5 and 6.

It is observed from Tables 5 & 6 that a high percentage (92% in case of questionnaire and 94% in case of rating scales) of total variance was explained by the first factor. The significance of the second and third factor loadings were tested by using Burt's[2] and Humphrey's[3] test of significance and the values obtained are presented in Tables 7 & 8. According to Burt's formula when more than 50% of the factor loading are less than the corresponding Critical Value, then that factor is to be considered as insignificant. Again, according to Humphrey's rule, when the product of the two highest loadings of a factor is less than $2/\sqrt{N}$ where N is the number of cases in the sample, then that factor is insignificant. Only the first factor loadings were significant according to Burt's as well as Humphrey's rule for both the questionnaire and the rating scale.

Conclusion

After factorially analysing the intercorrelations among the ratings on different traits, it can be concluded that the supervisors' responses on different traits were highly inter-

Table 4

Inter-Correlations among the scores obtained on different traits on the basis of rating scale. (N=62)

	Traits	(1)	(2)	(3)	(4)	(5)
1.	Accuracy in work	—	.8159	.7813	.6215	.8011
2.	Speed of work	.8159	—	.8523	.7010	.7648
3.	Knowledge of job	.7813	.8523	—	.7446	.7986
4.	Carefulness & work organisation	.6215	.7010	.7446	—	.6965
5.	Ability to work without constant supervision	.8011	.7648	.7986	.6965	—

All the correlations were significant at the 1% level.

is necessary. Otherwise, it is more or less useless to request the supervisors to rate the workers on different traits simultaneously. One overall assessment would be as good as the composite of several assessments on different traits under this situation. Either proper instructions regarding how to judge the workers differentially on separate traits and how to discriminate the traits etc., should be given to the supervisors, or objective data (wherever the work is measurable) should be provided along with the ratings. When such training is provided, assessment of worker with respect to traits would perhaps give better result.

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Putting a Value on Human Resources

Dr. Rensis Likert, Director ISR and an expert in the field of management behavioural theory, contends that when executives speak of people being their most valuable asset, it is double talk. "They don't know what people are worth, "he asserts.

"I've asked thousands of managers all over the world how much it would cost them to recruit and build from scratch the kind of organization they have now. They consistently estimated it in the region of three times payroll or more. "Last year, payrolls averaged about eight times net income, so you can see that the human organization, on a conservative basis, is worth 24 or 25 times a company's net income."

Dr. Likert points out that a firm could have a 10% or 20% fluctuation in the value of its human organization from year to year and never know it, "An able president who increases the productive capacity, hence the value, of his human organization by only 5% would be achieving earnings double the figure on the balance sheet. The way things stand now, his achievement would neither be recognized nor rewarded."

Dr. Likert argues that in times of economic difficulty a company would be wiser to sell its inventory, plant or real estate, than lay off staff. Companies do not normally take this course, however, because they have fo account for physical resources on the balance sheet. On the other hand, they do not have to account for the human organization, customer relations, or community reputation.

Adds Dr. Likert : "So the manager says: 'If I have to cut back, I'll cut where they aren't watching. Where they watch me, I behave myself'. He'd cut back R & D, except that top management watches R & D. If they couldn't count the cash box, he'd use cash. Managers will cut the costs in any area the company doesn't keep under surveillance."

—*International Management*, Oct. 1970,

Job Satisfaction, Morale, Productivity, Industrial Behaviour and Union Membership

Prabhakar Singh*

The behaviour of workers in industry is a fascinating subject of research. During the past thirty years, many studies have been made to investigate the various determinants of industrial behaviour, with concentration largely on single aspects: job satisfaction, morale, productivity, behaviour etc. The studies generally overlooked the role of the labour union and other extraneous variables.

A comprehensive scientific investigation appears called for due to the inconsistancy in the findings regarding the interrelation among these factors. Some of the studies report a positive correlation. The present investigation was undertaken to search out the probability of any definite correlation among the above-mentioned parameters.

Hypotheses

The main hypotheses of the investigation are:

(i) That union membership is negatively related with job satisfaction, morale, productivity and industrial behaviour; and

(ii) If extraneous variables associated with dependent variables are controlled, dependent variables will always show a definite relation.

The Sample

The study was conducted on workers of an Indian Jute Textile Mill. The company had a strength of 2433 workers. Labour-management relations of the company were very poor and resulted in frequent disturbances on different issues like wages, holidays, overtime payment, retrenchment and supervision of workers.

The sample consisted of 180 workers representing different work groups, i.e. pro-management and pro-union. For classifying the work force on the basis of their affiliation to different groups, a list of all the workers was prepared from factory records and taken to the representatives of the mangagement to elicit information about their affiliations. Likewise union officials were also contacted. A list of persons falling in each of the two categories (pro-management and pro-union) for which unanimous reports were available from the management and unions was thus prepared. In this list, age, income, marital status and incumbancy factors were also balanced. It included 30 workers (15 each) of 30 years and below in age with monthly income of Rs. 130

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The Author is thankful to Prof. Raja Ram Shastri, Vice-Chancellor, Kashi Vidyapith, Varanasi, for his kind guidance.

Table-1

Union's Effect on Satisfaction

Group	No.	Mean	S.D.	C.R.	P.
Pro-Management	90	67.24	10.20	18.97	.01
Pro-Union	90	41.95	8.00		

Table-2

Union's Effect on Morale

Group	No.	Mean	S.D.	C.R.	P.
Pro-Management	90	343.43	37.74	13.27	.01
Pro-Union	90	265.25	41.25		

Table-3

Union's Effect on Production

Production Group	Pro-Management	Pro-Union	P.
			df=2
Above Average	56	$15x^2 = 31.26$	
Average	27	15	.01
Below Average	07	60	

Table-4

Unions' Effect on Absenteeism

Absence Group	Pro-Management	Pro-Union	P.
0.25	45	27	df=2
			$x^2=7.62$
26-50 days	27	40	.05
51-75 days	18	23	

and below; 50 workers (25 each) in the age group 31-40 years with monthly income of Rs. 131-160; and 100 workers (50 each) were of 41 years and above, with monthly income of Rs. 161 and above.

The Tool

Information about workers' job satisfaction and morale were gathered with the help of different inventories. Besides, information about productivity, absenteeism and behaviour were gathered from such secondary sources as records and files of time office, supervisors, jobbers, mistries, workers personal files and other records maintained by the company. Rating scales were also used.

Result

Workers' affiliation to different industrial pressure groups, as seen in Tables 1, 2, 3, 4, 5,

Table-5

Union's Effect on Worker's Behaviour Towards Supervision and Management

Behaviour Group	Pro-Management	Pro-Union	P.
Excellent	58	23	df=2
			$x^2 = 27.58$
Fair	23	46	.01
Very Poor	09	21	

Table-6

Union's Effect on Worker's Behaviour Towards Work Fellows

Behaviour Group	Pro-Management	Pro-Union	P.
Excellent	18	44	df=2
Fair	44	39	$x^2 = 23.80$
Very Poor	28	07	.01

Table-7

Inter-Correlation among all the Parameters for Total Sample of Study

Parameters	2	3	4	5	6
1. Satisfaction	.3139	.3652	.1056*	.4510	—.2045
2. Morale		.6299	—.4430	.5050	—.4759
3. Production			—.4481	.5001	—.5351
4. Absenteeism				.4744	—.2466
5. Behaviour (Supervision & Management)					—.3275
6. Behaviour (work fellows)					1.000

*All values are significant at .05 level except this one

and 6 affects their satisfaction, morale, production, absenteeism and behaviour. Table 7 shows the existing relations among all these parameters.

Conclusion

On the basis of the foregoing tables the following conclusions could easily be drawn:

(i) Union membership has a negative relation with satisfaction, morale, production and behaviour towards supervision and management; and has a positive relation with absenteeism and behaviour towards fellow-workers.

(ii) Job satisfaction, morale and production tend to move together and have a positive relation with behaviour towards supervision and management i.e. there exists a positive relation among these parameters.

(iii) Job satisfaction, morale and production relate negatively to absenteeism and behaviour towards fellow-workers

Meaningless Work

Meaningless work is depersonalizing and constricting and it leads to boredom, apathy, anonymity and discontent. It puts the person in the position of having to reassess himself, because the job task does not clearly specify who he is; it does not evoke his own uniqueness, nor does it demand personal involvement. It neither creates nor affirms any feeling of self-esteem in the person. Meaningless work does not ask a man who he is, but only what he has.

The personal reassessment may lead unconsciously or willfully to such industrially undesirable actions as work stoppage or slowdown, pilfering, wildcat strikes, clock-watching, excessive absenteeism, labour turnover, poor job performance, and various emotional problems. Most of these "actions" can be seen as games, too, but they are antigames directed against and opposed to the established activity that can be understood as a game. Management, therefore, is apt to see these actions as rule violations of its game—in short, as cheating.

—*Management Review*, Dec. 1969, p. 12.

Why Do We Work ?

GK Shenoy*

Increasing productivity has been the concern of man from times immemorial. A factory owner, an employer, an officer or business executive naturally expects his subordinates to produce more, to create more or simply turn out more work in his own sphere. Increased turnover of work or more production means naturally more earning, more profits and more wages in the long run for the workers. Naturally, the master and the servant both should be keenly interested in increasing productivity. The community is also benefited and the nation too is the final benefactor in the form of increase in G. N. P. In this article the author analyses the forces which motivate men to work and to put in their best.

THERE was a feeling in olden days and it exists even now in many quarters that people work for money which indirectly provides them food, clothing and shelter. Yes! people do work for money. Money brings better living, status, power, and a host of other things as well. Money is everything, to a certain extent.

The Money Concept

This idea, however, is slowly losing ground. Man, it has been found out, does not live by bread alone. Money is not the only motivation according to recent researches made by a new type of scientists called social scientists or behaviourial scientists.

In fact money and extra benefits often called as fringe-benefits have a peculiar function. Their absence is likely to make workers unhappy and discontented. But there is no evidence that by themselves they make workers more productive unless other external motivation is there.

Even salary increase on an annual basis is mostly looked upon as a reward for completion of a year's service. Moreover, the increments are anticipated in advance and practically taken for granted even before they are sanctioned. Therefore an increment is not taken as an incentive to new effort.

Even sharing of profit is considered not so much as an incentive to productivity as a factor that creates loyalty especially in a big concern. The company management may look upon accumulation of profit as a direct result of productivity and may like to link profit with productivity. A human being works for money up to a certain extent—an extent determined by his own mental attitude. Beyond that he may work for something else, something higher and greater, some intangible value which is not possible to assess in terms of money alone.

According to Maslow's theory of motivation, man has various human needs which have to be satisfied to bolster up his morale. If these needs remain unfulfilled, there is danger of frustration creeping in. According to Maslow "Man is a wanting animal", and that "satisfied wants do not motivate behaviour."

The first human need is physiological, i.e. a quiet home life. The next need is economic and emotional security, by which is meant per-

*Principal, Vivekananda College, Puttur, S. Kanara (Mysore).

manency of job. Next comes social need, by which is meant companionship and social life. To satisfy esteem needs one must get recognition in society, awards and in general "a pat on the back." The final need, according to him, is the self-actualization need, by which is meant the job-satisfaction one gets by pursuing the profession of his choice in order to enable him to use his potentialities to the fullest extent.

Just as sick men cannot work, the one whose needs, as above, are not satisfied, and whose desires are thwarted is as sick as a man with rickets.

The Loyalty Theory of Work

There was also another theory which considered that the prime reason why people work was out of a sense of loyalty to either an individual, or a king, or an emperor or an organization or a companion. History is replete with instances where splendid monuments have been raised by people in memory of kings and emperors. The Pyramids might have been constructed out of loyalty to the rulers.

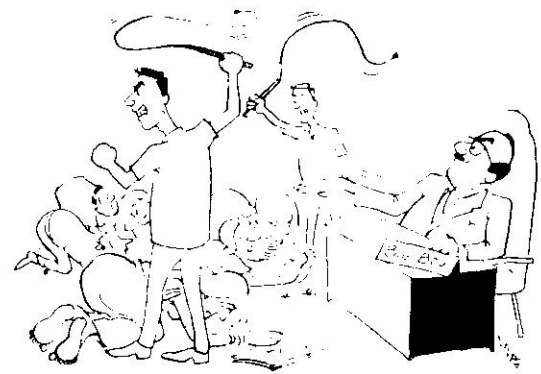
The soldier is loyal to the army and the nation. The office worker is loyal to his manager etc., etc. This theory of loyalty, of course, is true to a certain extent. The employers naturally tried to win the loyalty of the subordinates by offering fringe benefits like free meals, free transport, soft music within office, sports and games, recreational facilities etc. To some extent the loyalty of workers was won over by these methods and productivity increased. Social scientists have now come to the conclusion that incentives like more pay and recreational facilities are good to a certain extent but they do not lead automatically to an increase in productivity. These incentivies make a person like the job he has undertaken, making him stay on the job.

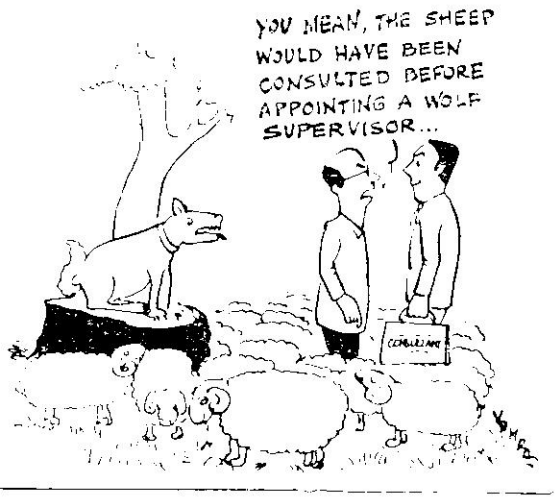
Loyalty as a motivating force has a limited appeal. Loyalty to individuals will always be the guiding factor up to a certain extent. But the modern trend is for loyalty to become impersonal. Loyalty to nation, to certain principles and ideologies are stronger than loyalty to individuals.

Therefore, the desire to be loyal is better sublimated by bringing in higher loyalties to avoid mercinary motives.

Is Coercion a Proper Method ?

Coercive methods are in the very nature of things temporary because human nature, being as it is, tries to assert itself. As an instrument of higher production, coercion or fear have ceased





to have much relevance in modern times.

Naturally a boss used to think that if the subordinate is snubbed, warned and threatened he could extract more work from him. Tongue lashing was the most common technique by which work was extracted from subordinates. As the capacity to hire and fire was in the same individual, naturally it had the desired effect of goading the workers. Of course, in medieval times violence was freely used to compel workers to put in their best. Slave labour was made to work with the whip being freely used. It is now fairly established that fear is the crudest and the worst motive for extracting work.

Where "the sword of Democles" in the form of fear is hanging over the heads of workers, initiative disappears. In such a situation, the tendency is for the worker to do just that amount of work which will not be objected.

Productivity Linked to Psychological Factors

Need for Motivation:

Social scientists have now discovered that increased production is linked to strong *motivation*. People have to be motivated psychologically which includes a feeling of responsibility, a sense of accomplishment, job satisfaction, a sense of involvement and personal participation. It is not money that is the vital motivating factor but all the above psychological factors which make an individual put in his best in his work. What are the factors aiding productivity?

Sense of Involvement:

A sense of being involved in some national or social purpose will be a good motivation. A Japanese manual worker, it is said, even when he is digging a trench works like a man under fire. What motivates him? The answer is found to be in the feeling which he entertains that he is working for the nation and not for money.

When the motivation is there in the form of nationalism, religion, good of society, a cause, there is tremendous productive capacity.

Job Suited to Aptitude:

Increased productivity is bound to result if education enables one to know one's talents and fits one into a job suitable to one's talents. How can a B.Sc. graduate with a background of scientific discipline of the laboratory find satisfaction in a job unrelated to his skills? The waste of human resources in this type of wrong placement is certainly undesirable.

When an individual feels that he has entered the profession for which he has a natural inclination, his productive capacity receives a tremendous boost. Look at the artists and writers who sit late at nights to complete their work unmindful of the pangs of hunger and sleep!

In such cases, job-satisfaction becomes the self-regenerating mechanism. Such persons become "self-starters" those who work on their own without having to be coaxed or cajoled. In this context, the importance of determining the aptitude of individuals before they decide on their profession, assumes great significance.

Participation in Decision-making:

"We only care if we share." This is not merely a simple platitude but has proved to be the most effective technique, a "gimmick" (to use an American slang) in the process of enlist-

ing the co-operation of workers in increasing productivity.

A complex organisation like a company has to take hundreds of decisions, some very simple and some momentous, for its smooth functioning, and for increasing production. Many a time, the worker who actually handles the machinery is ignored and decisions are taken at higher levels. Therefore, when such a decision is sought to be implemented, there is natural resistence and reluctance to execute ideas of others. The correct way is to associate the concerned workers in any decision-making. This would at once transform the situation and enable the worker to have a sense of involvement and even achievement.

The sense of involvement of workers in the founding, running and maintaining an institution or establishment is the *sine qua non* for increasing productivity. It has rightly been observed "Worker's participation and motivation provide psychological satisfaction that money cannot provide."

While addressing the heads of Public sector undertakings at New Delhi in July 1969, Prime Minister Mrs. Gandhi analysed the causes for the poor performance of public sector undertakings and commented that a lion's share of blame should invariably fall on "poorly motivated people," at the helm of affairs. If lack of motivation is the bane of highly paid officers, how can we expect the poor ignorant workers to be motivated?

In some industrial establishments the method of inviting "ideas" from workers has led to considerable participation and meaningful association of workers and management. Suitable rewards are given to those whose ideas are accepted and made use of. The monetary value of these awards should be commensurate with the savings involved as otherwise there is every likelihood that interest in such incentives will slowly disappear.

Sharing an idea with consequent participation in implementing the idea, naturally leads to involvement in work. The general remark that is heard among workers and subordinates is "Who cares for our ideas?" This must be avoided. An atmosphere in which every worker or subordinate feels that he too has contributed something, must prevail.

Massive Increase in Financial Status:

There is evidence to believe, on the other hand, that if there is a massive increase in the financial status of an individual by promotion or upgrading, productivity receives a good boost. Here the increase in financial status must be of such an order as to make an impact on the individual's life, and enable his friends and neighbours to notice his new status. The healthy practice of recruiting men for higher posts from the cadre of juniors is based upon psychological studies. Every factory worker who can aspire to rise to the highest position in a factory is definitely motivated.

Adam Smith, in his book *Wealth of the Nations* emphasises that self-interest is the basis of prosperity of a nation. Self-enrichment is

A sense of involvement of workers in the founding, running and maintaining an institution is the sine quo non for increasing productivity.

a powerful motive that acts as a catalytic agent, nay a compelling force in shaping an individual's destiny.

One of the methods suggested to encourage efficient workers is to grant more than one increment for meritorious services or outstanding performance. Here the element of subjectivity while granting such increments should be reduced to the minimum, as otherwise charges of partisanship and nepotism would be levied. In fact, a definite procedure may be evolved and a citation in which the extraordinary service of the concerned person might be recorded, should be circulated among others. In general, a standing committee should be formed to decide the award of such merit increments.

Productivity Related to "Climate" and "Morale":

A soldier is said to be fighting not on his belly but on his morale. What is this "morale?" It is a state of mind by which an individual develops the necessary willpower to subordinate his personal interests in favour of larger interests. It is a determination to work against all odds. In an industrial establishment, this has to be built up step by step, brick by brick, through mutual confidence between the workers and the management. If the workers feel that their interests are safe in the hands of the manager and that they will get a square deal from him, the morale of the workers is automatically built up. For this, leadership naturally has to come from the manager. In fact, the road to productivity lies through leadership, motivation, climate and morale. Napoleon, the famous general, was reported to have personally helped a group of soldiers who were carrying logs of wood, with great difficulty. Napoleon was only motivating his soldiers by his personal example. By involving himself deeply in the work of his soldiers, he identified himself with his subordinates to get the best out of them.

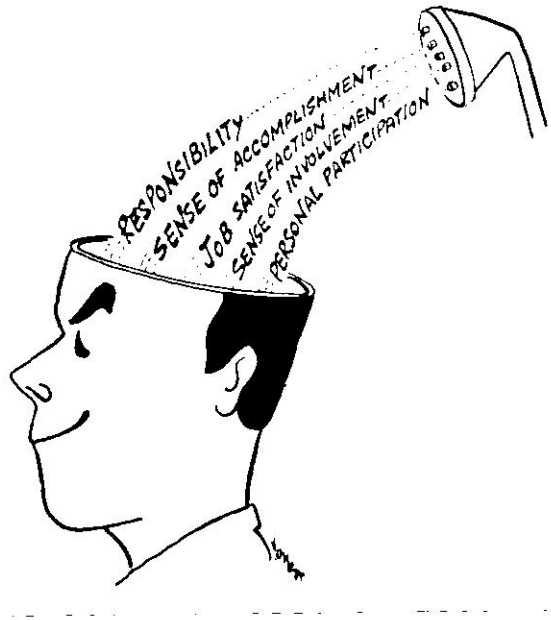
What considerations should be borne in mind in dealing with labour to build up their morale? The worker expects to be treated as a human being, needing sympathy and justice. He wants grievances to be looked into promptly and fairly. He wants a "pat on the back" whenever he goes beyond his limits of duty to do some useful work which he does of his own accord. He wants his ego to be satisfied, if not pampered. These are some of the simple ways by which morale is built up.

Motivating Forces of Indian Labour:

Unless labour force is motivated properly, productivity will not rise. Each country has to evolve her own motivating force which can give a direction to production. The Japanese miracle was not an accident. The unparelleled sucess story of Japan's post-war recovery was written only because of the self-discipline of the Japanese workers, a self-discipline which is a combination of a high sense of patriotism and a sense of hard work.

Almost similar is the case of West Germany, where the motivating force of labour is the traditional nationalism combined with an inborn sense of dignity of labour. It was only in U.S.A. that for some time money was a dominating motivating force and workers produced more with the idea of earning more. There too, a change has been noticeable and psychological factors like pride in work, job satisfaction, and sense of involvement are replacing the money-concept. The political system in Russia apparently glorifies the workers who are motivated by the sense of loyalty to the state and to the larger interest of the working class in general.

In India, with its deep background of spiritualism, diverse religious ways, many languages and social customs, the labour force will have to evolve its own motivating force consistent with its national genius. Mahatma Gandhi did, of course, bring in the concept of Sarvodaya as motivating force but his death put an end to his experiments in this direction.



Commitment from Within:

The modern social scientists have taken a long time to discover that man works from an inner conviction, "a commitment from within," another name for what our ancient Indian philosophers suggested as "Shrudha". The "Shrudha" or an abiding conviction or faith in the profession or work you have chosen is the whip, a catalytic agent, a motivation in your work. It is neither money, nor fringe benefits, promotion, job satisfaction and participation or involvement but a deep "commitment from within" which is not inborn but has to be cultivated.

The concept of "commitment" to work must be made a part of education. It is only when it is dinned into the ears of the younger generation that as a part of social obligation one has to learn this commitment that its impact will be felt a generation or two hence.

The stone carvers of Belur had such a commitment. The rock carvers of Mahabalipuram had it. The men who built the Taj-Mahal had it. The men who are cutting out that poem on the rock at Kanyakumari Rock Memorial of Swami Vivekananda are having it, in an abiding measure. The astronauts Edevin Aldrin and Neil Armstrong have that commitment from within.

Blow-up Time

If a man of 34 yells at his wife and kids and quits work abruptly, it's evidently quite normal. "The critical age—the mid-30s is the time when a man faces reality and finds that reality does not measure up to his dreams," says an employment expert at the Industrial Relations Centre of the California Institute of Technology. At least 85 percent of young men in professional positions undergo this experience, according to studies of more than 1,000 men.

—Modern Manufacturing

Induction:

For Better Use of Human Resources

RC Madan*

A planned induction programme helps the new employees to identify themselves with the organisation and its objectives. It builds confidence and promotes a sense of belonging. An induction programme is important not only from the employees' point of view, but it is equally important for the employers. It is most effective when it is properly designed and conducted. Induction process is all the more imperative for Indian workers who are comparatively less technologically oriented than their western counterparts.

AS time goes by, each specialised field in industry, viz., engineering, production, procurement, stores, sales, personnel, etc., develops improved methods to do the things scientifically. The field of personnel management in India has passed through the teething troubles, and after infancy is now entering the stage of "maturity". Induction is one of the personnel practices, which is no less important than any other practice.

International Labour Organisation has defined induction as a process of familiarising new entrants with the undertaking and with their own jobs. In other words, new entrants when they are finally selected are required to be introduced to the department and their new work. According to the Indian Institute of Personnel Management a systematic, planned introduction or induction as it is usually called, is no new fangled idea or pampering of new workers, but a scientific approach to the problems of a new worker and his integration into the factory community. Unnecessary personnel problems come up if haste and lack of sensitivity exist at early stage. The study team of National Productivity Council has reported that induction programmes are given high priority among personnel management functions in U.S.A. In India too, some of the progressive companies have recognised the need for proper induction of a new employee to his job; yet many of the concerns do not subscribe to the idea, because, they consider induction training as mere formality. They emphasise more on the immediate job assignment.

New employees, with a planned induction programme, are helped to identify themselves with the organisation and its procedures. And through this, they get to understand the significance of the work they would be doing. Proper planned induction programme is the first and primary step towards the human relations approach. This builds confidence and promotes belongingness.

It is a proven fact that the first few days in the employment life are most critical. New employees are much more concerned about their surroundings, and it becomes the responsibility

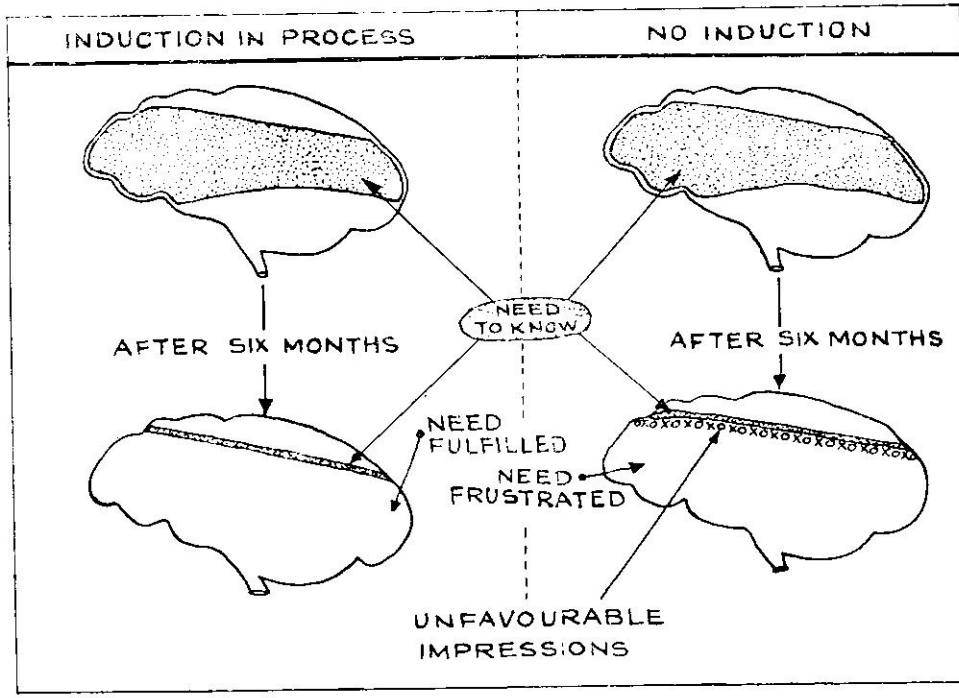
*Personnel Officer, Vardhman Spinning and General Mills, Ludhiana

of the management to fulfil the "need to know". Induction process is the scientific method to fulfil this need. Where there is no such programme, employees try to find out the information regarding "need to know" from one source or the other. The need, no doubt, is fulfilled but it may not be at the right time and in the right manner. Moreover, many of their queries may be answered in a wrong way or may remain unanswered. As a consequence, unfavourable, unavoidable and meaningless impressions may make an impact on the minds of employees. A diagrammatic representation for such a situation is given below.

Two cases are presented in the diagram. Firstly, where induction programme exists and secondly, where it does not. In the first, the "need to know" is fulfilled satisfactorily. In the second case, there is every likelihood that needs are frustrated. This frustration gives rise to unfavourable impressions which stay for long. These impressions are related with unnecessary fears and anxieties (as shown by dotted line in the diagram).

In a study of the seven units at Ghaziabad (U.P.) conducted by the author, it was observed that in practice none of the units followed any induction procedure. When the employees came to attend the interview, depending upon the curiosity, they might get to know something about the company. But on the part of management, there was no such programme, whereby the personnel selected were given any regular induction. It may be noted, that the study was conducted in small-scale engineering units only. Nevertheless, in small units, where face-to-face relationship predominates, a manager who likes and respects people may prove highly successful. In large organisations, however, good intentions are not enough; induction programmes are needed to ensure an environment conducive to productivity.

INDUCTION AND HUMAN BRAIN



Dale Yoder, in his book "Personnel Management and Industrial Relations" has described that labour turnover is heaviest in the first six months of employment. Exit interviews were conducted by the author, for employees who left within six months of their employement in two large organisations (employing approximately 1800 and 1100 employees). The respondents expressed, among others, the major reason as lack of or poorly-designed induction programme. Some of them told that they were trying for some other jobs from the very beginning. From the analysis of expressions, it was found that unfavourable impressions remained in their minds throughout the period they stayed and ultimately these impressions led them to leave.

Not only that induction programme is important from employees' point of view, but is equally important for employers. Let us look at the total expenditure, for the selection process for one post of shift-supervisor.

		Rs.
i.	Advertisement	450.00
ii.	Postage-correspondence	25.15
iii.	Trevelling Allowances to Applicants	515.00
iv.	Payment to clerical staff	220.00
v.	Various tests and interview	475.00
	Total Rs.	1685.15

If a selected employee quits, besides a loss of Rs. 1685.15, loss to production is also considerable. In case of accident, machine stops and thus is a direct loss to production as well as to the employee. The last but not the least is the situation, when the employee stays but has low morale. This situation also has a direct relationship with production.

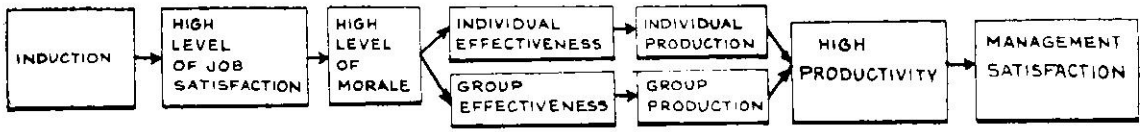
Considering the other side of the coin, when employees' duties are clearly described at the outset, misunderstandings are less likely to develop, and unfavourable situations can be avoided The diagram on page 249 will show that induction process is beneficial both to the employees and management.

Let us now look at the nature of induction programme. Planned induction should consist of a series of communications, written or through lectures to enable the individual to know the company, the job and his fellow employees. The following should be conveyed through the induction programme.

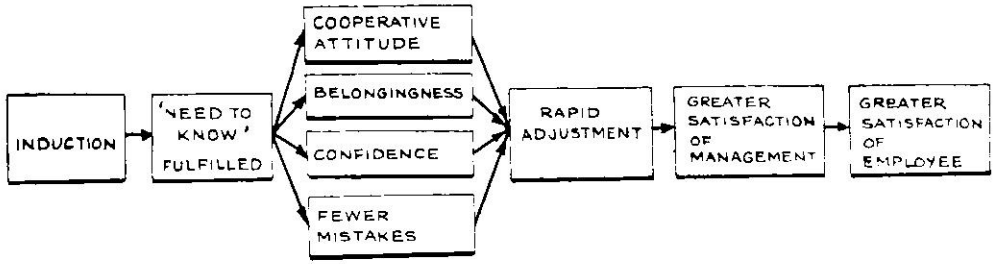
i. History, objectives, services, organisation of the company.

ii. Personnel policies and practices of the company.

New employees are much more concerned about their surroundings and it becomes the responsibility of the management to fulfil the need to know !



INDUCTION USEFUL TO MANAGEMENT



INDUCTION USEFUL TO EMPLOYEE

iii. Information of immediate concern, like: location of canteen; washplace and toilet rooms; time to break off for tiffin; what leave an employee is entitled to and how to apply for; how to get first wages and salary, etc.

iv. Information relating to job and the concerned department.

The success of the induction course depends upon the quality of the person conducting it. The inductor should be able to draw out the interest of the inductees. Therefore, care must be taken in the selection of the inductor.

Introduction to the company, the department and the job can be carried out quite informally by an individual in small organisations, whereas, in the larger organisations, a formal course of induction is necessary. Besides personal contacts, written media, and displays through audio-visual aids, are useful in the induction process.

Induction is a continuous phenomenon, which needs to be imparted from time to time. Reorientation is important at the time of promotions, transfers, technological changes, etc.

Induction programme is an essential phase of personnel management. It is most effective when it is properly designed and conducted. Induction process is more needed for Indian workers who are comparatively less technologically oriented than their western counterparts. Personnel departments of various companies in our country, should, therefore, start inducing new employees, as well as employees already in employment to make best use of human resources in industry.

The let oneself be bound by a duty from the moment you see it approaching is a part of the integrity that alone justifies responsibility.

—Dag Hammarskjold

Labour:

'The Sensitive Creature'

PS Ahluwalia*

Labour is perhaps the most important productive factor in industrial production. And they are sensitive because they are human beings. More often one finds labour in revolt. Why is it so? The question needs a careful study. No doubt there has been marked change in the labour-management relations during the last three decades particularly after attainment of independence. Yet, one does not notice a significant change in the labour's outlook. One still hears about strikes, *gheraos*, etc. The author identifies the problems and suggests certain measures for bringing about better understanding between management and labour.

YES ! Labour is a very sensitive group amongst all the animate things, contrary to the earlier belief that labour is a commodity, a bargaining item which could be traded in the market.

In the early thirties, a *Bara Sahib* used to have the privilege of hitting the labour like a basketball and labour's colleagues had the audacity and impertinence of watching the fun and even praising the *Bara Sahib* if his aim was found to be perfect.

During that period of industrial change, at least machines were better cared for than the workers, since the latter could be replaced easily when they were worn out but the machines were more difficult to obtain. It became the fiction of the time that the employer had *not bought* the worker *but merely hired* his labour so that worker's health and living conditions were not his concern.

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In recent times, industry has changed in many respects from the early days of the industrial revolution and industrial labour has figured much more in the news of the world today and more so in India—probably due to their typical behaviour. Certain managing bodies had taught their employees that work is a painful and unpleasant necessity, but employees are now distressed that they believed them. So employees are launching a crusade against the so-called 'haves'—even resorting to brutal methods—for achieving a better lot in life.

Strike for anything has become a fashion and a hobby for many, not only in underdeveloped countries like India but even in advanced countries. After U.S.A., Britain was in the news for the biggest strike of postal employees, a death blow to the economy which was considered to be the result of another confrontation between working class and managing class.

In India, as against *gheraos* and other inhuman methods adopted by the agitated labour class, the teachers (respectable class) in one

of our States had gone on strike because they were not paid salaries for eight consecutive months. We still expected them to survive. (Provocative attitude of managing bodies.)

Recently, I saw an old frail human figure along with his family members on hunger strike because he had not been paid the provident fund (life long savings) by his employer (a believer of live and let live philosophy) after his retirement. He was branded as a crack (he wants to live and not to die silently against his old age for asking such dues) teaching others to adopt unmannerly agitational approach. We also read recently that a manager of a factory was stabbed to death outside the works in a scuffle between the striking class and management.

All this indicates that the labour force is in the process of revolt. So, the question is asked often: Is it so? Then, why? Why this revengeful attitude? What wrong have we (ruling class) done? and so on. But no one probes seriously "What is wrong with the conditions under which these people are acting"?

The industrial labour movement in India took shape in the year 1877, when the first wage rate protest at the Empress Mill, Nagpur, was witnessed. This was a humble beginning and what seemed a simple protest was the beginning of an industrial revolution.

The last 30 years or so have seen rapid and marked changes in the mechanics of playing with labour and manufacturing processes due to complexity, speed and character of technological change and interdependence between the sciences of human behaviour and engineering. The assumption that laws of nature and properties of material will not suddenly be different tomorrow from what it was yesterday has been proved to be incorrect as the years passed by.

Against this background, I am of the opinion, we cannot understand the attitudes of either management or workers unless they are seen in their historical context, unless the past is revealed (an unpleasant necessity) and unless we realize that much that has been regarded as 'human nature' is, in fact, purely the product of a particular culture at a particular stage of development. It will be really worthwhile to peep into the forgetable past and see the plight of industrial labour and the trade unions prevailing before and after the Independence era, with perhaps some glimpse into the future.

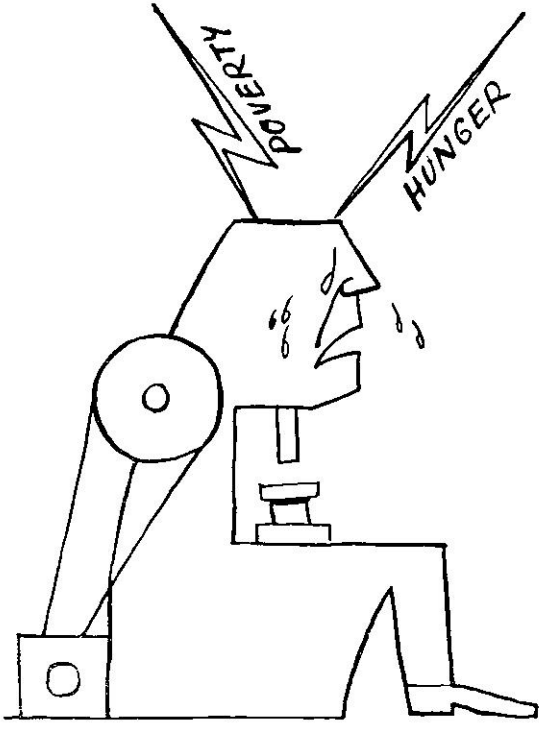
Strike for anything has become a fashion and a hobby for many, not only in developing countries like India but even in advanced countries.

Pre-Independence Period

It was the dark period of suppression of labour. Those dealing with supply of labour were having flourishing trade. Those were the days of *Bara Sahibs* whose attitude was in no way better than the treatment being meted out to *Harijans* by the upper class. Physical ill-treatment, like kicking and slapping the workers on the shopfloor was not uncommon and use of abusive language was a daily affair. Poverty was described as 'God's providence' and low status, the result of birth in a poor class. The concept of dignity of labour and recognition of their social needs were invariably unknown. An ideal factory used to be fashioned like a model cow-shed, the milch cows of which were, of course, the industrial workers.

Industrial labour was regarded as an operating mechanism and human body a machine, capable of a certain amount of output, to which the mind is somehow attached to have a sense of fear of miseries and starvation. Happiness —real happiness was a thing to come.

No trade union was in existence during this period. The orientation of unions was generally as follows:



Human body is a machine with a mind to think

Politically-based Unions :

They were mostly influenced by outsiders and their activities were motivated mostly for national independence movement. Labour uplift was not their ultimate motto, but political freedom was the primary goal. Nationalist discontentment against the British rule, rather than labour welfare, led to the formation of these unions. Such unions could organise many countrywide labour strikes, paralysing the working machinery of *Angrez Raj*, as was the famous railwaymen's strike.

Stereotyped or Pauper Unions :

Such unions used to have a '*ma-bap*' relationship with the officials, thus having official recognition and were an instrument or a tool in the hands of Britishers for achieving their predetermined objectives. The leaders of such unions were, no doubt, from the working class but they were made to do the work of "stool pigeon." The workforce had no sense of belongingness and no feeling of togetherness for the national cause. The common thought used to be: why work if the Britishers reap the harvest while we are only paid subsistence allowance in the form of '*Baksheesh*'. Upper echelons of industrialists used to believe in the old adage: "Even an idiot knows that the labour class must be kept poor or he will never be industrialist."

Post-Independence Period

On August 15, 1947, India attained *Swaraj*. The administration of India came into the hands of Indians, who had struggled as one man for this day for about a century. History is replete with sacrifices made by them.

We had a dream that all our past miseries of nearly two centuries would now be over. We took a vow of having a socialistic State where all will have two square meals to eat, a roof on their head, and work for every two hands; there would be no difference between man and man and a person will be judged on the basis of his work and not by his religion, state, caste, or creed. We embarked upon the construction of gigantic industrial complexes, so that every able-bodied person would gain appropriate employment. We got convinced that there was the need on the part of the labouring class to work together as one soul effectively and harmoniously. Government officials, educators and others were expected to contribute their bit towards this challenging task of giving India a facelift.

We started recognising the dignity of labour and the educated class (white collar strata) started replacing the illiterate working labour in managing the affairs of industries.

But with all this tall talk and evangelical preachings for the last two decades, I would not be doing justice to the readers if I fail to mention that there is no significant change in the labour's outlook. Why is it so? Because we could not give a practical shape (even though we fully realize the value of it) to the importance of human forces, i. e. the one who is to manage and the other

who is to be managed; or the one who is to exercise authority and the other who is to obey.

We have been witnessing the alarming industrial unrest and strife in the industrial scene during the past two years, which has thrown all the known principles and norms of the so-called industrial relations, managerial ideology and human engineering in the gutter. Wilful insubordination and other disturbing factors like coercive techniques in the form of *gherao* for achieving set and rigid objectives by labour have further worsened the already strained management-labour relations.

We are spending more time and efforts in developing machines and things like that than trying to understand and develop our workers, who are animate and the most precious capital resource of an industrial society. A recalcitrant worker is more harmful than a faulty machine in an industrial complex.

The concept of promoting multiple trade unions under one roof to the advantage of management is still popular and the mushroom growth and multiplicity of small unions has, in fact, created more distrust and disharmony. Up to 1953, nearly 2,700 registered unions were counted with a claimed membership of 3,34,000. The position will now be different. Group factionalism, rivalries and polemics among the unions and their instability are coming in the way of human relations because each union is hacking its way through in its own direction and landing in the jungle of chaos. A cursory look at the procedure of granting recognition to representative unions of the working class convinces us that the policies formulated and the methods adopted are of hoodwinking nature based on vested interest; they need to be overhauled, from top to bottom.

I make no apology in saying that most of the representative unions of industrial workers have no real backing of the workers, with the result that they are hardly effective in motivating the workers for implementing the agreements reached with the management. Workers always feel that their union leaders are in league with the management, with the result that such people

Persuasion and consent can replace coercion

expend more energies in attempting to defeat managements' objectives than they would in achieving them.

The public are much concerned about this industrial warfare and hope for a truce or perhaps a lasting peace. Voluminous reports have been published by various committees of eminent persons on this subject, most of which went into cold storage; few which were accepted were not implemented. My suggestion is for a simplified solution for the cure of these so-called perpetual ills, by defining the end and viewing the beginning and then joining these two known points by the shortest path to avoid surprises at the end.

Role of Trade Unions

Our pride should not hurt us simply because, in course of time, the hideously underrewarded masses organised themselves into trade unions to demand their rightful share and having discovered their power, they have reached a stage where each group is able to demand, and with menaces to obtain a greater share than it is in their own long-term interest to obtain.

A tradesman, in this present age, has basic loyalty to his profession, then to his firm or employer and lastly to the trade union. It is the conflict of these loyalties which has created problems for the serious-minded individuals.

The prime responsibility of a trade union is constant whether in the year 1877 or 1971, being to defend and advance the interest of worker-members. Its democracy is a basic characteristic because ultimate power of membership is decisive. The structure of a trade union should be such as can adjust to circumstances while retaining its essential features.

Trade unions do not complain that most managers see their primary responsibility to operate the enterprise as efficiently as possible. Their complaint is that their own actions are often judged according to completely inappropriate criteria. As no director will like to tell the shareholders that the bankruptcy is due to his interest for employees, similarly no union should be condemned because it refuses to subordinate its members' interest.

Trade unionists are as conscious of the national interest as any other group of citizens, and educated workers should be encouraged to accept gladly the leadership of elected unions. There should not be any repressive measures against these leaders.

Training in principles, objectives and system of effective working of trade unions should be given to all the elected labour leaders by the Central Labour Institute, fully supported by the Government, so that unions can function in a methodical way and also be able to develop trade union consciousness among the working class.

Recognition Procedure

The procedure should be such that it looks fair in the eyes of others. The bona fides of certified unions with whom the management should bargain in good faith can be established only through fair, secret ballot elections. There is a fear that reactionary elements may take advantage of such elections and come in power. But the results of the last general elections should act as an eye opener to those who still cling to such views. We saw the politieal parties having heterogeneous views grouping together and winning the elections, but they soon started crumbling down like a house of cards as they could not deliver the goods to the masses at large. If such a grave risk can be taken for the formation of a Government of the country, then why don't we give a fair trial by conducting elections on the same pattern for the formation of the unions in the industries too? Once the results are declared and the union formed, no defection or toppling over cliques should be allowed. The elected representatives of the union should be allowed to operate for at least 3 years. No outsider should be allowed to stand for elections.

It may be noted that with the establishment of popular and trusted unions, the workers would turn to their leader rather than to the supervisor in seeking decisions which affect their welfare and this would be a good aid for increasing production because the supervisor would be able to devote more time to concentrate on technical problems than on what he is now engaged in. Also, such elected unions will lose militancy attitude and will become business like, thus helping a great deal in labour-management harmony.

Industrial Truce

The prime requisite without which industrial order is getting degenerated into anarchy is industrial discipline. When we turn to the field of management, we soon discover that attempts are still being made to base discipline on bribes and threats, the carrot or the stick. But it is becoming increasingly evident that these sanctions are no longer as effective as they once were.

The reason for this change is apparent and Government should play a major role in motivating the habits of the working class, and, once the sense of belongingness is inculcated, discipline will improve and truce will last. It is said that a day's token strike by Central Government employees will cost the nation Rs. 3.5 crores, apart from hardships to nearly 62 lakh passengers who are carried daily by nearly 57,000 trains. The strike will also dislocate the handling of nearly 15 crore letters, 1.2 lakh telegrams and 3 lakh trunk calls. These figures are a mere reflection of the price the nation has to pay, whenever industrial truce is disturbed.

Labour-Members in Managing Bodies

Tenants sometimes feel, "What is there to live for in a house where you can't drive a nail into the wall or undertake the tiniest improvement!" So is the labour's feeling if treated like a tenant.

Labour participation in management will induce the process of collective bargaining for settling disputes. The present internecine will also get minimised because the dispute will be discussed around the conference table and not in the playground.

Short-term contract will cease to exist, which, the moment it is signed, invariably brings up new issues, thus affecting the whole atmosphere. Fine words buttress no partnership but if the theme of workers' participation is accepted, coercion and submission would be replaced by persuasion and consent. 'Bargaining' of unhealthy type will be replaced by 'Productivity bargaining' which will make a new breakthrough in industrial efficiency and industrial relations.

Concept of 'progress,' i.e., profits to few and hardships to many, will mean differently because labour will look into such problems of profit sharing as the management would, were they in management's shoes.

The Pay Envelope

Psychologically, everyone dreams of a bigger pay envelope. It is a usual fear that the employer wants to pay as little as possible and extract as much work as he can, whereas the workers seek maximum wage at maximum efforts, even though both beat the drum on the principle of "fair wage for a fair day's work." This wage imbalance, or the cry of increased dearness allowance or compensatory allowance, is directly coupled with the market rates of the commodities of daily use. So, why not strike at the root of the problem by arresting the increase in the price of commodities of daily necessities? Should it be treated as a difficult problem? Many countries have succeeded in doing so. Deterrent punishment meted out to black-marketeers, unscrupulous traders and those dealing with spurious goods could put things right; otherwise, the cry of bigger pay envelope will bend the back of industrialists, and a bare living wage will torture the soul of workers.

Industrial Research

Whatever is applicable to the west will not necessarily be applicable to the east and for this reason industrial research on Indian workers and industries is of paramount importance and should be taken up on a war-footing.

The existing uncertainty and confusion about the understanding of union-management relations underlines the need for basic research on a national, regional, as well as community basis, designed to provide objective data, which can reveal the essential nature and sources of good and bad labour relations in local plants, regional areas throughout Indian industries, backed by further experimentation in order to reinforce and expand generalisations or principles derived from research.

More *Swadeshi* research is also needed on the factors involved in the establishment of a "working harmony"—a psychological atmosphere where the management and the union, in the organised plant can get on with the job of producing more goods building job satisfaction, creating high morale and maintaining industrial stability.

The Challenge of Change

We should realise that it is a time of action and not of slogans as our stakes are high and targets difficult. The threat of foreign invasion is by no means unreal today. Our *jawans* have given ample proof of their worthiness and in order to sustain their efforts we should be technologically and economically strong, the success of which depends upon an enlightened approach towards the working class.

Here lies the challenge of change, the need for systematic, meaningful and productive approach to the future, the need to bury cherished but outmoded habits under the new challenge of industrial stability wherein the cost will be enormous if the social aspects of technological progress are ignored. ●●●

Low-Cost Automation for Export Production

OP Jain*

The Fourth Five-Year Plan (1969-74) has set an annual export target at Rs. 1900 crores in 1973-74, compared to the actual export figures of Rs. 1300-1400 crores in 1969-70. In order that the prescribed increased rate of 7% in annual exports from the country is satisfactorily achieved during the Plan period, export efforts will need to be broad-based and also by achieving international competitiveness in price and quality. Broadening of export base implies the increasing participation of all the economic sectors and the production units of each sector in export business. Such a participation is, undoubtedly, to be limited to the production of quality goods at competitive costs.

At present, only a limited number of production units actively participate in exports. Very few units in the small scale sector are reported to be exporting an appreciable portion of their production. The small and medium industrial units have considerable potential to produce for export, but are reported to be inhibited from doing so because of their high costs of production and less than satisfactory quality of their manufacturers.

Some devices are, therefore, to be selected and adopted by these units to reduce their costs of production and to improve quality of their products. Low-cost automation is suggested to be a device for improving the productivity and increasing the competitive strength of small scale industries' products.

LOW-cost automation, as it is understood under certain production conditions, connotes the adoption of certain automatic devices and the introduction of certain automatic equipment as attachment to the existing machines, which tend to reduce human interference in manipulation and control of machines. In other words, it substitutes application and exercise of certain human attributes by automatic devices. In general terms, it is described to be a state of mind and discipline wherein one proceeds to arrive at a higher degree of technological level of operations through a step by step manner. It seeks to build around a system as against to replace a system; that is, an old but usable equipment is not treated as a junk merely because a contraption has been/can be built around it but a contraption is built to supplement the old capability of the existing machine.

Low-cost automation needs to be distinguished from automation in general, mostly by the fact that it is low cost, implying thereby that it strives to delegate those human attributes to a machine which a particular business or factory needs most. It seeks to introduce only that system which the business or factory needs, not more or less, in view of the market prospects of its products. It needs also to be distinguished from mechanisation. Mechanisation reduces physical efforts but the operator is still required

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to control the machine. Automation replaces both the operator's mental and physical efforts.

In Operation

Low cost automation is introduced to improve the operation of a factory in terms of its output, cost of production or quality of product. It proceeds with the identification of the 'centering' aspect of manufacturing operations which, when replaced by supplemented with an automatic device, will enhance the productivity of the industry, increase output and reduce production costs by eliminating wastage. The automatic devices are added to the existing machine to eliminate or reduce to a minimum human action in producing goods in such fields as receiving information, decision making, remembering, acting, exerting forces and controling. The automatic devices seek to perform some or all of these activities either singly or simultaneously.

The more popular among the automatic devices or components added to the existing machines are the standard pneumatic equipment and electric equipment. Standard pneumatic equipment includes energy convectors: pumps and compressors, motors, cylinders, pressure intensifiers; controllers; directional control valves, check valves, pressure control valves, shut-off valves; and auxiliary equipment; flow lines and connections, reservoirs, filters, lubricators, heat exchangers, and mufflers. Electric equipment comprises energy convectors, electric motors, pull (or push) electro-magnet, rotary solenoids, controllers, limit switches, various types of relays such as latch stays, time delay relays, overload relays, etc, timers (synchronous motor, bi-metal, clock, fluids, etc.), programming units or logic blocks, and pressure switches. Application of these types of automatic equipment are not entirely unknown to the small and medium scale units. It will, however, be proper to emphasise the functions which these equipment can perform to increase productivity through high speed of action and improved quality through imparting necessary precision and fineness to the ultimate product.

A mechanical latch or a trigger can "feel" if a product is already at a certain location and also ascertain, subject to certain limitations, if all the products conform to a certain shape or size. A float can determine if the liquid level is at a certain point and can relay the amount of viscosity of the liquid to a mechanical drag.

Low-cost automation is advocated for reducing production costs and improving quality of the product in the small and medium sectors of Industry.

A mechanical limit switch or mechanical trigger gets its information from the touch of physical stimulus which activates an electrical switch and which completes an electrical circuit and releases a mechanical linkage. A thermo-device can, because of the heat, expand its content to "pressurize" a switching diaphragm or a closing valve. An electronic eye can "see" if a material has passed a certain point and can "know" if the size of a piece is large enough or if that piece is smooth enough. It can give information on the colour and attributes of a product.

The above are a few instances of automatic devices which can be pressed to task under low cost automation by a small scale unit at a very little cost for increasing its productivity. Similar instances can be given of suitable automatic equipment or devices which can replace human attributes to a large extent in other fields of activities mentioned above. The main consideration in selecting the specific equipment or device is the cost factor in view of the specific purpose it is to serve. The guiding principle is that one may not spend more on an addition of a device than what he expects to receive in return. According to one source of information on the subject, automation can best be described as low cost if the total cost of the components in each application is under £ 2000 at the present

prices and if there is reasonable chance of recovery of this capital outlay through increased productivity in about a year. Such a time estimate may not be true under all circumstances, but it emphasises the need for working out the direct and indirect cost of adding or supplementing a specific automatic device to the existing machine and the profit to be realised therefrom over a period of time.

Economic Aspects

The two important economic aspects of low cost automation are :

(i) likelihood of displacement of human labour; and

(ii) possibilities of reduction in costs.

Manufacturing on a small scale is generally associated with the labour intensity of operations and, therefore, the provision of large employment opportunities. It is, therefore, feared that automation of the whole or a part of small scale manufacturing, irrespective of the capital cost involved therein, might lead to displacement of human labour. It is true that there will be a certain degree of reduction in human labour employed on the centering part of the manufacturing processes as a result of the introduction of low-cost automation, but the increase in quantity and efficiency of total production is expected to generate more employment opportunities for people having varied skills and experiences at different levels of production. This observation emanates from the argument that changes in aggregate employment are governed by the growth in aggregate demand for goods and services and the growth in the labour force, as a result of the growth in output per manhour. Expectations of greater employment avenues in the small scale sector in consequence of introduction of low cost automation can be realised if such an automation is properly phased out and confined to such a part which is very crucial from the viewpoint of increase in total output and productivity.

Introduction of low-cost automation can lead to reduction in costs of labour, materials and overhead items of expenditure and thereby ensure cost competitiveness particularly in international markets. Reduction in labour cost can be achieved through increase in output per worker and the use of less skilled labour, with the same or better results. It is, however, to be noted that before any automatic device is added to an existing machine for cost reduction, it is to be made sure that the existing output rate cannot be stepped up through other techniques of production planning.

In case an introduction of automatic device is considered to be inevitable, the human skill deficiency at the 'centering' part of the manufacturing operation will be made up and greater confidence and speed will be generated with the consequent increase in overall output per person. Further, an automatic device at such a point will reduce the need for skilled labour with the resultant saving in small tools and hence reduction in labour cost per unit of output.

Low-cost automation is expected to reduce material cost through the use of lesser quantities of material for a product, the use of cheaper materials and/or the reduction in scraps. It is possible that a unit may be using more material than necessary per unit of output because operators might not be so skilled as to apply the proper quantities of all the necessary raw materials. In certain cases, these operators may be using certain materials which, though not the ingredients of the final product, have to be used for making production possible. One certain instance of such materials is fuels used to soften a piece of metal in order to make it workable. At other times, a unit may be using more raw materials because its plant cannot operate on a smaller production level necessary to meet the given volume of demand. In case, an automatic device or equipment can regulate the speed of plant operations to the desired level of production, material usage will be reduced with a consequent economy in material cost. In case labour cost is reduced through an automatic device or equipment, it is possible to use scraps which might be resulting from wrong operations or some physical necessity of starting with more raw material than is required for the end-products.

Similarly, overhead costs can also be economised as a result of the introduction of low-cost automation, in more than one form. With the reduction in number of direct employees proportionate to the total output, a part of the cost on supervisory labour will be saved. Further, as the operational specifications will be strictly followed, there is likely to be the saving in maintenance costs of machines in critical areas. Tool expenses are also likely to be saved. There may be slight increase in overhead costs due to more strict scheduling and demand for new device or equipment to be produced. But the savings in costs on different accounts will be larger than the increase in capital costs following the introduction of low-cost automation.

Introduction of low-cost automation can lead to reduction in costs of labour, materials and overheads and thereby ensure cost competitiveness, particularly in international markets.

Selective Approach

It may be gathered by now that the introduction of low-cost automation envisages a substantial degree of advance in mechanisation. As such, it is to be encouraged in the progressive sector of small scale industries producing quality and precision products for export in particular. As mechanisation progresses in small scale sector, either through substituting dominantly manual by mechanical operations or through replacing obsolete by modern machinery or both, the scope for low-cost automation will increase. In other words, the techniques of low-cost automation for stepping up productivity in the small scale sector will have to be introduced on a selective basis and in a phased manner.

Low-cost automation should, in the first phase, be introduced in such small exporting industries as manufacture precision goods like scientific instruments, electrical measuring instruments, etc. In these industries, there is urgent need to improve the competitiveness of individual units through cost reduction and quality standards.

In the second phase, low cost automation can be introduced in exporting industries producing products such as sewing machines, bicycle, electronic components, sophisticated plastic goods, etc. The products of these industries have already entered the export markets and can make much greater headway in such markets in case their products are price and quality competitive. Since these industries have originally been structured to meet domestic demand for their products, they need manufacturing adaptions/innovations for attaining the needed competitiveness through low-cost automation.

Essential Steps

Propagation of low-cost automation in the export-oriented industries in the small scale sector is a two-fold task. Firstly, cost benefits relationship of this technique are to be worked out on the basis of necessary technical data and economic facts so that the results are substantial to induce and apprise enterprises of selected industries about the desirability of the technique. Secondly, certain institutional facilities are to be provided at different levels for facilitating adoption of low cost automation by competent enterprises of selected industries. An integrated approach is, therefore, necessary to accomplish the two-fold task so that the maximum benefit accrues in the desired direction.

Working groups have been set up and are expected to be set up in future for study of mechanisation/or modernisation of small scale industries in general and the selected industries in particular. These groups can as well study the possibilities of introducing low-cost automation in the selected industries and also determine the criteria of selection of individual enterprises for the purpose. The selection criteria can be the

export prospects of their products, export capabilities of the enterprises, etc. Alternatively, a separate working group can be set up for selection of small exporting industries which can ensure maximum benefits of low-cost automation in terms of cost reduction and quality improvement. Such a group can as well work out a phased programme for the purpose, in terms of the number of enterprises and products to be covered under it.

Both the aspects of the task can be tackled simultaneously on an institutional basis. A properly staffed institution is absolutely necessary for working out economics of low-cost automation to convince the selected enterprises about the benefits of this technique and also to render counselling services to the selected enterprises on a continuous basis. In U.K., the Ministry of Technology, in collaboration with the Paisley College of Technology, has set up a Centre to provide the advisory services and instructional facilities for encouraging industrial companies, particularly small ones, to make greater use of existing low-cost automatic control equipment and automatic techniques.

Low-cost automation is a specialised engineering job. It entails:

(i) localisation of the need to automate for the reason that other principles of production techniques cannot help to achieve the objective;

(ii) application of value analysis for an efficient identification of unnecessary cost, i.e. cost which provides neither quality nor use;

(iii) determination of element/elements of the job which really merits the application of low-cost automation;

(iv) designing of the automatic device to ensure optimum combination of safety, cost economy and operational efficiency; and

(v) experimentation with the designed device in a laboratory.

It shows that a person entrusted with the job of low-cost automation will need to have inter-disciplinary knowledge and expertise, which a small manufacturer cannot afford to employ on his own. That is why, an institutional arrangement is necessary for executing the programme in view. Such an arrangement can be an additional responsibility of an agency already engaged in improving the production and raising the productivity in the small scale sector. The agency like this can be provided by the Small Scale Industries Development Organisation (SSIDO), in the manner that the University of Philippines Institute for Small Scale Industries has set up a Centre for the purpose. The proposed Centre in the SSIDO can, besides rendering counselling, impart training in low-cost automation to the operators of selected enterprises in a phased manner. The ECAFE Secretariat has already decided in persuance of a proposal made by the 9th Working Party of Small Scale Industries to organise a Roving Seminar on low-cost automation for demonstration and practical training of industries and expansion of workers in the ECAFE region.

Summary

Low-cost automation is not to be confused with automation in general, on the one hand, and mechanisation on the other. It is advocated for reducing production costs and improving product quality in the small and medium sectors of the industry. In view of the need to step up exports of small industries' products during the Fourth Five-Year Plan period, a programme of low cost automation should be formulated and employed on a selective basis and in a phased manner. Export-oriented industries, which are essentially mechanised are the best-suited for introduction of low cost automation. Since low-cost automation requires an inter-disciplinary expertise, the programme will need to be propagated vigorously by setting up a Working Group to formulate it in all its details and by establishing a Low-Cost Automation Centre, preferably within the SSIDO. The proposed Centre will organise training and render counselling in methods and practices of low-cost automation for the benefit of operators in small industries sector.

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Export Incentives: Need for Measuring Impact

Dr P Chattopadhyay*

Providing incentives to exports is a common phenomenon both in the developed and underdeveloped countries. Export incentives aim at encouraging the exporters towards boosting their exports by making exports competitive. India too has various schemes of export incentives. According to the author, these schemes are complicated and have not been able to make as much an impact as perhaps the Government intended. While giving greater emphasis to non-traditional exports, the importance of our traditional exports should not be ignored and subjected to certain disincentives. Administration of incentive schemes by various agencies has been one of the weakest links in the chain. The need is for a positive thinking for creating the right atmosphere in which exporters are genuinely motivated to boost exports. Exporters have to be convinced that exports can be made economically viable.

EXPORT incentives in India have been introduced with several purposes. The major objectives of incentives are to activate the exporters towards boosting their exports through the creation of a climate in which the exporters may feel that the export effort is worthwhile; secondly, incentives have been designed to compensate the exporters for the losses suffered by them in exports; thirdly, incentives aim at creating an adequate infrastructure for exports so that the hurdles that come in the way on this account are removed; fourthly, by removing disincentives the exporters would be encouraged to put in greater effort for boosting exports; and, last but not the least, to help the exporters to organise for greater utilisation of production capacity through import of plant and machinery, intermediate goods and raw materials.

Incentives are quite common among the exporters from different countries of both the developed and underdeveloped world. To match these incentives of competitors from other countries, the Government of India have also devised some incentives tending to put the Indian exporters on the same footing as those of other countries. Incentives have in view a reduction in prices of the export products in various ways so that Indian export products can meet the keen competition abroad on grounds of prices. How far the incentives have been able to motivate the exporters and how costly they have been are matters that require some consideration in view of the indifferent movements in exports from year to year and from commodity to commodity.

The incentive schemes formulated by the Government are complicated and require a sensitive administrative set up which does not seem to have been there yet, in spite of the intentions of the Government. Instead, what has actually been done is to proliferate the agencies of the Government in many different fields

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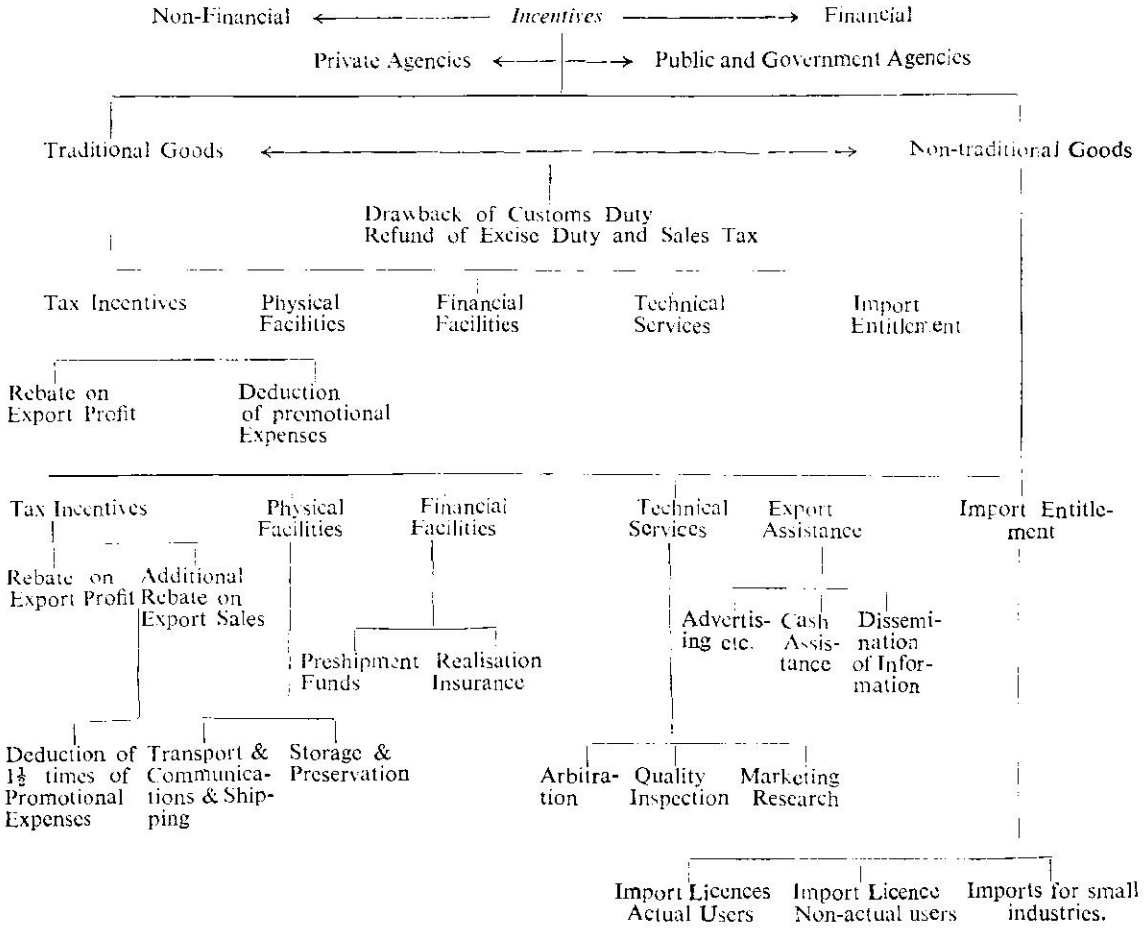
Chart 1


Non-Financial
Incentives
Financial
Private Agencies
Public and Government Agencies
Traditional Goods
Non-traditional Goods
Drawback of Customs Duty
Refund of Excise Duty and Sales Tax
Tax Incentives
Physical Facilities
Financial Facilities
Technical Services
Import Entitlement
Rebate on Export Profit
Deduction of promotional Expenses
Tax Incentives
Physical Facilities
Financial Facilities
Technical Services
Export Assistance
Import Entitlement
Rebate on Export Profit
Additional Rebate on Export Sales
Preshipment Funds
Realisation Insurance
Advertising etc.
Cash Assistance
Dissemination of Information
Deduction of 1½ times of Promotional Expenses
Transport & Communications & Shipping
Storage & Preservation
Arbitration
Quality Inspection
Marketing Research
Import Licences Actual Users
Import Licence Non-actual users
Imports for small industries.

connected with the export effort and in the process causing a heavy drainage of resources.

Types of Incentives

The types of incentive schemes formulated by the Government of India have various purposes in view. The schemes make a distinction between traditional and non-traditional items corresponding to the increasing need for promotion of non-traditional goods. Chart I shows the different types of incentives relevant for traditional and non-traditional goods.

Removal of disincentives is manifest in the desire of the Government to simplify the procedures and to simplify the export documents, reduction in the time taken at the ports, discounting facilities with the banks for quicker realisation of export proceeds, priorities given to exporters in various matters and the export performance awards to exporters of various products and commodities and recognition of manufacturer-exporters as export houses when their exports have exceeded a certain specified amount for traditional and non-traditional export items. Recognition is granted when they have satisfied specified conditions. This entitles them to certain advantages.

Promotional Incentives

Promotional incentives given by the Government of India are based on the idea that the items that are exported from India should be more in number and diversified in character. Traditionally, India has been an exporter of jute manufactures, tea, cotton textile and some minerals like mica and manganese ore. Industrialisation of the country during the era under planning put a stress on new industries like engineering and chemicals. It was necessary to create an image of the country abroad in the markets for industrial goods. Cost and price pushes within the country required that some reliefs were given to exporters of these non-traditional items to enhance their competitive ability. The promotional incentives relate to both financial and non-financial incentives. Among the financial incentives may be mentioned the cash assistance, drawback of customs and refund of excise duty on raw materials, parts and components as well as intermediate goods and rebate on income tax. The freight concessions allowed by the Railway Board and the premium on import entitlements or profit on sale of such imported goods may also be included in the category of financial incentives.

While giving greater importance to non-traditional exports, the importance of non-traditional exports should not be ignored.

The promotional incentives have in view increasing export of new items in both traditional and new markets. One of the results of this category of incentives is that India now exports about 3000 categories of products and to almost all the markets excepting those countries with whom our relations are not cordial. These incentives have given the exporters some leverage to reduce prices in cases where full cost or even marginal cost prices would be uncompetitive in foreign markets. The rationale of these incentives is that when the new products are facing keen competition abroad to make a headway it is necessary that the losses caused in the process are borne by the State. In addition, in most foreign countries, incentives are given in various ways which need be matched for enhancing the competitive ability of our goods. These incentives are sought to create adequate motivation among exporters in conditions of a fairly good and profitable domestic market and a demanding and loss-bearing foreign market. Whether the motivation so created is a real and sustaining one is a different matter.

Incentives for Consolidation

Distinguishing between the promotional and non-promotional incentives, one finds that a

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major emphasis has been laid on promoting new products in new markets and traditional markets, not so much on consolidation and dynamic expansion of export of traditional goods to the traditional markets. As a matter of fact, some of the traditional exports have been subject to positive disincentives. The cases are of jute and tea. Both these items have suffered materially because of indifference, apathy and untoward policy measures at a time when they deserved a higher priority than the non-traditional items. It is perhaps not known widely that in the cost of both jute goods and tea, the incidence of indirect taxes is of the order of 25 paise for every rupee, apart from export duty. The drawback of customs and refund of excise together do not recompense industry more than 15 paise in a rupee as regards exports. This is astonishing from two points of view:

(1) These goods do not have any significant import content.

(2) These are perhaps the only profitable export products, earning net foreign exchange.

The gross neglect meted out to these items is manifest in the sense that the share of exports of these items from India *vis-a-vis* total world exports is on the decline and the share of their exports in total production is also diminishing every year. Yet these products together earned 28 per cent of the total foreign exchange earnings in 1968-69. Not that Government did not act at all. But it did at a time when considerable harm was already done to the long-term future of these products from India. All the attention that is now being given to these products has come a little too late. The hens laying golden eggs have been almost permanently disabled.

Administration of Incentive Schemes

The administration of incentive schemes has remained one of the weakest links in the chain. Government has established a large number of agencies for looking after exports. The effectiveness of these agencies has not, however, been as much as one would desire of them. The export promotion councils and the commodity boards have behaved like extensions of the bureaucracy rather than well-organised units meaning business. The performance of the Tea Board as recently assessed by the Public Accounts Committee of the Parliament will testify to this. Other agencies are also not very different. An aggregative, trading approach to exports initiated by the Government and these agencies and the administration of incentive schemes through them have come in the way of generation of an incentive effect in the following ways :

(1) The elaborate procedures through which the exporters are expected to go have caused a scare among them.

(2) The time taken for dispensation of incentives has been inordinately long.

(3) The lobbying necessary has been a factor that puts the exporters in a fix.

(4) The incentive schemes have not been as straight as desirable. For instance, the element of additionality in the additional rebate on export sales has been absent in conditions of loss-bearing export of the items qualifying for such rebate.

(5) For the export of the same items, the exporters have to approach different authorities for drawback of customs, refund of excise and sales tax and for claiming cash assistance, etc. This is not congenial for generating the required atmosphere, to say the least.

(6) These schemes do not subscribe to a scientific system and have a kind of adhocism involved. One, in this context, remembers the strictures given by the Public Accounts Committee on the administration of export promotion schemes and their indifferent effectiveness.

(7) There does not seem to have been any kind of cost-effectiveness studies of the administrative set-up established in this country with a large number of agencies, often with overlapping jurisdictions.

(8) The aim of the Government, according to the recently adopted *export policy resolution*, is to induce importers to expand and adapt their production with a view to entering into enduring relationships with overseas importers and to offer attractive terms and conditions to importers. The actual steps taken in this respect are grossly inadequate as regards traditional exports.

Conclusions

Incentive schemes in an extremely delicate area like exports must have certain features. First and foremost, they must be capable of creating an atmosphere in which the exporters are genuinely motivated to boost exports, as a stimulating, rewarding economic activity. At present our schemes lack a sharp edge. Further, such schemes should respect and acknowledge the existence of need hierarchy as suggested by Maslow, for effective sustenance of the effort that an exporter puts in over a period of time. The Government has distinguished between traditional and non-traditional exports in so far as a higher priority is accorded to the latter, larger quantum of financial assistance is given and preferential treatment is given to the exporters of non-traditional goods, in according recognition to export houses, etc. In many ways this distinction has started having its rebuff. It is a fact that subsidisation of non-traditional exports has made such exporters sell goods abroad at prices recovering not more than 40 to 45 per cent of the cost of production. It is a failure of our national export policy that as yet exporters do not believe that exports can be made economically viable. Incentive schemes need change from time to time but they need not be as complicated as they are now. It is also necessary that cost-effectiveness studies should be made with respect to the commodities and the individual schemes in operation. One has a feeling that the present dissipation of effort must stop. ●●●

Reverence for life...does not allow the scholar to live for his science alone, even if he is very useful to the community in so doing. It does not permit the artist to exist only for his art, even if he gives inspiration to many by its means. It refuses to let the businessman imagine that he fulfils all legitimate demands in the course of his business activities. It demands from all that they should sacrifice a portion of their own lives for others.

– Albert Schweitzer

The Computer Revolution

John Morris*

With the development of computer, we are witnessing a new structure of human society, with new sources of power more threatening and more promising than anything that we dared dream of twenty years ago. The new revolution differs from the older revolutions in one important aspect. Whereas the older revolutions were based on new sources of physical power, the new revolution is based upon a new source of mental power. This new tool will bring forth different reactions from different people. There will be some who will be overwhelmed by it, discouraged by the appearance of something which not only takes away their jobs, but also takes away that element of their jobs which gave them status. On the other hand, there will be those who rejoice in introducing a new intellectual tool more powerful than any tool that men have ever used before. These are the people to be watched.

WHEN Reinhold Niebuhr, who was to become one of the most prominent American Protestant theologians, left his small church in the Midwest and went to Detroit in 1915, he began to preach the same cheerful liberal Christian doctrine of good works and social progress that he had learned as a student, summed up in that old slogan of the nineteenth century American liberals, "Onward and upward forever!"

But things weren't going onward and upward forever for the men who worked in Detroit. Henry Ford had just opened the first automotive mass production line, which was revolutionizing the making of the automobile. In a different sense, it was also revolutionizing the lives of the men who worked on those lines, for they found themselves no more than cogs in a vast, almost overwhelming machine. They were no longer humans, but pairs of hands which turned a wrench or screwdriver, using the same motion day after day. Against the dehumanizing effect of the mass-production line, Niebuhr found it necessary to re-formulate the Christian message in terms which had been forgotten by the liberal church of his day. The revolution in automobile production was thus closely connected with a revolution in religious understanding.

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As an outsider, I cannot speak with any direct knowledge of the effect of industrialization upon the individual person in India; but one thing which Gandhi made absolutely clear, even to us outsiders, was the overwhelming effect of industrialization upon the individual. Although his message was quite different from that of Niebuhr, he resembled the American theologian in his emphasis upon the religious meaning of the new industrial era, and upon the importance of the individual in this new era.

Computers: New Source of Mental Power

We are going through still another such revolution today. With the development of the computer, we are witnessing a new structuring of human society, with new sources of power more threatening and more promising than anything that we dared dream of twenty years ago.

As Norbert Wiener pointed out in his book *Cybernetics*, the new revolution differs from the older revolutions in one important respect. Whereas the older revolutions were based upon new sources of physical power—the power of the steam engine, the power of coal, the power of electricity —the new revolution is based upon a new source of mental power, an increase in our power of computation.

The invention of the computer is like the invention of the printing press. The printing press was also the source of vastly increased intellectual activity, as it brought books and newspapers to everyman, and with them the demand for the right to learn to read and write, and thus to communicate his thoughts to others whom he could not see. When every person could learn to read and write, the intellectual revolution that accompanied the industrial revolution had begun.

We should be prepared for an equally important revolution today; we can see some of its symptoms already. Henry Ford's production line has gone through another revolution, as computers are used to control many of the machines on the production line. I wish you could visit the Ford plant, near Detroit, to see the effect of the computer upon it. You would be able to compare it with the paintings in the Detroit Institute of Arts, which picture the production line of 1932, on the same location as the present plant. Forty years ago, the line was swarming with men, riveting, tightening screws, pushing the car bodies from place to place. Today, the line seems almost deserted. At many points, production is controlled from the console of a computer, which makes many of the decisions formerly made by men. Automatic tools, under the control of computers, perform hundreds of the operations which once required the skill and experience of trained men.

In Detroit, then, and in hundreds of other cities a tremendous and rather frightening change has come about. Many of the tasks which once could only be performed by human beings are now being performed by machines. What meaning does this change have for the people who are caught up in it?

With the development of computer, we are witnessing a new structuring of human society, with new sources of power, more threatening and more promising than anything that we dared dream of twenty years ago.

Human Being *vs* Machine!

There are many ways of characterizing the differences between a person and a machine, but one of the most obvious differences is that a machine can commit errors, but it cannot do wrongs. The machine is not an ethical subject, like a human being. It does not choose between good and evil. It makes no sense to praise or to blame a machine, just as it makes no sense to kick a gasoline-powered engine when it won't start. We have no justification for getting angry at a machine, but this does not keep us from getting angry. We can be just as frustrated, just as impatient, when a machine fails to function as when a human being commits some wrong. This anger and frustration are expressed, then, in strange and unpredictable ways. Rather than striking out against the machine, we strike out against human beings, or against ourselves.

We have often heard it said that computers are "thinking machines." It does not seem to me that they are anything of the sort, unless we define "thinking" to mean an impoverished kind of data processing quite unlike the creative levels of human thought. I have come to agree with the sculptor Jean Arp, who said before he died in 1966, that "The reverred machine will soon devour the universe and infinity. Man does not suspect that what he is following will lead

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him to nothingness. . . . We must restore man once more to his humble place in nature."

Every major invention has brought with it major social changes and realignments. Men who have grown up with a standard, habitual response to the world around them cannot suddenly give up the views that they have held and which give them a sense of security in the world, and which make this a world that they belong to. They are confused and frightened by forces over which they feel that they have no control. We have only to visit an automobile plant, where overhead cranes carry huge chunks of metal, where gigantic presses shape sheet metal into hoods (or bonnets, as the English call them), fenders, roof tops and the other parts of the car, and to contrast the immense size and power of the machines with the men who work beside them, in order to understand something about the effect that such machines—with the heat and noise that they produce, with the possibility at any moment of crushing a man's hand in a press, or his foot beneath a casting—must have had on the men who first worked with them. Men were overwhelmed by the machine.

It may be that the computer, then, which is equally impressive in its power in contrast with men, which can perform a billion computations while a man is performing only one, which works with incredible speed and accuracy, may also overwhelm the men that created it.

In the factory, the sense of overwhelming, superhuman power could terrify some of the men that worked with it. But there was another, directly opposite force at work. Man saw the machine as a source of immense power that he could control for his own uses. It was a slave that he could master. At the throttle of a locomotive, the engineer was one of the heroes of his time, streaking across the countryside with immense power, which could destroy any human in its path. Another hero was the pilot of the riverboat, as Mark Twain describes him in mid-nineteenth century America, guiding the destinies of the tiny humans whom he deigned to steer along the hazardous course of the riverbed. The truck driver (or lorry driver, if you prefer), the airplane pilot, the man at the controls of a giant crane, all are men with superhuman mechanical powers at their command.

The machine, then, can have one or the other of two opposite effects. When a man feels that he is at the controls, he is blessed or cursed with immense power, perhaps a demonic power that makes him feel that he is like a god. When a man feels overwhelmed by the machine, he feels its impersonality and its immense force, like a Juggernaut that is threatening to destroy him, and which he cannot control. Both of these forces were at work in the industrial revolutions of the past.

What the steam engine did for man a century ago, the computer is doing for him today. And just as, a century ago, there were those like John Henry—the mythical American railroad man who could not win in a contest with the steam-drill—so today the computer is displacing millions of people who are no longer able to compete against the computational power of the machine.

Who are these people? Above all, they are the white-collar workers, the accountants, the filing clerks, the billing clerks, the men and women who once kept accounts in offices, but who find that operating a computer is too much for them. They cannot compete against it.

But it is not only the clerical workers who are being displaced by the computer. When the computer was first programmed to control industrial production, it led to the dream of the automatic factory, in which computers controlled

every stage of production. This dream has become a reality in some plants, particularly those that produce petroleum products where the delicate control of the system requires the quick response of the computer to keep it going.

Substituting Men

Many of the automobile plants, like the Ford plant, have automated most of their subassemblies. The result of this kind of computer-based control system is seen in Detroit, where many of the skilled mechanics, welders, machinists, tool makers, find that their delicate skills and long-trained habits are no longer needed. Not long ago, I saw the Packard automobile plant in Detroit standing deserted, with the hundreds of skilled men that it once employed now out of work, or in some other occupation. The empty Packard plant became a symbol for me of one of the effects of computers and automation on the men and women of our society.

The effect of the computer is a different effect from that of the steam engine. It does not provide a new source of physical power, but a new source of mental power. The automobile factory works with tools which are not greatly different from those that were used twenty-five years ago, but the methods of controlling those tools are different. A metal lathe today uses the same concepts in its construction that a metal lathe used fifty years ago, but the method of controlling has changed, The computer decides, on the basis of the plan that has been provided, where to make the cut, how fast to proceed, when the piece has been finished, and whether it meets pre-assigned specifications. This is an intellectual task, the sort of task that men have done.

The Two Sides of Revolution

And we can expect that people will react to this new tool in much the same way that they reacted to the old tool. There will be some who will be overwhelmed by it, discouraged by the appearance of something which not only takes their jobs away, but also takes away that element of their jobs which gave them status in their work or trade, and made them feel like persons. On the other hand, there will be those who rejoice in a new intellectual tool more powerful than any tool that men have ever used before. These are the people to be watched. The tendency to play God has always been with us, but the power to control the lives of other people has never been as strong as it is today.

It would be pleasant to suppose that the religious leaders of our own day could speak meaningfully to the people who are overwhelmed by this new power that men have let loose upon the earth today; but among the people with whom I have worked, and in the computing journals, the traditional messages of the religious world play no part whatever. It is not simply that the religious view is rejected, because if it were rejected it would at least be seen as a force to contend with; rather, its message is wholly ignored, because it is wholly irrelevant to any question that a computer programmer or engineer might face.

As the power and the pervasive influence of the machines increases, the ethical questions will arise and must be answered. I would hope that those answers would reflect the traditional religious concern for the sanctity of the individual person. But if this is the answer that the present generation of computer workers gives, it will only be because religious leaders have recognized that a revolution has taken place, and that they must take account of it. ●●●

A computer does not substitute for judgment any more than a pencil substitutes for literacy. But writing ability without a pencil is not a particular advantage.

—Robert S. McNamara.

Computer and Numbering Systems

DK Bhatnagar*

This paper traces the need, development and use of numbering systems employed in the computer since the beginning of the civilization. Role of numbering systems in the design and working of computer has been described. Negative base number systems and reflected number systems have also been discussed.

NUMBERING systems play a vital role in the working and design of the computer. They shape the internal logic and memory elements of the machine. It was since the beginning of the civilization, perhaps, that the man has been trying to find out ways to represent and communicate information in the form of numbers, alphabets or some other ways. Day-to-day problems also urged him to devise some means of doing addition, subtraction and other calculations. The need for development of various numbering systems and their use in computation can be seen if we make a brief critical study of some of the earlier and present-day systems of counting and calculating.

As soon as the ancient man of prehistoric age started keeping cattle, he was worried none may be missing some day. And so, an idea of enumeration flocked his mind. One of the earliest methods of counting developed was with the use of fingers. If, for example, a man had four cows, he would take stock of them with the counting on fingers of his hand, adding one by one up to four and the missing one, if any, could be spotted. Idea of 'missing' or 'getting more' from someone, made him feel of the operation of subtraction and addition. This was, perhaps, the first step towards the concept of computation. Our present-day digital computer also makes computation, adding quantities a bit by bit.

Primitive man, who was very keen observer, specially of the astronomical phenomena, established many results which have become universal. Number representation, an important thing to do, attracted attention of many people. Different civilizations of antiquity represented numbers in different ways and in various scripts. Grouping in two and four and also in five and ten was a very common practice with the ancient people, perhaps because of anatomical reasons. Egyptians (3500 B.C.) used a cumulative decimal system of representation, consisting of symbols for numbers one, ten and all powers of ten up to one lakh. They also performed simple arithmetical operations employing this system. One of the main drawbacks of this system was that zero was never used. Moreover, repetition of the same symbol several times to

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represent a number created great difficulties for handling even small numbers. This non-positional characteristic of the system devoid of zero may be accounted as one of the main hurdles for rapid advancement of methods of calculations.

Babylonians employed two types of notational numbering systems—Cumulative decimal and Sexagesimal.[1] The former was generally used for small numbers dealing with day-to-day problems whereas the later one having radix sixty was practised for complicated mathematical and astrological problems. Babylonians tried the solution of some algebraic equations but sometimes had to review the problem according to the techniques available with them. The main feature of Babylonian sexagesimal system was that it was a positional numbering system. The digits from one to fifty nine were represented by repetitive combinations of symbols for one and ten and above that powers of sixty were used. As an example, the number 452 (where each digit has been written in Babylonian script of numbers) would be equal to $4\times60^2+5\times60^1+2\times60^0=$ 14702. This made the representation of the number very short and provided an edge in computation over the then existing clumsy systems of representation in the sense that calculations became simpler. Babylonians, who, at a later stage developed a symbol for zero, never used it at the end of the number. For example, they wrote 3609 or 3069 but never 3690. Therefore, it is clear that the zero of the Babylonians was different from our present zero. This was the main drawback and because of that the system could not be used in Arabic devices which we use today and, also, because of it, the system did not advance to a stage of invention of algorithms.[2]

But, undoubtedly, Babylonian system gave the mathematicians the basic idea of place value of a digit in the number which played a very important role in the future development of numbering systems and computational methods.

Pythagorean mathematicians from Greek civilization represented numbers either by points or dots in the sand in the form of triangle, square or other geometrical figures. They derived many relationships which were of great help in computation. One of the greatest contribution of the pythagoreans was the discovery of irriational number, e.g. $\sqrt{2}$ which was later used in algebra and calculus.

Contributions in the field of numbering system and computation were carried on by Romans, Arabs, Indians, Chinese and several other cultures of the past. Specifically monumental work has been done by the Hindus in the field of Arithmetic. Their contribution includes discovery of principle of position some time in the first century A.D.[3] Hindus also employed a symbol for zero as '0' (or *Sunya* as they called it). It may be point of argument that Hindus might have borrowed their zero and idea of positional notation from Babylonians but they, in India, were the first people to have used a complete positional system of decimal notation with proper sign for zero as is used today universally.

This decimal system of notation, popularly came to be known as Hindu-Arabic system, proved very useful, specially, for written computations. Earlier, calculations were done generally on abacus[4], a manual calculating device. A beautiful account of abacus and the effect of Hindu-Arabic system on it has been given by Martin Gardener in his recent paper on abacus.[4] Abacus has a history that dates back to Greeks and other ancient cultures. It is an arrangement of rods or grooves with counters made of movable round pebbles*, beads or similar objects (see figure 1). It was the book by Fibonacci (1202 A.D.) that helped spread Hindu-Arabic decimal system of notation in Europe. Discussions and oral teachings also helped in this direction. After a tough opposition from abacists who for the written arithmetical calculations were using Roman numerals at that time, the era of abacus gradually bowed out of Europe. One of the greatest drawbacks of abacus is that if a particular device of it has only five columns, as an example, its limitations would be to handle any number which contained not more than five digits. But it is very interesting to see that in the recent past the use of abacus in countries like Japan, China and Russia has become popular

*The word calculates comes from 'calculus', a Latin translation for Pebbles.

again. Sometimes it is even used in preference to fast digital computers of the modern world. One of the important observations about the abacus is that it works on the principle of position.

Researches Leading to Development of Computers

Modern digital computers were the result of the efforts by man to devise some means of calculation which could handle large numbers and exhibit more speed, reliability and accuracy. As a result, Blaise Pascal, a French mathematician designed a machine capable of doing addition and subtraction in 1642. This machine consisted of six wheels, each wheel having ten numbers from 0 to 9 around the circumference. Positional decimal numbering system was used in constructing this machine. Digits on first wheel stood for unit place, those on second represented tens, on 3rd hundreds and so on.

An improvement over this machine was done by William Leibniz in 1671 by building a device which could multiply as well. Next step in this direction was by Charles Babbage, an English mathematician, in 1833 towards an automatic calculating machine. He conceived of a device called analytical engine based on decimal numbering systems, which could store the data to be operated on, perform arithmetic and had a control unit to instruct how operations were to take place. There was a provision for output of results also. Unfortunately, he could not actually build the complete device, perhaps, because of limited technology at that time, yet he had provided sufficient idea of a modern digital machine.

In 1925, V. Bush, an American electrical engineer, designed a machine which could solve differential equations. Working for seven years, it was in 1944 about a century after Babbage's efforts that the first automatic sequence control calculator called 'Mark I' was constructed by a physicist, Harvard H. Aiken at Harward University in collaboration with the International Business Machines.

The first true electronic, high-speed, large-scale computer, as came to be known to the world, was ENIAC (Electronic Numerical Integrator and Calculator) built by J.W. Mauchly and M.J. Echert of University of Pennsylvania, in 1946. One of the important advantages of this machine over its fore-running devices was its speed. In this system electronic vacuum tube 'filip-flop' was used in place of electromagnetic relays as used in Mark I. Since then the progress in the sophistication of computers both in software and hardware has been tremendous. For example, in deisgn, beginning from vacuum tube (as in 'Mark I') the use of microminiaturised circuits (e.g. in I.B.M. 360) and a step next to it 'large-scale integration'—are pointers of advancement in computer technology specially in terms of gaining very high speed and compatibility.

Most of the high-speed, modern digital computers employ binary numbering system. Representation of the numbers in the binary form has received considerable attention specially since the middle age period. In 1938, L. Couflignal recommended the use of binary numbering system for the construction of computers.[5] This numbering system has only two digits 0 and 1 with base 2 as compared to decimal numbering system which has ten digits 0 to 9 with base 10. The two-state condition of the electronic switches used in the computer is well represented by the two numbers 0 and 1, one of the states by 1 and another by zero. This two-state condition means either a particular current, voltage, force is present or absent. The arithmetic operations are performed in the computer by means of combinations of binary switching (or logic) elements having two alternate pathways. For storage, binary memory elements are used. The complex switching networks are designed so as to work in accordance with rules of the well-known Boolean Algebra.

Systems with bases other than two and ten are also used for computational purposes. Specially a system with base eight has much relevance to the computer system. If instead of binary logic based on 0 and 1, a logic based on any other system is used, the internal design of the computer is changed accordingly. In a system using decimal numbers 0, 1, 2, 3, 4,....9 and numbers being represented by electric currents, these digits could well be represented by various intensities of current. Some of the early

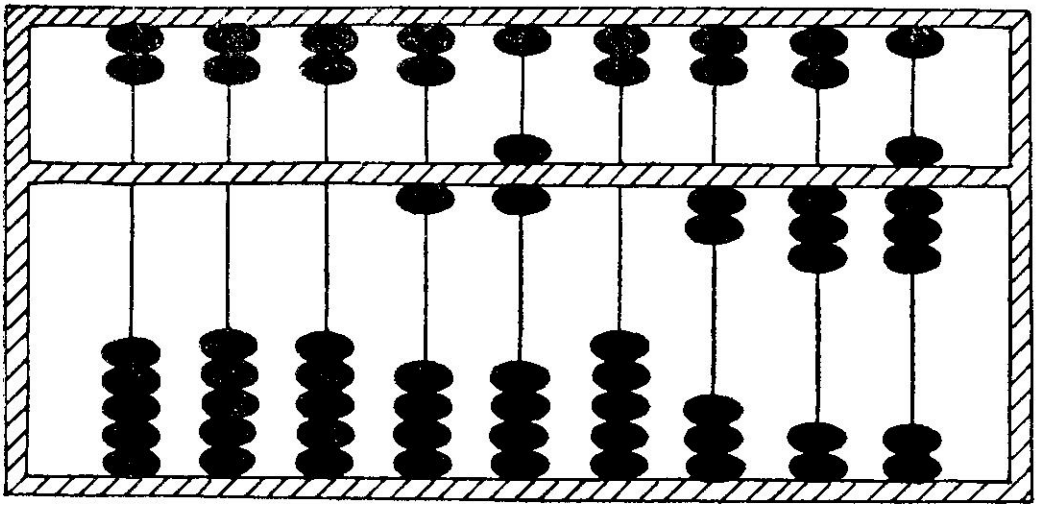

FIGURE – 1 CHINESE SUAN-PAN
Showing the number 160238

machines were based on decimal system. For example, Pascal used systems of wheels with ten teeth on each wheel to represent ten decimal digits from 0 to 9. Babbage also conceived of only decimal system in his proposed machine. Conversion of a number with one base to a number with some other base can easily be done by various methods and hence a number can be represented in any base according to convenience. Any number in a fixed integral positive base numbering system, say, having a base b (b>1) can be represented by the sequences of digits of the form:

$$\pm P_n\ P_{n-1}\ P_{n-2} \ldots\ldots P_1\ P_0\ P_{-1}\ P_{-2}\ P_{-3} \ldots\ldots$$

where each of the above digits in the expression has been taken out from the numbers 0, 1 . . . . b-1 and has positional significance with weightage in terms of powers of b, decreasing by one from left to right. The base point between P_0 & P-1 separates the whole and the fraction parts. Hence, if, for example, it is desired to convert a binary number say $(N)_2 = P_2\ P_1 P_0\ P_{-1}\ P_{-2}\ P_{-3}$ to a number in decimal, each of the digits P_2, P_1, P_0, P_{-1}, P_{-2}, P_{-3} has to be accordingly multiplied by 2^2, 2^1, 2^0, 2^{-1}, 2^{-2}, 2^{-3} respectively and multiplication results added together to give the desired conversion. Here the dot between P_0 and P_{-1} is called binary point.

One of the major disadvantages of binary system is that number of digits required to write a number is usually much larger than what it is in decimal or any other numbering system, making it very clumsy as it is clear from the table shown. But as there are only two digits in the binary system the basic arithmetic process of addition, subtraction, multiplication and division have become very simple. As an example, tables of binary addition and multiplication have been

Much can be achieved out of computers if flexible and improved programmes are prepared which can reduce strenuous human activities.

shown below.

Addition

	0	1
0	0	1
1	1	10

Multiplication

	0	1
0	0	0
1	0	1

Base 10	Base 8	Base 2
0	0	0
1	1	1
2	2	10
3	3	11
4	4	100
5	5	101
6	6	110
7	7	111
8	10	1000
9	11	1001
10	12	1010
11	13	1011
12	14	1100
16	20	10000
50	62	110010
100	144	1100100

Table 1 Showing representation of numbers in decimal octal and binaty numbering systems.

Moreover complementation process with binary numbers in 1's complement is similar than that with numbers in any other system. Just change binary 1's to 0's and 0's to 1's and add one to the low order digit of the result so obtained to get 1's complement of the binary number. This process of complementariness is generally very useful for subtraction of number (shown in the table) when there is no extra circuitry for subtraction in a computer. Alternatively, a subtraction circuit can be built in place of addition circuitry and addition can be performed by subtraction of complement number.

Besides various positive base numbering systems used in connection with the computer system, numbering systems with negative base have also come under investigation.[6,7]

As in the positive base system, any number in the negative base system can be represented by the expression $P_n P_{n-1} \ldots P_1 P_0 P_{-1} \ldots\ldots$ where each of the above digits having positional significance has been taken out from the numbers (0, 1.....L-1). L denotes the negative base. For example, the number 245 in (-10) base

When N>M		When N<M	
N =	110101	N =	101010
M =	100110	M =	111101
	011001		000010
+	1	+	1
Complement M	011010		
N	110101	Complement M	000011
		N+	101010
Over flow 1	001111		101101
Result =	1111	As no overflow recomplement it	
			010010
		+	1
			010011
		Result =	10011

Fig. 2. Showing binary subtraction by complementation method when

(i) number N > M
(ii) number N < M

system would represent the decimal equivalent as

$$(245)_{-10} = 2(-10)^2 + 4(-10)^1 + 5(-10)^0$$
$$= 2.100 - 4.10 + 5.1$$
$$= 165$$

Similarly $(1010)_{-2} = 1(-2)^3 + 0(-2)^2 + 1(-2)^1 + 0(-2)^0$
$$= 1.8 + 0.4 = 1.2 + 0.1$$
$$= -10 \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

and $(11110)_{-2} = 1(-2)^4 + 1(-2)^3 + 1(-2)^2$
$$1(-2)^1 + 0(-2)^0$$
$$= 1.16 - 1.8 + 1.4 - 1.2 + 0.1$$
$$= +10 \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Following observations in connection with the negative base numbering system are worth noting:

(a) Positional weights attached to the digits in the number expression are alternatively positive. This means that for two different numbers in the negative base systems, there are two numbers whose magnitudes are same but signs are different as is evident from examples (i) and (ii) given above.

(b) Range of digits of a negative base number system, say, in the base - 10, is the same as in the positive base number system with base 10.

(c) Unlike the system with a positive base, sign of a number in a negative base system is not specified separately but is self-contained.

Arithmetic calculations can be done in binary negative base system keeping in mind that $1+1=110$ and also understanding the ambiguity about 'carriers'. As an example if it is desired to add 110110 to 11110, it will be as follows:

```
c c |
    |  (iv)
c c |
  c c |
      |  (iii)
  c c |
    c c (ii)
      c c(i)
    1 1 1 1 0  ——  ——  ——  ten
    1 1 0 1 0  ——  ——  ——  six
    ---------------------
..  ..1 0 0 0 0  ——   —  ——  sixteen
```

Explanation: To start with, when 0 is added to 0, no carry is produced. When 1 is added to 1 (i.e. 110), two carries are created as shown in (i). A carry added to 1 again creates two carries as shown in (ii). Now two carries and two 1's when added together produce two double carries which have been shown in (iii) and have been placed one above the other and so on. Result so obtained finally comes to 10000.

Operations other than addition can also be performed. Multiplication can be done by repeated addition. Subtraction is facilitated by multiplying by—1, i.e 11 in minus two system and adding. For division, sign of the negative binary number has to be decided first. If we study a few numbers with their representations in binary system, rule can be evolved about the sign.

As deduced earlier $(11110)_{-2} = +10$

and $(1010)_{-2} = -10$

similarly $(11010)_{-2} = +6$

and $(1110)_{-2} = -6$

Let us take a number with more digits.

$$(100,0011)_{-2} = +63$$

$$(100,001)_{-2} = -31$$

From the various examples, it is clear that if the number is positive, the total number of negative binary digits is odd, whereas if it is negative, the total number of these digits is even.

Reflected Numbering System

Deviating from the conventional system, reflected numbering system is very useful for certain problems (e.g. analogue to digital conversion). For example, if it is required to digitalise analogue quantity in the normal system, difficulty may arise in transitional phase. Supposing that the value of analogue quantity in decimal notation lies between the numbers

Table 3: Representation of Numbers in Conventional and Reflected System

Base 2		Base 6		Base 8		Base 10	
Conventional	Reflected	Conventional	Reflected	Conventional	Reflected	Conventional	Reflected
0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1
10	11	2	2	2	2	2	2
11	10	3	3	3	3	3	3
100	110	4	4	4	4	4	4
101	111	5	5	5	5	5	5
110	101	10	15	6	6	6	6
111	100	11	14	7	7	7	7
1000	1100	12	13	10	17	8	8
1001	1101	13	12	11	16	9	9
1010	1111	14	11	12	15	10	19
1011	1110	15	10	13	14	11	18
1100	1010	20	20	14	13	12	17
1101	1011	21	21	15	12	13	16
1110	1001	22	22	16	11	14	15
1111	1000	23	23	17	10	15	14
10000	11000	24	24	20	20	16	13
10001	11001	25	25	21	21	17	12
10010	11011	30	35	22	22	18	11
10011	11010	31	34	23	23	19	10
10100	11110	32	33	24	24	20	20

99999 and 100000, in such a case, all the digits counters start moving from 99999 onward simultaneously and because of incorrect operation of the machine some digits may change while others may not.

Reflected number system, where only one digit changes at a time, is used to remove such intricacies[8]. Table 3 depicts the behaviour of the reflected number systems as compared with the other conventional systems.

To sum up, though it has always been the need and the effort of the human being to design fast methods of calculation, absence of a suitable numbering system in the pre-Christian era was the main reason for the slow development of computing devices during that time. Various numbering systems evolved played a great role in the designing and working of faster, larger and cheaper computers. Much more can be achieved out of these computers if highly-flexible and improved programmes are prepared which can help reduce strenuous human activities.

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Hydraulic Test and Wet Preservation of High Pressure Boilers

HC Chopra* & T Sampat*

High pressure boilers used for steam generation in process industry or power plants need be very reliable in function and able to withstand expected pressue. Otherwise, it can mean accidents and sudden stoppage of production. Spare boilers are in stock at power stations or process industry. These too must not fail the users. In case of spare boilers, long idle periods can mean rusting and corrosion of the metal and consequent weakening of pressure-resisting power. Therefore, boilers should be pretested before use as to their power. The idle ones should be preserved against corrosion. Even the water used in boilers should be tested to ward off harmful effects on the boiler.

ANY vessel meant to withstand pressure during normal service or utility should be tested beforehand for its suitability and tolerance to the pressure and other specified conditions for which it is designed and fabricated. This is of paramount importance from the point of safety of the project and operating personnel, besides its technical importance, implications, durability and efficiency of service. That is why statutory requirements exist in every country to ensure pretesting.

Boilers, used for generation of steam at high pressure and temperature, either in process industry and/or Thermal Power Generation Plants, is subjected to high pressure and temperature and larger capacity units come into existence with better and improved design.

This paper discusses the Hydraulic pressure test for a high pressure boiler unit, with particular emphasis on the adoption of the right type of chemical treatment for conditioning the water to be used for hydraulic testing as well as for the preservation work to be followed in case of lay-off of the boiler for a sufficiently long spell. The chief aim of chemical conditioning is to prevent internal deterioration of the boiler and safeguard the material, thus providing a strong base for protection of the material from after-effects of the pressure test and preservation work. The principle in such pressure test is to confirm the tolerance of the main vessel and its auxiliary parts to the maximum pressure for which they are designed and fabricated and also to eliminate any technical flaw due to bad material or poor workmanship before putting the vessel into actual operational utility.

An Industrial boiler, such as steam generating unit is designed and fabricated to generate steam of specified quantity at a particular temperature and pressure and at a continuous rate suiting the turbine and or the process demand.

Typical Specification

The steam raising unit comprises of a radiant furnace boiler with auxiliary equipment designed

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to generate 300 tons of steam per hour at 100 Kg/cm² pressure and at a temperature of 510°C.

Broadly, from the convenience of operation and maintenance point of view, the Power Plant layout can be divided into two major sections:

i. Boiler and connected auxiliaries, involved directly in the generation of steam:

ii. Turbo-generator and connected auxiliaries.

A thermal power plant complex, before being commissioned, passes through various transformations, such as:

1. Inception and planning
2. Design and fabrication
3. Erection
4. Precommissioning, trial operations and tests
5. Post-commissioning, trials and tests
6. Actual pressing of the units into operation, i.e., commercial running.

The major operations to be followed after erection, preceding pre-commissioning programme of the boiler unit would be:

1. Hydraulic test
2. Wet preservation of the boiler. (Normally this may not be necessary for some units. But since this depends upon the basis of design and nature of erection schedule followed, in actual field it becomes difficult to achieve. This is discussed in detail at a later stage in this paper).
3. Chemical cleaning acid and/or alkali boil out.
4. Initial operation, trial running, setting up of various control equipments, safety, devices, precision adjustments etc.

It will be worthwhile mentioning here that the prime consideration before going in for the erection of a Thermal Power Plant is to ensure availability of uninterrupted supply of demineralised water in case no suchearlier provision exists. If the erection is to add and augment power generating capacity in an already serving station, there is every chance of availability of demineralised water. But if the erection is altogether in a new environment, the above feasibility must be ensured. In other words, erection and commissioning of demineralisation plant must precede erection and commissioning of boiler unit. This is one of the most important and essential steps for a successful commissioning and adequate trouble-free service of operation in years to come, besides other vital aspects that must also be ensured for trouble-free operation of the steam generation unit. This paper is restricted to a considered study of hydraulic and further involved preservation work alone.

Selection of suitable pumps, water of suitable quality, correct type of chemicals for conditioning the water and, above all, correct steps taken during the actual programme are very vital for successful completion of the job. These are discussed here.

It is a most unwise step to use untreated water for hydraulic programme. Greatest care is needed in usage of right quality of water in case of high pressure units. It may be argued here that acid cleaning and/or alkali boil out to be followed might nullify and remove the bad effects of using raw water.

However, common sense dictates that prevention is better than cure. Secondly, it will still be worse to introduce something unwanted and harmful knowingly just because of initial ill planning and poor know-how. There are cases of disastrous incidents within months of starting normal operation, owing to use of raw water in untreated form for hydraulic programme and administration of unsuitable chemicals for internal conditioning. Chemicals that are beneficial during normal operation for a particular purpose might prove highly harmful if used during hydraulic and preservation work even for the same purpose.

Generally erection and commissioning schedules are so planned that sufficient time gap will be there between hydraulic programme and chemical cleaning operation; similarly between cleaning and initial operation schedule.

Boiler erection with respect to furnace brick work, thermal insulation work, sensing probe location, insertion, fixing at various points for different monitoring control operation, could be made ready for initial firing for cleaning work only after a successful completion of hydraulic pressure test.

Any leak due to poor welding work, faulty material, incorrect erection due to negligence and lack of sufficient care (which are not uncommon in any major erection) or any other reason might go undetected, particularly in the embedded portions, and may lead to considerable dismantling work and avoidable duplication, wastage of time, material and money. Therefore it is necessary to proceed with completion of furnace work and other side insulation work after successful completion of hydraulic programme. Period gap will vary from unit to unit, depending upon the nature of design, fabrication, site conditions, availability of material in time, erection schedule followed, efficiency of the gang etc. But for purposes of planning a thing, a minimum of two to three months can be easily taken, on a rough estimate. As told earlier, this has purely a relative value. This depends upon the quantum and nature of work, and has definite relation with well-conceived planning, perfect co-ordination and execution with proper synchronisation at various levels of different wings of the project.

The gap between hydraulic testing and chemical cleaning dictates the necessity for wet preservation of the boiler. Proper preservation from the very initial stage is most essential. This point should never be overlooked.

After a successful completion of hydraulic test, boiler drum and connected lower portions can be easily drained and may not require preservation; strictly speaking, even these portions cannot be dried at this stage and moisture adhering to the walls will start rusting the material, and as such it is wise and safe to practise wet preservation. Secondly, super-heater columns cannot be drained. Some authors suggest ejection of the water from coils by means of compressed hot air. This, no doubt, sounds convenient and appears to be an easy solution. But in practice it has its own shortcomings and limitations at site conditions; The authors have bitter personal experience of such a venture at the Delhi power station.

Certain boiler designs provide isolation of superheater coils from main boiler portions. This has a great initial advantage in eliminating totally super-heater columns during initial hydraulic. Boiler drum and connected lower portions and other auxiliaries can be put to test, which need not require preservation work.

A total hydraulic including super-heater/ super-heaters can be easily conducted just before acid cleaning programme and any defects rectified in super heater coils. This eliminates wastage of time and preservation work. The problem is in cases where such isolation facilities do not exist and are not anticipated. This may be contemplated earlier and the needful done. But it remains to be seen and solved as to how far this would be feasible and convenient from design, fabrication, erection and operation points of view in the actual field work.

Fill Tank

Provision of a Steel Tank close to the boiler site, preferably at the basement will ease the work to a great extent during hydraulic, which otherwise might prove highly expensive, cumbersome and even an ordeal. This tank must be of larger capacity than the full water volume of the largest boiler in the Powr Station as explained later.

It can serve a dual purpose:

1. Whenever any unit in operation has to be stopped for one reason or the other and that too for a short duration, necessitating emptying the boiler too, water can be easily drained to this tank and taken back instead of draining it out.
2. Initial Hydraulic and Hydraulic programme followed after every overhauling schedule can be very easily practised.

Sometimes it may become necessary to fill and drain several times due to some correction or other at various pressure levels. Provision of fill tank will help in reusing the same water till successful completion, thus averting wastage of large quantities of DM water every time (the quantity of water being handled at each stage exceeds 100 tons).

A typical sketch explaining arrangement of one such tank and connected pipelines is shown in Annexure I.

This tank proves to be extremely beneficial in a running station where the number of units

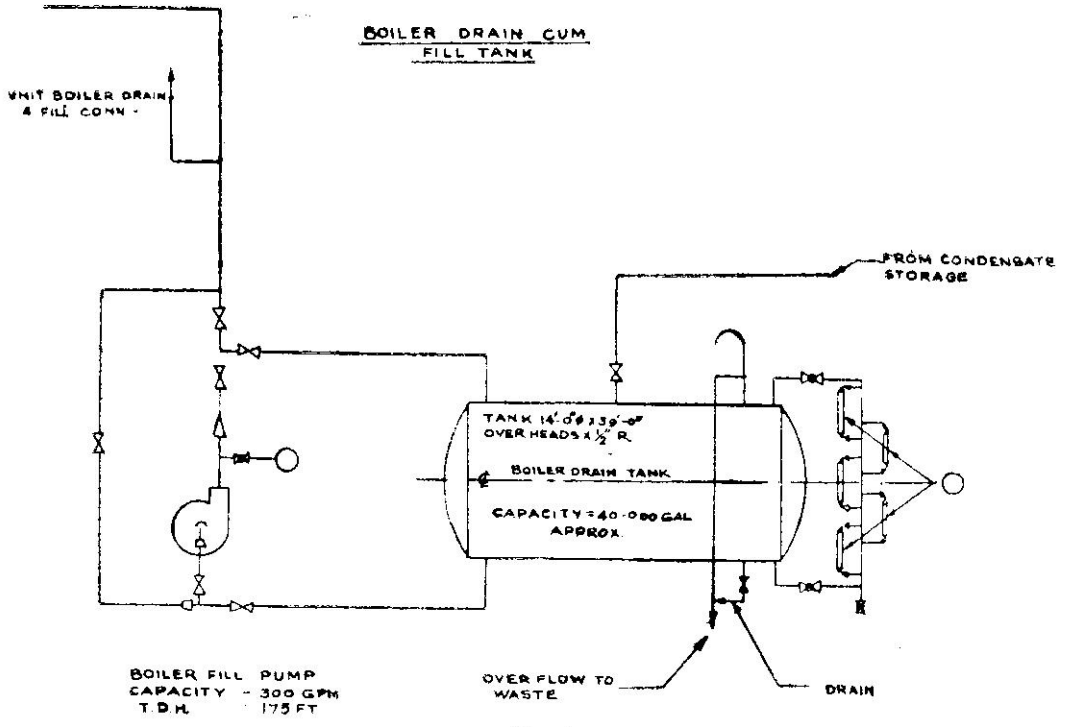


Fig. 1

are more and one unit or other will be under maintenance schedule. The tank shown can serve boilers having evaporation capacity of upto 300 tons/hr.

Holding capacity of the Fill Tank is judged on the following criteria.

Viewing from hydraulic test angle, the boiler can be divided into three major portions;

A Drum and water wall
B Economiser portions
C Superheater columns and connected further onward pipings.

$$F\,(\text{tons}) = (B+e) \quad \ldots.(1)$$

$$B\,(\text{tons}) = (DW+E+S.H) \quad \ldots.(2)$$

where F is Capacity of fill tank in M Tonnes.
B —Capacity of whole of the largest boiler unit.
e —25% excess of B.
DW—Capacity of drum plus water walls
E —Capacity of Economiser.
S.H.—Capacity of super heater columns and connected pipes.

Choice of Pumps

Two pumps are necessary:

i. One fixed and coupled with the Fill Tank, capable of drawing water from fill tank and to fill the whole boiler with a boosting capacity to raise the pressure easily to a minimum of 10 to 20 Kg/cm². It should also be designed with such impellers to handle a water of pH value varying from 8.0 —10.5 with a maximum temp. of 90°C. The impleller of the pump should not be of chrome alloy casting. Pipelines can be so arranged that water from boiler can also be emptied through the same pump for putting into the fill tank, in case of necessity.

ii. The other movable pressure raising pump unit. The characteristics of the pump should preferably be of the order that at a decently regular and slow rate, it should be capable of raising the pressure. It is better that the pump is designed to raise a pressure of a minimum of $2\frac{1}{2}$

times that of designed working pressure of the boiler unit. The same pump can be used to pressurise feed line and connected heaters while they are tested, as they must stand higher pressure than boiler during normal operation, as provided in the statutory premium of the Boiler Act.

Pumping rate should be given due consideration, as uneven and abnormal rate of increasing pressure might create stress resulting in tube fracture and further complication due to uneven stress introduced in the metal at different sections of the Boiler.

Quality of Water and Recommendations for Chemicals

It is absolutely advisable and essential to use demineralised water even from the very beginning, particularly for high pressure units. No risk is worth taking. An essential hidden menace to be taken care of is the dissolved oxygen in water. Dissolved gases, especially dissolved oxygen is the hidden enemy in water for the welfare of the boiler and its auxiliaries even in traces, particularly in a high pressure and high superheat boiler. Rusting and corrosion are the two dangerous diseases for a thermal power plant and it is not enough holding only oxygen responsible for this:

The water to be used is.

i. Demineralised water, free from colloidal as well as dissolved silica.

ii. pH of the water should be within a range of 8.5—9.5, preferably tending to higher limit.

iii. Absolutely no trace of dissolved oxygen.

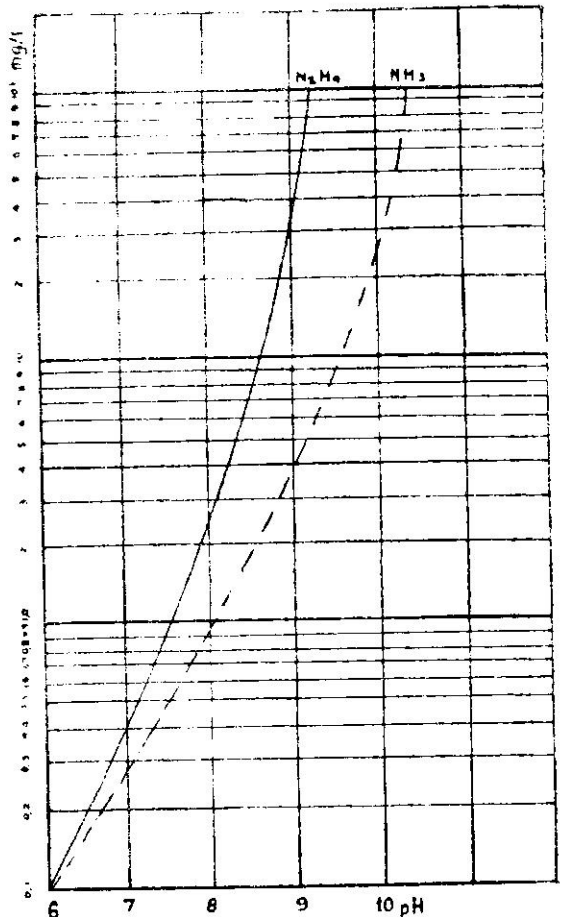
iv. The temp. of water should be of the order of 70°C-90°C.

v. Hydrazine reserve should be between 100-200 ppm as N_2H_4.

As no solid chemical is recommended for achieving the values for hydraulic and preservation purposes and thus not preferred, the choice falls only on two items.

1. Hydrazine Hydrate, preferably of lower percentage concentration for easy handling.

2. Ammonium Hydroxide.



Quantity of NH_3 or N_2H_4 required for alkalization of fully demineralized water.

Fig. 2

Hydrazine Hydrate is for scavenging oxygen and Ammonium Hydroxide for boosting alkalinity to the desired extent. This couple proves to be most ideal for Hydraulic and preservation work. The greatest advantage is that these are liquids and readily miscible with water in all proportions.

HYDRAZINE N_2H_4

It is colourless, corrosive liquid that fumes strongly in air; miscible with water in all pro-

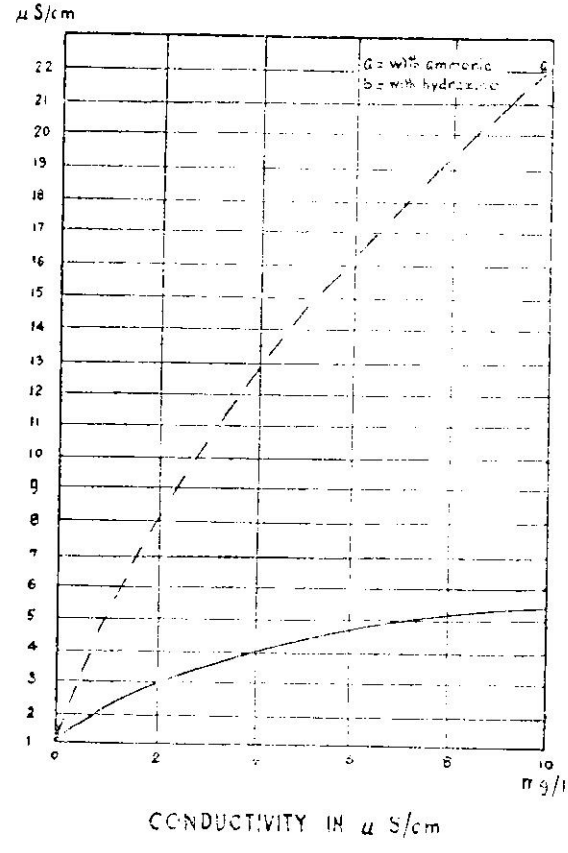


Fig. 3

portions; over a range of pressure Hydrazine and water form a constant boiling mixture (Azeotrope): Hydrazine and its hydrate absorb moisture and carbon dioxide from air. They slowly oxidize in air with liberation of Nitrogen. Powerful reducing agent. The product of reduction has no bad side effect to the system.

$$N_2H_4+O_2=N_2+2H_2O$$

The rate of reaction varies with temperature, pH, concentration of hydrazine and various catalysts; the reaction rate is maximum in moderately alkaline solution and ceases altogether in acid medium. The reaction is certainly a heterogeneous one.

$$6\ Fe_2O_3+N_2H_4=4\ Fe_3O_4+2H_2O$$

(Brownish red in Colour/Rust) — (Black Oxide Magnetite)

Ferric Oxide — *Ferrosic Oxide*

When hydrazine is introduced into the boiler for the first time, this reaction continues until all the rust has been reduced to magnetite. An interesting point to be noted is that magnetite is converted back to ferric oxide by oxygen, the layer of magnetite is always available to deal with sudden increases in dissolved oxygen—in fact it acts as a solid reserve of hydrazine. Ferrosic Oxide is highly resistant to the existing condition of water in a running boiler. This is one of the greatest advantages in preventing or minimising boiler corrosion.

(Reversion): $4\ Fe_3O_4+O_2=6Fe_2O_3$

Physically hydrazine is similar to water but chemically it is reducing, decomposable, basic and bifunctional. It reduces oxygen to water in catalytic metal surfaces. Metal ions such as Cu†† and Ni††, are reduced to free metal. A slightly weaker base than ammonia, hydrazine hydrate dissociates at 170°C.

$N_2H_4—H_2O=N_2H_4+H_2O$ and above 350°C N_2H_4 breaks up into $3N_2H_4=N_2+4NH_3$

For wet preservation and initial hydralnic processes, a temp. of 70°C to 90°C for fill water may be maintained with a pH range from 8.5 to 9.5

Administration of Chemicals

As this paper particularly refers to a possible hydraulic test followed by wet preservation, details are more applicable to the above schedule.

Hydrazine for scavenging residual oxygen from the fill water and ammonia to boost the alkalinity to the desired extent are to be used. Refer to graph at Fig. 2 and 3 for the calculation of the amount of chemicals to be mixed in accordance with the residual values desired.

There are two ways of introducing the chemicals:

1. Demineralised water inquantity required, depending upon the total volume of boiler

refer to equation 1) is taken in the fill tank, whose temperature is raised to 90°C and kept by direct steam heating. Predetermined quantities of chemicals are added and mixed with the water in the tank. The water can be thoroughly agitated for even mixing of the chemicals through mechanical stirrer or by keeping recirculation of the pump on for such period, till samples collected from various levels of the tank (samples can be collected from gauge glass drains provided at different levels) show almost the same analytical data. i.e.

i. pH
ii. Temp.
iii. Electrical conductivity
iv. Residual hydrazine content.

Now the water in fill tank is fit to be taken inside the boiler unit.

2. Alternatively, precalculated amount of hydrazine and ammonia are kept in a separate chemical tank in a diluted form and introduced into the suction of the fill pump.

Here it should be kept in mind that the rate of dosing of the chemicals needs timely alteration in proportion to the rate and quantum of water being pumped in. Otherwise mixing will be uneven.

Where there is no facility to heat up the water in order to effect a better reaction rate between hydrazine and oxygen, activated carbon filter can be inserted at the delivery of the fill pump. Activated carbon is a good catalyst in increasing the reaction rate between hydrazine and oxygen even at ordinary temperature. At an elevated temperature, the reaction rate between oxygen and hydrazine is geared up and this also ensures quicker and better formation of magnetite coating.

Cold demineralised water without any addition of chemicals is to be taken into the boiler from fill tank through fill pump. The manholes of the drum have to be kept open and water taken through bottom headers, allowed to rise and overflow through drum manholes till the ejection is fairly clear, colourless and free from visual suspended impurities. Now the water course is to be diverted through economiser and allowed to overflow through manholes of the drum. These two operations ensure cleaning of economiser and water wall tubes and prevent carryover of suspended impurities to superheater columns. The manholes may be closed and water level further raised and water allowed to fill in super-heater columns. Water is to be allowed to overflow through all the vents till the ejections through various vents are free of air bubbles and suspended impurities. With the fill pump the pressure may be raised to a maximum of 10 Kg/cm^2. Now the other pump may be used to raise the pressure slowly and steadily till the desired pressure is attained.

(During normal operation condition, the boiler unit is subjected to high pressure, temperature with alkaline water inside. But this condition cannot be created during hydraulic. As such the pressure is usually raised to 1/4th excess of working pressure, say for instance, if the working pressure is 100 kg/cm^2 the unit should withstand successfully upto a pressure of 100+25=125 Kg/cm^2 for a minimum of 15 mts without any drop in pressure).

If there is any drop in pressure, the leaking spot has to be located and leakage sealed in a suitable manner.

In order to locate any leakage during hydraulic a little quantity of sodium salt of Tetra Bromo fluroscene (Eosin Red) may be added to the water in fill Tank. The dye is red but shows a brilliant fluorescent in ultra violet light and even pin holes can be easily and readily spotted.

Once hydraulic is over, the water from boiler may be drained to waste. To further continue with preservation work—fresh demineralised water has to be taken in fill tank and, as suggested earlier, the required amount of hydrazine and ammonium hydroxide are added, besides raising the temperature to 80° C or 90° C.

This conditioned water, may be taken through bottom headers and diverted through economiser and filled in superheater columns.

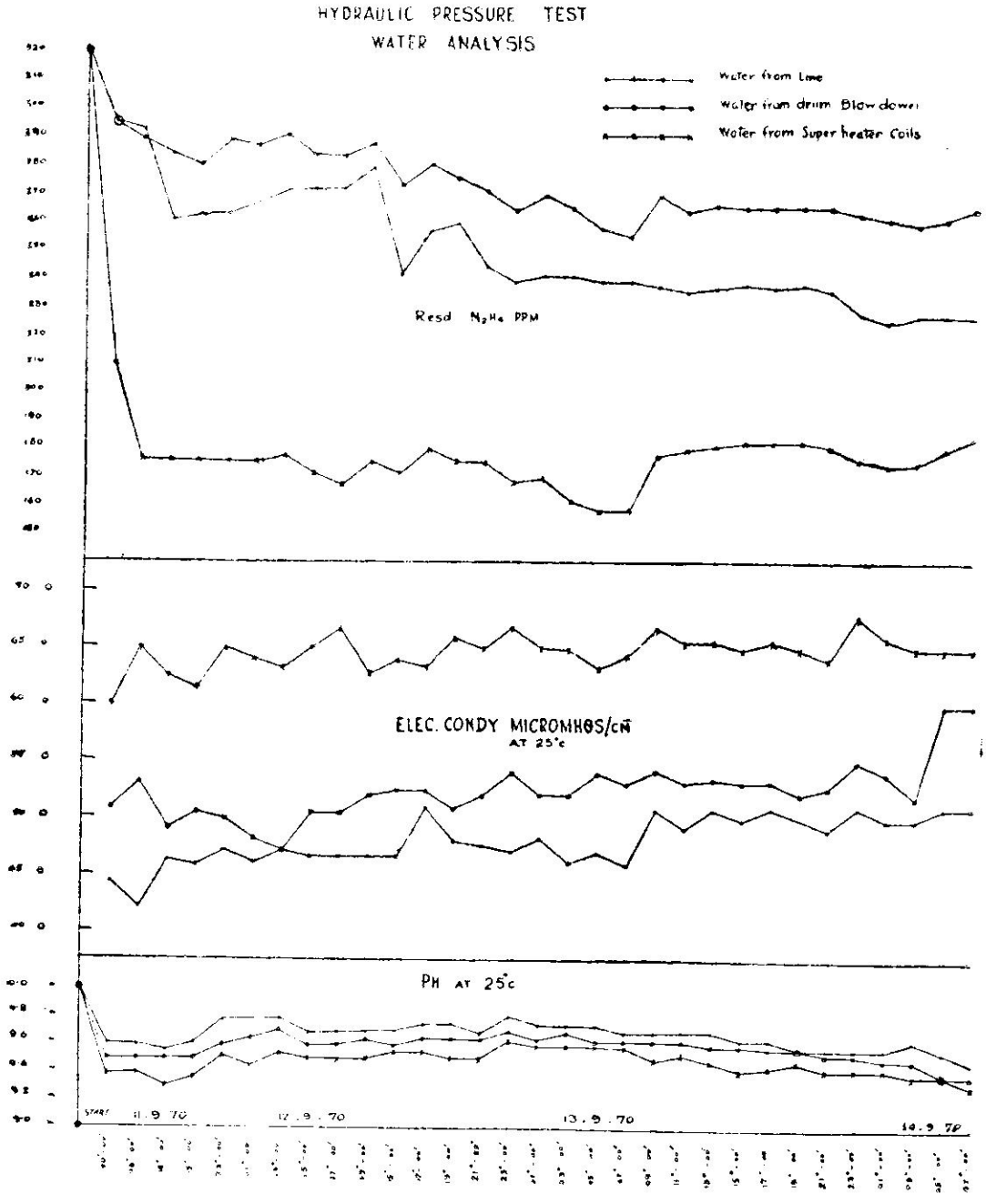

HYDRAULIC PRESSURE TEST
WATER ANALYSIS
Water from Lime
Water from drum Blow down
Water from Super heater Coils
Resd N_2H_4 PPM
ELEC. CONDY MICROMHOS/cm
AT 25°c
PH AT 25°c
START
11.9.70
12.9.70
13.9.70
14.9.70

Fig. 4

Water may be allowed to overflow through super-heater vents. Sample may be collected from super-heater vents and analysed for residual hydrazine content. Overflow may be continued till the ejection shows a hydrazine content nearly equal to that of the water in fill tank. Now vents can be closed and pressure raised with the help of fill pump upto 10 Kg/cm². This will prevent seeping of atmospheric air into the boiler. Now the unit is wet preserved. Regular bi-weekly samples may be collected from boiler drum through blow down sampling point and super-heater columns. Samples have to be analysed for pH, electrical conductivity and residual hydrazine content.

It is to be seen during preservation period, that pressure is not allowed to drop much. It should be always maintained between 7 to 10 Kg/cm_2.

During the initial stage, even though there is no ingress of atmospheric oxygen, N_2 H_4 will be consumed in the process of conversion of Fe_2 O_3 to Fe_3 O_4. This consumption will come to a stop as soon as the conversion is over.

Whenever, residual hydrazine content drops below 80 ppm, the water in the boiler may be drained to fill-tank and fresh hydrazine and ammonia added to boost the value to the desired extent. Again as practised earlier, the water may be taken to boiler and unit kept under pressure.

The authors have successfully wet preserved a boiler of 100 Kg/cm² working pressure with 300 tons/hr. of steam evaporating capacity for more than 20 months at a stretch.

A typical hydraulic test results data in graphical representation is shown in Fig. 4 for ready reference.

For a boiler, wet laying off with Nitrogen cap is the most suitable procedure.

For units in operation, due to obvious reasons, if dry laying-off is preferred, the aim should be to drain the boiler hot at a sufficiently high temperature, so that the condensate in the superheater element gets evaporated by drawing upon the available heat from the furnace. A standard procedure is to do away with minimum flow requirement through the economiser as soon as the flue gas outlet temp. drops below 260° C. The boiler is drained through all the bottom blowdown headers for one minute each at a pressure of 8 kg/cm² to dispense with the accumulated sludge in the bottom headers. The boiler is drained completely as soon as the flue gas temp. drops to 170° C. through all the blow down headers simultaneously. If the boiler is not fast cooled, 8 Kg/cm² and 170° C might more or less synchronise. There is no necessity for further controlling the temp. while the water is drained at 8 Kg/cm², since 170°C—180° C. flue gas temp. cannot do any harm to the boiler tubes. It is also not necessary to regulate flow of draining and there is absolutely no risk involved in it. In cases where no fast cooling is warranted and the unit is to remain idle for a long period, it is better to allow the temp. to fall as gradually as possible by cutting out all draught fans and even closing the relevant gas dampers. Dry laying-off, if, not practised carefully, may lead to disastrous after-effects. On the contrary, one can be sure of what is practised in wet laying schedule; Periodical checking of the fill water will bring to light the actual condition and at any time, with short notice, the unit can be brought into service, while this cannot be the case with units wet-laid-off.

Concluding, if adequate precaution is taken and, as detailed, things are practised during initial hydraulic and wet preservation time, there is no reason why a unit cannot be commissioned successfully without any trouble. ●●●

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Utilisation of Waste and Byproducts of Coal Industry

S Ranga Raja Rao* & PN Ash*

Out of the annual production of 75 million tonnes of coal in our country, 22 million is small-sized slack coal, which has very little ready market. Coal dust, middlings, rejects, slurries are also products that consumers look down upon. These could be made marketable with a little effort at altering their form. The Central Fuel Research Institute had been working in this direction for some time and they have perfected processes for better utilisation of these products. The work done by the Institute can be very significant inasmuch as a good amount of coal that would have gone waste can find a place in industrial and domestic fuel consumption.

SOME wastes are invariably produced in every industry. It is well known that utilization of these waste products improves the process economics of the main product of the concerned industry. In some cases byproduct utilization improves the overall economy of the main product. This paper deals with some of the processes developed at Central Fuel Research Institute for utilization of waste and byproducts of the coal industries.

Byproducts of Coal-Mining and Preparation

In coal-mining practice, about 30 per cent of the coal produced is of a size less than 1 inch (known as slack coal) and finds little ready market. Due to increased mechanisation in mining and subsequent coal processing, the amount of fine coal material produced is continually increasing and accumulates in pit heads and processing plant sites. Again, in the coal washing process two or three products—cleans, middlings and rejects—are produced depending on the scheme of washing. In this process, *cleans* are the desired end products and *middlings* and *rejects* are the byproducts or waste products. *Slurry* is another waste product which is also obtained during coal washing. Their effective utilisation improves the economics of the coal washing process and the cost of the washed coal gets reduced.

Agglomerates from Coal Dust, Middlings, Rejects, Slurries etc.

In India, there are about 800 coal mines, producing about 75 million tonnes of coal annually. The slack coal produced is of the order of 22 million tonnes, out of which about 7 million tonnes are coal dust (-1/8"). The twelve coal washeries are presently treating about 11 million tonnes of coal per annum, producing about 2.75 million tonnes of middlings and about 0.6 million tonnes of rejects. The present production of washery slurry is more than 1 million tonnes.

For utilization of these waste products,

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processes have been developed at CFRI during its studies on coal beneficiation, briquetting, production of special shaped fuel (Formed Coke Process), etc. The CFRI 'Formed Coke Process' (Indian Patent No. 99654) for production of domestic, industrial and metallurgical fuel is of special significance in the utilization of dust and slack coal from mines producing non-caking coal.

Briefly the process (Fig. 1) consists in grinding the coal to the required size consist, pyrolysing it in fluid bed, mixing the resulting char with a select part of the tar (obtained during pyrolysis), briquetting the mixture into desirable size and shape and curing the briquettes. Subsequent carbonization is done depending on their end use. Another recent CFRI process (under patent) of utilising the dust coal or pulverised coal slack consists in making spherical pellets using binders, both inorganic and organic, the pellets are then devolatilised to desired levels. Pellets of size up to one inch diameter have been made with point strength of up to even 70 kg having good handling characteristics. Their combustion characteristics have been satisfactory. This process is also applicable to utilising washery rejects. Washery slurry as well as the byproduct fuels which include middlings from the washeries can also be utilised. The process has been successfully employed with regard to coking coal waste products.

Smokeless Domestic Fuel from Undersized Low Grade Coals

About 5 million tonnes of low grade coking coals of Jharia coalfield are annually used for the production of domestic coke by a crude process called '*bhatta*' method. In this method the byproducts evolved pollute the atmosphere, causing severe health hazards: besides the smoke nuisance, the soft coke produced is of indifferent quality. Besides these, the major disadvantage of the method is that only sized lump coals are used, leaving behind a substantial portion of undersized (below 3 inch and above ¼ inch) coal unused. These can be employed in the stoker carbonisation process developed and patented by the CFRI to make smokeless fuels for the domestic market. This simple and inexpensive technique has been successfully employed for commercial production of domestic smokeless fuel at Hyderabad. The process does not require elaborate byproduct recovery systems which render the low temperature carbonisation process for the manufacture of domestic fuel uneconomic in small scale. In the CFRI process, which is applicable to coals from different fields and not necessarily restricted to Jharia coalfield alone, the coals are devolatilised in a moving grate inside a chamber where the evolving gases are burnt to provide the required heat for the process.

Upgrading of Small Coal

A specific project for utilization of small coal (a waste product) studied by the Institute relates to the small coal accumulation problem in the Bisrampur colliery (of National Coal Development Corporation) in Madhya Pradesh. Nearly one lakh tonnes of fine coal (—6 mm) of high ash valued at Rs. 30 lakhs get accumulated every year as a waste heap, causing economic strain, besides leading to hazards of fires in the mine site. In studying this problem, CFRI explored various techniques for upgrading of the fines including (i) selective and wet screening, (ii) separation in hydrocyclone and concentrating table and (iii) oleofloatation process developed by CFRI (Indian Patent No. 100675). The most attractive solution suggested by CFRI consists in wet screening at 1 mm, followed by upgrading the slurry in hydrocyclone which results in 80-90 per cent recovery with 16% ash as against 22% ash in the raw small coal. The beneficiated product finds ready market in the nearby power station.

Active Carbon from Coal, Lignite or Charfines

Earlier CFRI developed the process know-how for the production of active carbon from coal and lignite (also charfines, a waste product of carbonization of lignite). Active carbon is used as a gas and colour absorbent. The CFRI process consists of subjecting powdred coal or lignite to carbonization in static or fluidised bed, followed by activation with steam or steam and air under specified conditions. The process is

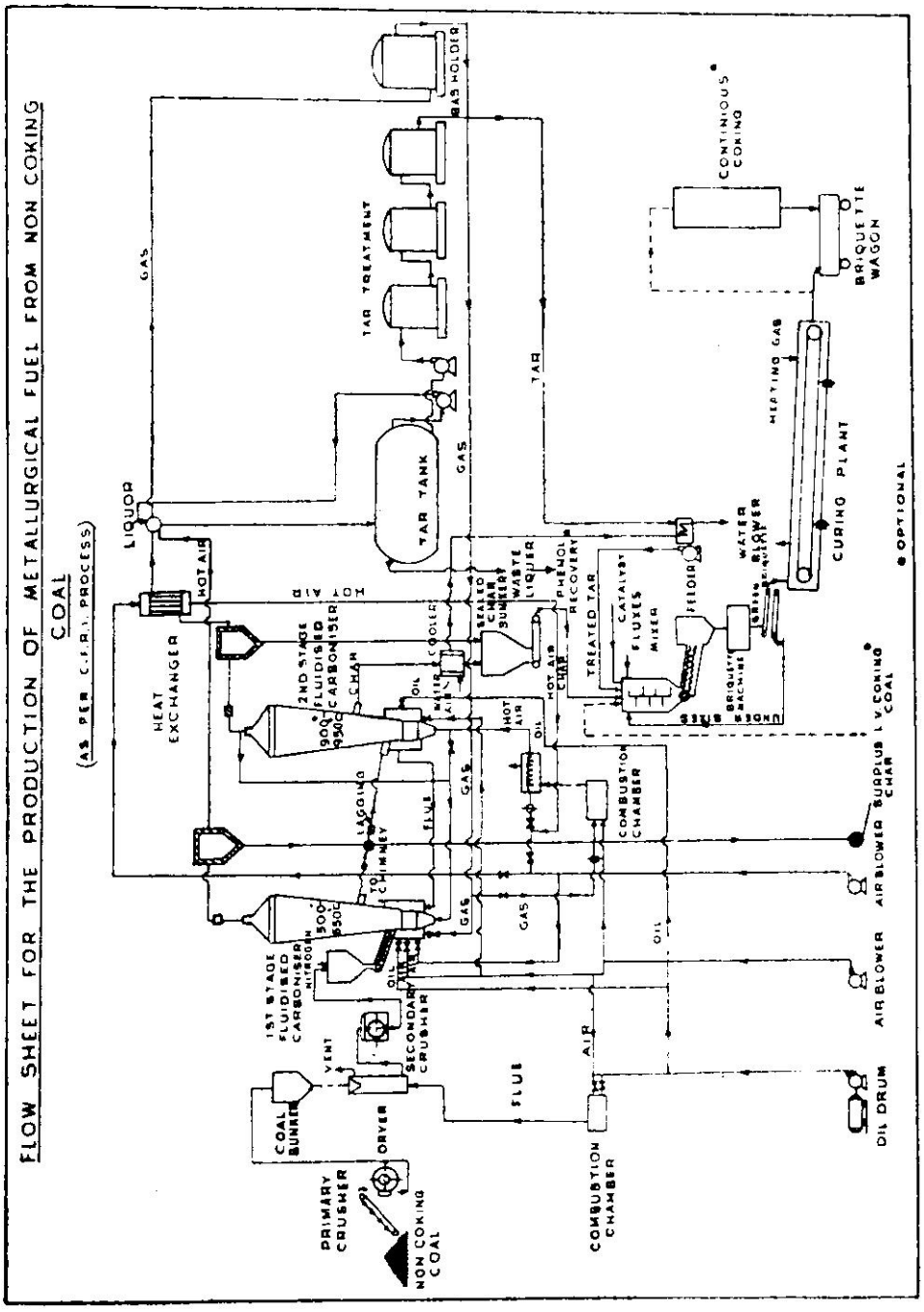
FLOW SHEET FOR THE PRODUCTION OF METALLURGICAL FUEL FROM NON COKING COAL
(AS PER C.F.R.I. PROCESS)
GAS HOLDER
TAR TREATMENT
TAR TANK
GAS
TAR
LIQUOR
HOT AIR
HEAT EXCHANGER
2ND STAGE FLUIDISED CARBONISER
800°C 950°C
1ST STAGE FLUIDISED CARBONISER NITROGEN
500° 550°C
SEALED CHAR SUMP
WASTE LIQUOR
PHENOL RECOVERY
TREATED TAR
CATALYST FLUXES MIXER
FEEDER
WATER BLOWER
CONTINUOUS COKING
BRIQUETTE WAGON
HEATING GAS
CURING PLANT
OPTIONAL
COOLER
OIL
WATER
HOT AIR
CHAR
LAGGING
FLUE
TO CHIMNEY
COMBUSTION CHAMBER
SURPLUS L.V. COKING COAL
AIR BLOWER
OIL DRUM
VENT
SECONDARY CRUSHER
COAL BUNKER
DRYER
PRIMARY CRUSHER
NON COKING COAL
AIR

Fig. 1

covered by patent rights. It has been licensed to Madras Government for commercial exploitation. Besides raw lignite, the process may be applied to lignite charfines which are obtained as a waste product of the briquetting process in the Neyveli Lignite Corporation.

Waste from Coal/Lignite Carbonisation

Coke Breeze: Coke breeze, especially the smaller size (—20mm) is a major waste product of the coke ovens. The present annual production of coke breeze (—20 mm) is of the order of 1 million tonnes. Because of high abrasivity, difficult combustion characteristics and fineness, their direct utilization in boilers is difficult. Table 1 shows the extent of coke breeze production in steel plants and merchant cokeries. The CFRI "Formed Coke Process" (mentioned earlier) is a major outlet for the utilization of this waste material to produce shaped briquettes for domestic, industrial or metallurgical use. The briquettes have compression strength as high as 3500-4000 lb/sq. in . These are thermally stable, uniform in size and can have any desired shape or size for ensuring good gas permeability and bulk density when charged into a blast furnace or foundry cupola.

Use of coke breeze for sintering of iron ore fines and production of lean gas are known. It can also be used in coking blend and producer plant. Besides low and high pressure briquetting of coke breeze, CFRI has also developed a process (referred to earlier) for the production of pellets from coke breeze as a fuel for domestic and industrial use.

Waste Product of Combustion

Fly ash: Fly ash is an industrial waste of thermal power stations. Its present annual production is about 3.5 million tonnes. By the end of the Fourth Plan, fly ash production is expected to be about 7 million tonnes due to expansion in the thermal power generation programme. At present only 7% of the total production finds use in admixture with cement and in soil stabilisation work. For enhancing further utilisation of this waste product, CFRI has developed two processes to manufacture bricks/building blocks, roofing tiles and the like, employing fly ash produced in the dry bottom pulverised fuel-fired power stations. In the first process, lime, sand and a few chemicals are used along with fly ash and pressure is applied to manufacture shaped products which are subsequently cured with steam for a specified period to yield products having required strength. The bulk density of these products is lower compared to that of the conventional clay-based bricks. The strength of these products, which do not require

Table 1
Coke Breeze Production in Steel Plants and Merchant Cokeries

Cokeries	Coal carbonized/ year in million tonnes	Coal production/ year in million tonnes	Coke breeze (20 mm—0) production year/ in million tonnes	Remarks
Steel plant cokeries				
Bhilai	3.44	2.62	0.265	Due to the renovation of the three batteries current production from Durgapur Steel Plant is lower than the figure shown.
Rourkela	1.67	1.27	0.139	
Durgapur	2.54	1.93	0.200	
IISCO	2.16	1.64	0.197	
TISCO	2.25	1.73	0.171	
Total	12.06	9.19	0.972	
Merchant cokeries				
Durgapur Coke Ovens Project	0.94	0.71	0.071	
Others	0.76	0.58	0.041	
Total	1.70	1.29	0.112	
Grand total	13.76	10.48	1.084	

any firing, increases with time and their compressive strength is similar to that of first class building brick. The other CFRI process has led to the production of sintered bricks similar to burnt clay building bricks. Both the processes are comparable with conventional methods in terms of cost of brick production.

UTILIZATION OF TAR & BYPRODUCTS

Processing Crude Anthracene Coke to Anthracene and Anthraquinone

The anthracene containing fractions constituting about 2.5% of tar are at present used as fuel and for the production of carbon black. At the present level of carbonisation practice in the country, a potential availability of over 9000 tons/year of crude anthracene is estimated. Anthracene occurs to the extent of 1% in high temperature coal tar and is usually recovered along with phenanthrene and carbazole as crude anthracene paste. These compounds are not recovered at present in the country, presumably because of low demand. However, in view of the importance of anthracene in the production of anthraquinone which is in demand in dyestuffs industry, CFRI developed earlier a process for the recovery of anthracene from the crude anthracene paste (containing 20% anthracene). By the CFRI process (Indian Patent No. 76682) for isolation and purification of anthracene which has been further improved (Indian Patent No. 114299), anthracene of 95 per cen purity is obtained. Phenanthrene and carbazole are obtained as byproducts during purification process of anthracene and can be utilised as starting material for synthesis of agricultural chemicals.

A process (Indian Patent No. 66293) has also been worked out for the vapour phase catalytic oxidation of anthracene under fluidized conditions for the production of anthraquinone with more than 90 per cent yield. The process has been handed over to a Consultant Engineering Firm for undertaking commercialisation. The present demand for anthraquinone in India is of the order of 1000 tons per annum.

Use of Neutral Tar Oils for Phthalic Anhydride Production

Neutral tar oils of coal tar containing naphthalene, anthracene, phenanthrene and other higher aromatic hydrocarbons form a cheaper base for the production of phthalic anhydride, for which there is an estimated demand of about 30,000 tonnes per annum in India. Of the neutral tar oils in the coal tar produced in the country, naphthalene oil alone constitutes about 29,000 tonnes annually. The price of refined naphthalene, which is normally used to manufacture phthalic anhydride, is about ten times that of neutral tar fractions. Using this raw material CFRI developed a catalytic vapour phase oxidation process (Indian Patent No. 54960) for the production of phthalic anhydride. The CFRI has also developed a new catalyst for the process. A pilot plant for the production of crude phthalic anhydride and a phthalic anhydride purification plant, with capacity 250 kg/day, are functioning at CFRI.

Resin from Coal Tar Oil for Hardboard Manufacture

CFRI has developed a process for the production of a water soluble thermo-setting resin from the mixed phenols occurring in coal tar oil. The resin has been found to be admirably applicable to the production of hardboards and moulded articles using waste fibrous materials as fillers. This technique is also applicable to cotton waste, asbestos powder, glass wool, plywood veneer, etc. A plant capable of producing 1500 tons of hardboard per annum is estimated to require a total capital outlay of Rs. 16.5 lakhs. The cost of hardboard production is estimated at Rs. 0.25to 0.50 per sq. ft. (depending on resin con tent of the board) as against selling price of Rs. 0.50 to 1.25 per sq. ft. depending on quality and thickness.

Xylenes from Benzole Fractions

Meta-xylene occurring to the extent of about 2.5% in coke oven benzole fractions finds little use while the para and ortho-xylenes are in great demand. Paraxylene is an intermediate in the manufacture of terephthalic acid required for the

production of polyester fibre of the terylene group. Ortho-xylene is a suitable starting material for the production of phthalic anhydride which finds an outlet in the synthetic resins and dyestuff industry.

A process (Indian Patent No. 105686) has been developed at CFRI for the catalytic vapour phase transformation of metaxylene into ortho and para-xylene. The process is capable of being operated on a continuous basis. The novelty of the invention lies in the development of a suitable catalyst using low-cost, indigenously available ingredients. The CFRI process consists of passing meta-xylene vapours over the catalyst under specified conditions when a mixture of the three isomeric xylenes in the equilibrium concentration is obtained. The ortho-xylene is separated by efficient fractional distillation and para-xylene by fractional crystallization.

Cyclopentadiene from Coke Oven Gas

Cyclopentadiene is present in coke oven gas to the extent of about 0.2 to 0.3 g. per cubic metre. This important intermediate is useful for the production of pesticides, heptachlor and aldrin. A survey carried out by the Central Fuel Research Institute indicates that the recovery potentiality of cyclopentadiene is about 100 gallons per day from a 5,000 tonnes per day coal carbonisation plant. This will increase substantially if the benzole forerunnings are adequately collected and treated. A method has been developed at CFRI to isolate cyclopentadiene from the benzole forerunnings in two stages. The first stage consists of obtaining a fraction enriched in CPD and the second one comprises its actual isolation as a pure compound, by subjecting the CPD enriched fraction to dimerization and fractionation. In view of the importance of cyclopentadiene for the production of camphor derivatives pesticides and other agricultural chemicals, it is felt that arrangements for recovery of this material should receive due attention.

Utilization for Tar Bases

About 2% of the coal tar constitutes the tar bases. In India, however, there is no plant for the commercial recovery of tar bases from coal tar fraction itself. The market for the tar bases is at present restricted to the lower boiling fractions such as pyridines, quinolines and isoquinolines. Pyridines and its homologues are recovered from the coke oven gas in plants where ammonia fixation is practised. The higher bases, quinoline and isoquinoline find use in the pharmaceutical and dyestuff industries.

On the basis of 12.5 million tonnes of coal carbonised per annum it is possible to separate by proper fractionation about 200 to 250 tonnes each of picoline isomers and about 750 tonnes of quinoline, assuming only 50% recovery of each. Quinoline can be recovered from tar, while picolines can be recovered from tar liquor and benzol as well. These compounds, though present in very small quantities, should be recovered as they are high-priced products.

The Institute studied the possibility of recovering the tar bases using the upward flow ion-exchange column technique. The efficiency was found to be of the order of 98 per cent. Of the nitrogen heterocycles, beta-picoline is used for the manufacture of nicotinic acid (an ingredient of Vitamin B Complex), 3-cyanopyridine, nicotinamide and the cardiac drug coramine. Alpha-picoline is an important raw material for the production of vinyl pyridine which is used as a copolymer with styrene. Pyridine finds use in a wide range of medicinal products such as antiseptics, bacteriostatic drugs, antihistamine, urinary analgesics, for treatment of respiratory infections etc. Quinoline can be utilized for the production of nicotinic acid by oxidation to quinolinic acid, followed by selective decarboxylation. Gamma-picoline is used for the production of isonicotinic acid, 4-cyanopyridine etc., of which the former is used for the preparation of tuberculostat. In the CFRI process isolation of isonicotinic and nicotinic acids from the mixture of pyridine carboxylic acids is accomplished by taking advantage of their differing solubilities in alcohol and aqueous acetone.

CFRI has developed an improved process for the production of the acids, esters or amides through the intermediate formation of the cyano-derivatives. Beta-picoline is converted to 3-cyano-derivative and gamma-picoline to 4-

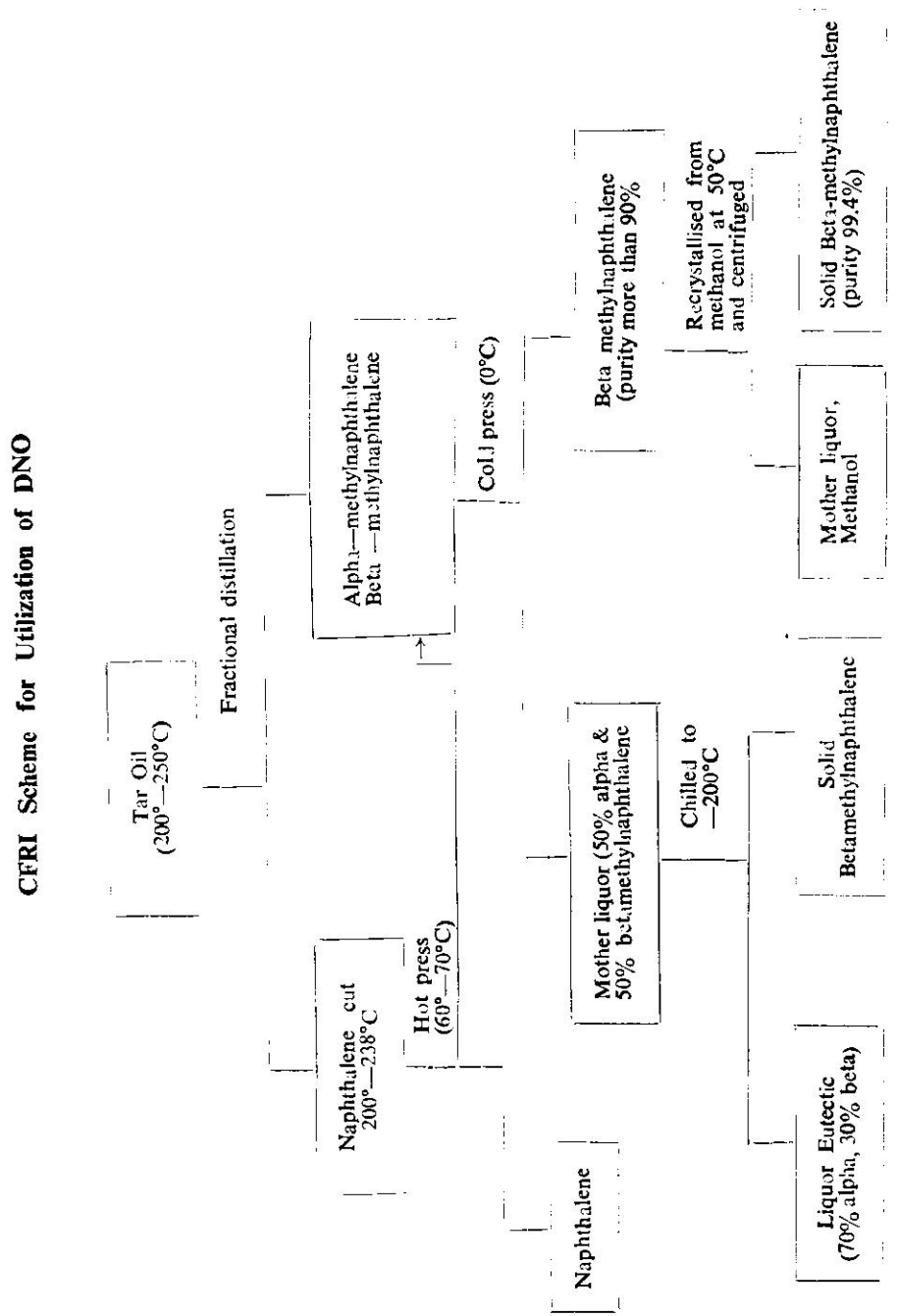
CFRI Scheme for Utilization of DNO
Tar Oil (200°—250°C)
Fractional distillation
Naphthalene cut 200°—238°C
Alpha—methylnaphthalene Beta —methylnaphthalene
Hot press (60°—70°C)
Cold press (0°C)
Beta methylnaphthalene (purity more than 90%
Recrystallised from methanol at 50°C and centrifuged
Mother liquor (50% alpha & 50% betamethylnaphthalene
Chilled to —200°C
Mother liquor, Methanol
Solid Beta-methylnaphthalene (purity 99.4%)
Naphthalene
Liquor Eutectic (70% alpha, 30% beta)
Solid Betamethylnaphthalene

Fig. 2

cyanoderivative by vapour phase catalytic reaction with air and ammonia. The reaction products are collected in suitable condensing system while unreacted material is isolated by refrigeration and recycled. The yield achieved is more than 90 per cent.

The bases may also find useful application for combating corrosion in petrol and diesel engines. If corrosion in the quencher is the problem, a possible solution may consist in injecting a spray of quinoline bases into the exhaust gases before their entry into the quencher. For refineries based on high sulphur crudes, such uses of tar bases may assume major importance.

Utilisation of Drained Naphthalene Oil—A Cokeoven Waste

Drained naphthalene oil (DNO), the oil left over after the removal of naphthalene, is produced in considerable quantities at the various steel plants as a byproduct during the production of naphthalene. Currently DNO is used as a blend with creosote oil. The composition of DNO obtained from the major coke ovens in India has shown that it contains about 5-20 per cent alkylnaphthalenes, besides a large proportion of naphthalene which apparently escapes recovery and finds its way into DNO. While firm figures for DNO yields are not available, it is estimated that it will be of the order of 1200 tons/yr. depending on the tar distillation capacity. CFRI has established the possibility of production of naphthalene from the alkylnaphthalenes present in tar using a low-cost, indigenously available catalyst. Procedures have also been developed for isolation of the two isomeric methylnaphthalenes which are important for the production of fine chemicals and organic intermediates in the pure state from tar oils and DNO. The CFRI scheme has been shown in Fig. 2.

Conclusion

Taking into consideration the large bulk of economically valuable waste and byproduct materials of the various industries whose utilisation adds to the cost-benefit of the main product, it is worthwhile thinking in terms of establishing a National Industrial Salvage Organisation to tackle the problems on a national scale and in a concerted way. Such institutions exist in some of the foreign countries, for instance the one in the United Kingdom.

Acknowledgement

The authors record their gratitude to Dr A Lahiri, Director and Mr AK Moitra, Assistant Director, CFRI for their courtesy in scrutinising the draft prepared and for their valuable suggestions. Thanks are due to the Director also for his permission for publication. ●●●

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Novel Rewards for Employee Suggestions

Some companies find that novel rewards help to elicit cost-saving suggestions from their employees. A subsidiary of one national company allows employees to use special reserved parking places for a month. Participation in the suggestion programme at a steel plant claimed about 25 percent when the firm started doling out trading stamps on top of cash bonuses. One bank offers employees shares of its stock for valuable suggestions.

—The Wall Street Journal

Standards: Their Role in Planning

RP Nadkarni*

Standards are useful for measuring performances in respect of manual work, machine operation, materials consumption, financial results etc. Standards must be realistic and should be set after proper time/method study. Standards are particularly important for materials consumption which constitutes nearly 60 per cent to 80 per cent of the total cost of the product. Even a small reduction in materials consumption through proper standards can lead to considerable savings. Machine's output standards are useful in planning out machine load on a product floor, in deciding performance and or replacement of a machine and in evaluating machine capacity requirements for targeted outputs. Standards for manual labour and for financial performance are also useful for efficient operations.

"YOU'LL require 5 metres of cloth for two shirts, Sir", says a tailor to his customer.

"Take these pills—three a day for four days. You'll be all right", says a doctor to his patient.

"Give me a $6\frac{3}{4}$" hat, that's my size", says a customer to a milliner.

We very often hear such conversation in our day to day life. This is a rather loose talk in terms of some standards or other. But industry calls for rigorous standards to measure performance of men and machines, materials and money.

What is a standard then? A standard is the measure of accomplishment that is capable of being attained with normal effort or resources for a specified activity done under specified systems/methods and conditions.

Utility of Standards

Standards are used for measuring performances in respect of manual work, machine operation, materials consumption, financial results or an individual's efficiency. The utility of standards can be readily appreciated from the following examples.

A Production Engineer would not be able to forecast his material requirements in the absence of standards for raw materials, nor would a Foreman be able to demand necessary output from a defaulting machinist if he doesn't know standard output per unit of time.

A cost accountant would be able to compute the cost of a product only if costs at various stages of manufacture are known; and a Development Engineer could estimate the number of machines required only if he knows production targets and machine output capacities.

A sound incentive scheme can never be introduced unless and until output standards have been properly set. Disciplinary action against an employee can be taken easily if certain codes of conduct are laid down.

Examples could be multiplied endlessly. But the point is that standards have multifarious

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uses both in forward evaluation and retrospective reviews. In other words, it is standards that pave the way to progress.

It is important to remembr that a proper time/method study needs to be conducted before establishing standards, or else, standards could become either 'too tight' or 'too loose'—both of which can seriously affect output and employee morale. Standards set thoughtlessly, particularly for an incentive scheme, can wreck employer-employee relations or turn out to be uneconomical.

Importance of standards can be appreciated since the cost of materials forms nearly 60 per cent to 80 per cent of the total cost of a product.

Standards for Materials

The importance of standards for materials consumption can be well appreciated as the cost of materials forms nearly 60% to 80 % of the total cost of a product. Even a 10% reduction in material consumption through proper standards would mean a saving of 6 to 8 per cent in the total cost. And when we say materials, we mean not only raw materials but also auxiliary materials such as fuel, oil, lubricants, steam, electricity, water, packaging materials, general stores, spare parts, etc.

We could evovle standards in terms of materials consumed per unit of output or vice versa; for example, 'x' kg. of steam per kg. of coke consumed, 'y' kilowatts of electric power consumed per tonne of production, 'z' cubic metres of process water used per kg. of product and so on.

In industries like cement, steel, chemicals, it is possible to establish standards for consumption of various materials in terms of what is known as 'equivalent tonne' of product so as to bring to a common denominator the various 'stage costs' for easy comparison and control.

A chemical factory was able to reduce its process water requirements by 15% just regulating the water supply within the specified standards. A manufacturer of metal containers could effect a saving of 8% in the materials cost by selecting proper size of steel sheets and reducing wastage. At a sales depot, the material stocks were slashed down by Rs. 3 lakhs through fixing of suitable ordering levels and economic ordering quantities. In another light engineering factory, substitution of stainless steel by polythene for a certain component reduced the cost of the product by 18%.

Standards for materials can thus be set by using techniques like consumption study, waste control, inventory control, value analysis etc.

Standards for Machine Output

Probably, machine cost comes next in the order of importance. Machine output standards are useful in planning out machine loading on a production floor, in deciding performance and/or replacement of machines and in evaluating machine capacity requirements for targetted outputs.

Standards for machine output can be determined by carrying out machine utilisation study. Such a study should include both time study. and method study. If carefully conducted, it can bring to light the suitability or otherwise of the type and design of machine, its location with respect to other machines or the manufacturing process etc.

Standards for materials can be set by using techniques like consumption study, waste control, inventory control, value analysis, etc.

In a limestone quarry, the establishment of footage to be drilled per drilling machine per shift revealed that 4 drilling machines were enough to meet the requirement of stone, thus rendering 2 others surplus. A transport contractor could decide on the basis of standards worked out for truck trips per shift that 16 trucks were adequate and that 2 additional trucks which he contemplated purchasing were not necessary.

Standards for Manual Labour

Manual work has been probably the first to have standards set, obviously because most of the manual operations can be timestudied. Other techniques of work measurement such as production study, work sampling, use of synthetic time standards, predetermined motion time studies etc., can also be employed to set standards for manual work. It is advisable to carry out a method study before setting time standards. Standards for manual ouput are useful for computing workforce for targeted production, basing incentive schemes, comparing individual performances etc.

While setting manual work standards, suitable time allowance should be provided for compensation against fatigue, working conditions, personal needs, unavoidable 'forced illness' for no fault of a worker etc. In short, any standards that are set should be realistic.

Standards for Financial Returns

We have so far been talking only about standards for materials, manpower and machines whose performances are measurable to some extent or other. Are there, however, standards for measuring financial performances of a company?

Thoughtful managements have worked out certain indices for evaluating financial performance from time to time, important among which are:

Profit on turnover—a certain percentage of turnover is set as standard for profit to be achieved.

Return on capital invested—a certain percentage of capital invested is set as standard for profit to be achieved.

Output to input ratio—a ratio of profit (output) to total expenditure (input) is set as standard to be achieved.

Such indices help management in taking correct timely action by reviewing financial performance in terms of these indices, locating high cost areas and channelising resources profitably.

Qualitative Standards

We have discussed quantitative standards so far but can we set qualitative standards? Yes, but such standards are difficult to evolve as qualitative measurement of performance is not an easy task, examples being characteristics of an individual such as honesty, integrity, ingenuity, sociability, leadership etc. Evaluation of those traits in an individual tends to be subjective and so the evaluator has to guard against this danger of subjectivity.

Are Standards Static?

Not at all. In fact standards have to be dynamic. They need to be reviewed at suitable

intervals of time or whenever market conditions, product design, manufacturing process, working method, materials, tools, equipment, layout, environments and/or working conditions change. Re-examination of standards, where an incentive scheme operates, is very necessary if any of the above-named factors change. A change in the factor can affect the output and hence an employee's earnings.

It is advisable to inform the concerned personnel whenever standards are set or revised so that they can be trained to achieve them.

Industry at large can considerably benefit through a healthy exchange of views on the various standards employed by the various organisations in any particular industry.

Standards and Standardisation

After having discussed everything about standards a doubt may arise as to what is the difference between setting standards and standardising. One should remember that these are two distinct things. Setting of standards means establishing a desired level of performance, whereas standardising means conforming the output to the standards set.

Standardisation and Variety Reduction

This article would not be complete without a mention about "variety reduction". After having set standards and started producing according to them, does the story end? No. One may be producing a large variety of articles/products or consuming a wide range of materials but one must ask oneself whether all these varieties need be produced or used? Is it economical to use or produce such varieties? Could some of them be eliminated to make the organisation or operation more profitable?

Hundreds of examples could be cited as to how economical it turns out to be to reduce variety! A company benefited by Rs. 30,000 annually by reducing 37 varieties of lubricants to merely 6. Another large office saved Rs. 12,000 a year by limiting the sizes of paper envelopes to 9 instead of 28 that existed previously. A cosmetics factory could raise its overall profitability from 5% to 7% by discontinuing the manufacture of some of the products.

It is painful to see a large variety of textile and other fabrics being manufactured, a large variety of houses and structures being constructed, a large variety of fancy goods being produced most of which are luxurious. It is ironical and unfortunate that it is going on unchecked at a time when our economy and society at large can ill afford it. Indian industry must carry out standardisation and variety reduction forthwith and set standards for materials consumption if national economy is to be improved. We must not be carried away by the Western styles, culture and ways of life. We must not emulate them blindly in any sphere, as not all of their ways are suited to us. We should adopt only those which are economically and socially profitable and useful to us. We must remember that the affluence the Western world is enjoying today is the rich dividend of their austerity, standardisation and variety reduction practised in the past. Let us practise these now so that we may be affluent a few decades hence.

Need for Compiling Industrywise Standards

Industry at large would surely benefit if a healthy exchange of views takes place on the various standards employed by the various organisations in any particular industry. Their experience in establishing, using and revising standards could be pooled together and disseminated for mutual benefit through productivity bodies or respective industrial associations.

COMPUTER AND CORPORATE POLICY—Proceedings of the Alumni Conference held at Bombay on March 13 & 14, 1970—Published by: Indian Institute of Management, Ahmedabad, Pages 127, Price not given.

Computers have made their appearance in many industries, as well as research and other organisations in India. Even the educated laymen are in the knowledge of the applications of computers, particularly through the wide publicity received by the spectacular achievements in space. The impact of computerisation has been felt by the common man in advanced countries through its applications in the said fields which affect the individual and his well-being. There is no doubt that computers are going to play an important role in the eoconomic and social affairs in India too in the coming years.

It is most appropriate at this juncture to organise seminars on the topic of computerisation to exchange experience, understand the potential and evaluate proper and effective use of computers. Such seminars should also aim at removing the misunderstandings with regard to the use of computers so that a 'climate' could be created for the effective introduction and use of computers. The book "Computers and Corporate Policy," being the proceedings of the Seminar is, therefore, most welcome, particularly from the point of view of contributions made by several specialists drawn from different backgrounds—scientists, managers, trade-unionists, actual users, management educationists and consultants.

The contribution of the Trade Union representatives to the seminar clearly indicates a positive cooperation of trade unions towards computerisation in the country. "Opposition of trade unions in our country to the computers is not on the question of principle of the introduction as a modern technology..,computers have come to stay.... To the trade unions, the horse of the modern technology of computers is at large, rough, and uncontrolled. It cannot be neglected and allowed to go in its own way. Nor it is advisable to kill it. The wise course is to control it, tame it, bridle it and ride over it. On the basis of this pragmatic approach, trade unions look upon the modern technology of computers, as an instrument of national economic growth."

The above views of the trade unions reflect a welcome change from the understood (or misunderstood?) views of labour attitude to ban the computers altogether. If this is the approach of the trade unions, this augers well for the effective use of computers as a force for national economic growth. Further, as reported in the proceedings "the Unions categorically declared that they would not object to the expansion of computerisaton in scientific, educational research, defence, weather forecasting, telecommunications, medical diagnostic services and some other activities."

The Conference reports success in the convergence of viewpoints on a possible computer policy, but emphasises divergence as regards the government's existing policy of encouraging manufacture of limited capability computers as against the actual requirement of the installations of computers with greater systems capabilities. The converging point of view relates to viewing computers not as cost cutting devices, but as instruments for national growth providing services in wider economic spheres both in private and public corporations and the government, with the installation of computers of large-scale capabilities. With the availability of the operational research and mathematical skills of a high order in the country, software programmes could be developed and even shared with the other developing countries.

The seminar has thus made a positive contribution. More conferences and seminars of this nature should be organised to focus attention on various aspects pertaining to the introduction and effective use of computers. Equally important is to arouse public opinion towards this new development which can also contribute towards the comfort, convenience and safety of people through computerisation in the area of "Social Information System".

—MVV RAMAN

THE DEVELOPING ECONOMIES AND THE INTERNATIONAL FRAMEWORK, S Venu, Publishers : Orient Longmans, 1971, Pages 301, Price Rs. 27.50

The book has five parts—Part I: The Trade problems of Developed and Less Developed Countries; Part II: Foreign Aid; Part III: Trade Problems Among the Developing Economies; Part IV : The Socialist and Developing Economies; Part V: The International Liquidity Conundurm.

Section A of part I gives a brief survey of the trade and income trends of the Less Developed Countries (LDC). This is followed by a presentation of diagonosis by some economists. The author is of the view that the process of economic development has created a "Great Gap" for LDCs, due to higher price of capital goods and the maintenance imports *vis-a-vis* slow increase in unit value of traditional exports. LDCs' exports has become a 'lagging' rather than 'leading sector' due to inelastic supplies.

Section B starts off with the analysis of discrimination in international trade particularly tariffs and quota restrictions. Evaluating the Kennedy Round, the author is of the view that it has contributed more towards strengthening the trade relations of Developed Countries (DC) more than between DC and LDC. For LDCs the 'ancient regime' of discriminatory preferences, internal taxes on imports from LDC continues to be unaffected. Author suggests that the DC should try to give tariff preference so as to offset the high money costs of producing manufactures in LDC. The promises of UNCTAD II seems to the author as mere 'lip service' paid by the rich.

International Commodity Agreements are mentioned alongwith some of the schemes such as Development Insurance Fund, OAS schemes, Meade schemes, etc. However, the author thinks that "As a means of income or resource transfers from the rich to the poor, commodity control schemes must be treated as generally inefficient".

Some of the techniques of export promotion in LDCs is discussed such as cash subsidies, multiple dual exchange rate, tax credits, import entitlements, drawbacks, export duties and exports bonus vouchers.

Part II deals with Foreign Aid both public and private investment—Section A deals with public aid defined as the flow of funds from "Governmental sources in the donor country to government or private donees in the recipient countries". The rationale for this is that economic growth means modernisation with some emphasis on heavy industry. This requires imports 'unrequited' by exports, thus, the need for external assistance. Sources and quantum of Aid with special reference to India is presented.

Economic effects of foreign aid for both donor and recipient countries is discussed with an illustration of Formosan success story. However, the author cautions that "the example cannot be held up to other underdeveloped nations". While discussing PL 480 Aid to India, the warning is given for timely action because "almost a third of India's money supply is now 'owned by the U.S.' in idle balances". The World Bank and IMF attempts in solving debt servicing burden has been more of a "temporary palliative". This section concludes with the discussion of UNCTAD II regarding Aid and Development. Section B starts with the definition and types of foreign private capital flow to LDCs. The rationale of this capital flow has been "of a defensive nature—to maintain market shares in a growing economy and in the short-run may not be profitable". Quantum and trends of flow with special reference to India is presented. Economic effects of private capital inflow are analysed with reference to resource allocation, price stability and balance of payments, etc.

Part III deals with the trade problems among the LDCs. The rationale of economic integration among LDCs and payment agreements has been given with a few illustrations such as India's attempt towards trade liberalisation, CACM, and Development Banks in LDCs.

Part IV deals with the relationship between the Socialist Bloc and LDCs. Starting with the rationale of Bilateralism, the trend in trade and Aid between India and Socialist Bloc is given. While discussing the economic effects of bilateralism, illustrations of UAR and Indonesia are given.

Part V deals with the current topical interest, viz. international liquidity conundrum. The problem is one of confidence, liquidity and adjustment. The plans to reform the international monetary system are many and varied. Some of them are presented in the book such as credit creation, increase in the price of gold, flexible exchange rate and creation of multiple reserve units. In spite of the implementation of SDR Scheme, the prophetic statement of the author seems to have come true viz., "the liquidity problem will again rear its head to plague the reformers in spite of repeated conferences and a mixed bag of solutions". (a la U.S. $ at present).

A brief comment on UNCTAD II and the Asian Drama appears in Appendices.

The title indicates that it discusses developing economies and the international framework. Sometimes the author has identified LDCs with India (e.g. Part II—Section A Ch. III and Sec. B II., Part III—Ch V and Part IV—Chs. II and V where the problems are specifically of India and not LDCs in general). As LDCs are a heterogenous group, this emphasis may sometimes lead to assuming India's situation as identical to that of LDCs as a whole. It would have been better if the author had concentrated on Indian economy and the international framework. This would be more appropriate title and the author could have concentrated on the problems of Indian economy substantiating the similarity or diversity or other LDCs in the present changing international framework.

The analysis is good but too brief. Of course, the size of book and the nature of the topic dealt would be too ambitious to expect more detailed analysis. The Author has succeeded in integrating and presenting lucidly various facets of the problem. However, the facts are moving faster and this has created an 'information gap' between the time of writing and its publication. It would be beneficial if a revised edition is brought out with inclusion of the recent developments in international scene such as GSP and liquidity problem, etc. It is also suggested that a brief resume at the beginning of each part be included.

The author has succeeded in his modest hope of presenting "a bird's-eye-view of the problems involved", but much is desired in depth of analysis of "the lines on which a solution could be effected". For the beginner to be initiated in international economies, the book is a good stepping stone. The book acts as an appetiser

—increasing the interest of the reader to get involved and induces him for further study.

—DR SS RAMU

FOREIGN TECHNOLOGY AND INVESTMENT: A Study of their Role in India's Industrialisation, Ashok V. Desai, Published by National Council of Applied Economic Research, New Delhi, 1971, pages 170, Price Rs. 25.

Import of foreign technology and foreign investment have remained subject to a fairly long-drawn debate, which is yet largely inconclusive. Various theories have been propounded in this context including the case for importing old and discarded technology from advanced countries. Sides have been taken by different countributors to the fray and the whole issue is yet to emerge as clear-cut as necessary, from the cloud of arguments on both sides in the debate. The factual basis of the debate has, however, suffered from fragmentation of different kinds. The present study offers much more than merely joining the fray in that it helps forming proper perspective in which the issue requires to be considered. It is a terse, analytical approach to the question with fairly frank and forthright observations and assessment of the role that foreign technology has so far played in India since 1951 to 1967, based on a close scrutiny of all the agreements approved during the period. Dr Ashok V. Desai, whose work it is, has given the study an incisive quality that should provoke wider discussion. It is a highly readable document, despite the large number of statistical tables and charts on various issues dealt with in the study. The detached over-view is indeed a distinguishing characteristic of the study.

The analysis is sharp and pinpointed. The details given in the tables are comprehensive. More than half of the book is occupied by the tables. The tables are, however, given as appendices, so that they do not disturb readability. While the account given and the observations of the author bear the impress of a thorough digestion, the author has done well to keep aloof. The purposive interpretation of facts is interesting insofar as it leads to an assessment of national policy and a set of suggestions for changes. It is not necessary that all these suggestions and recommendations will be found acceptable. Disagreements do not reflect on the quality of interpretation and analysis of the author.

One may join issue with the author on almost every aspect of the question dealt with in the study even on the basis of the data furnished. The pointer as to the paucity of organized information is real. So is the point that major policy decisions seem to have been taken in the past on the basis of inadequate knowledge of various issues involved. But the real bottleneck in this respect is that even where information has been available, it has hardly been susceptible of cross-checking. The author appears to believe that the price of technology has a close relationship with its quality, at least that is how he argues that high price of imported technology should not be a deterrent when its quality justifies such price. While voting in favour of cheaper technologies may have been in the long run costlier, the other side of the coin is that relatively indifferent technologies have been imported at a high price in a number of cases, indifferent in the sense that better quaity would have been available if discretion could be exercised. In the context of import of technology it is necessary to consider the binding aspects of loans and aids from foreign countries. Moreover, private arrangements, business connections, etc., have led us to import technology at high costs with different conditions attached. In some cases repetitive imports of such technology have taken place not only from the same countries but also from the same firms. Experience of other countries which initiated a take-off on the basis of imported technology may not repeat, indeed has not repeated in our country. The action taken by the Government of India in favour of sub-licensing imported know-how as late in the day as 1968 is understandable, to say the least.

On the question of export stipulations in the foreign collaboration agreements, the author raises several important issues that derserve serious consideration in formulating policies in

this respect. He seems to believe that surplus capacity, as witnessed during the period of the recent recession in this country, has proved a more powerful stimulant than stipulations in the agreements about exports. In developing this argument the author has underplayed the need for having to pay one's way in the matter of foreign exchange commitments arising out of such agreements. Earlier, Professor Bhagawati also advocated the installation of capacities greater than the current production needs. However, to motivate enterprises to instal excess capacity would require some more forceful reasons than have been put forth so far. Moreover, there are some other considerations that should be taken into account. During the recession, most firms exported under duress. Apart from the question of earning profit or other benefits arising out of exports, firms, did export to avoid a shutdown, sacrificing the proverbial half! The stipulations in the agreements anticipate normally. The firms are supposed to earn their way so that the repatriation of profit or other foreign exchange payments do not deplete the existing foreign exchange resources. Neither is, of course, a business proposition and may not be sustainable in the long run. But till the time the strain on foreign exchange continues, there should not be any relaxation of such stipulations, particularly in conditions in which the normal business motivation for exporting is absent, exports resulting in losses almost in all cases other than the main traditional items like jute and tea.

Lifting of the present restriction that all collaboration agreements must be approved by the Government as recommended in the study may have an undesirable effect on indigenous technology, which is normally put at a discount even where the quality is comparable. We have indeed quite a few instances to cite in this respect. Recognition to our scientists and technicians has been lukewarm, till they have earned such recognition from other countries. The conditions in which they have been expected to do their job have also not been ideal. To make collaborations open may put a permanent seal on their zeal. The avession to indigenous R & D findings will be borne out in the cases of jute manufactures of non-traditional types, fertilisers, etc.

Dr. Desai seems concerned about the reduction of the administrative workload. Apart from other considerations, experience suggests that the Central Secretariat and its suburbs are not interested in reducing workload on the administration. The propensities noticeable are of the other kind.

The provocative manner in which the author puts forth his views makes the study an absorbing account indeed. It should be read widely by all those who are concerned.

—DR. P. CHATTOPADHYAY

PAPER WORK SIMPLIFICATION, A.V. Deshmane, Published by: IBH Publishing Co., Bombay, Page 164, Price : Rs. 4

"Paper Work Simplification" by A. V. Deshmane is a pleasant stimulant for executives, and if his objective is to create an awareness about the magnitude and implications of the problems of paper work, he has accomplished this admirably well. Himself a business executive, Mr. Deshmane is keen all along in his writing, to weave humour into serious strands of problems of management. The book is replete with quotations and examples from foreign countries, which may suggest that "O & M" is unknown to India Industry. References to achievements of O & M in Government and Industry, in the country, could have provided validity and relevance to the management problems confronting the executives in India.

Mr Deshmane has stated only a part of the truth in mentioning that savings in administrative cost contribute directly to profits. The rising trend of office cost reflected by ever-growing number of its employees, restricts scope for savings in administrative expenses. The contribution of 'O&M' specialist is probably not so much in the matter of actual savings in overhead expenses, but in ensuring that office expenses (a small portion of the total cost) are such, which meet management's demand for information and knowledge. In other words, proper

understanding about the role of 'information' in management and, the office function as the processing agency, has to be developed anew. This alone will contribute to a reduction in the 'cost of delay', rather than cost of office services. The real challenge before the 'O&M' expert is to raise the productivity of knowledge which alone would revitalise the management function.

Mr Deshmane has rightly stressed on the 'O' part of 'O&M' when he states 'no high quality avails where rule of order fails'. It will be presumptuous to imagine that 'orderliness' is the task of 'O&M' man alone. 'O&M' man is a designer and he can give a pattern for others to weave. Lack of sustained efforts for maintenance of system once installed is the main weakness of Indian Management and no wonder sophisticated techniques are discarded as unsuited to Indian environment after initial enthusiasm. It has rightly been stated in the book that 'persuastion is an ideal, no doubt, but coercion at times becomes a necessity'. Since administrative cost is generally invisible and also masquerades, the O&M man has to develop a new awareness among executives engaged in the production, distribution of finances, etc., and for this the patronage of top management is essential.

The place and programme for the O&M specialist in an organisation has been referred to rather casually. It need be made known to executives in the country that for the development of the organisations, someone, call him 'O&M' man or otherwise, has 'function as a 'change-agent'. He would plan and bring about purposeful change—slowly and steadily—and also innerate management methods suited to the technology and economic environment. Since paper work is inextricably mixed up with planning execution and feedback of all activities, the 'bridges of understanding' (to quote Mr. Desh mane) have to be built by 'O&M' man.

The author probably did not want the size of the book to be more than what an executive can read during his journeys and, therefore, has purposefully avoided the irksome details about techniques of work measurement and manpower planning which are the core 'O&M' topics. Anyway, the author never intended writing a text book for students or O&M practitioners.

—J PRASAD

INDUSTRIAL PSYCHOLOGY (Fifth Edition), Joseph Tiffin and Ernest J McCormick, Publishers: Prentice-Hall of India Private Limited, New Delhi, Year: 1971. No. of Pages 682, Price: —Rs. 16.

The book presents concepts, procedures and experimental results which throw light on human behaviour in industrial situations. The focus is on research information which forms a basis of personnel practices current in industries. The major aspects dealt with in this book include personnel selection, social context of work, working conditions and consumer behaviour. The sections dealing with personnel selection and social context of work are of particular interest to personnel technicians in Indian industry as they provide detailed and useful information on current trends and problems.

The presentation is simple and easy to understand with plenty of illustrative pictures, diagrams and figures. Information presented stimulates interest of the reader as it meets immediate needs of persons idvolved in dealing with industrial behaviour. This book is of common interest to managerial personnel as well as personnel specialists. While it provides plenty of information regarding procedures used in dealing with human problems and results obtained, no rules of thumb are given. In the context of our industrial situations this book would provide inspiration and guidance for carrying out similar work to evolve appropriate approaches to local problems. Statistical material provided at the end of the book would be of great interest to personnel specialists, particularly those engaged in selection work.

It is a very readable, stimulating and useful book.

—DR M YOGA

DECISIONAL PHENOMENA AND THE MANAGEMENT ACCOUNTANT, Dr P. Chattopadhyay, Published by : Institute of Cost & Works Accountants of India, Calcutta, Pages 207, Price : Rs. 20.

The book is a research study intending to highlight the phenomena connected with decision making in Indian Industries and the role the Management Accountant can and should play.

Author in his survey of the present Indian Economy dwells on national income, industrial growth, Corporate Sector and Public Sector undertakings. He emphasises the need for market orientation to curb recessionary trend and to face the coming challenge of competition and consumer selectivity. Infusion of efficiency in enterprise operation through professionalism in management is called for. His observation, on re-constitution of Board of Directors of public limited companies, following Banking Laws Amendment Act of 1968, with experts in Finance, Marketing, Accountancy and Production, deserves due consideration. Need for adequate profit to meet dividend, sustenance and growth requirements is valid for Public Sector undertakings also. Discussion on topics like potentiality of industrial co-operatives, need for fast development of communication and transport facilities, mobilisation of rural surplus and channelisation to industrial sector through investment trust companies, Government fiscal policies and their impact on the economic growth, would have been useful addition.

Budget and standard costs are used as basis for measurement of efficiency at the sectional level. Fixation of piece-work rate and formulation of incentive scheme can be done on standard time arrived through work study. But Job Evaluation study to determine relative worth of each job in the enterprise can be done quite independent of work study. Increase in productivity indicates incremental gain in output level over input, resulting in reduction in cost. The gain of increased productivity can be shared by the consumers, employees, enterprise and the share-holders. Increase in productivity will create more demand necessitating increase in production and employment in the chain. Inter-firm comparison can be used to measure efficiency at the company level. But the units selected for the study should be comparable in respect of investment, capacity, employment etc. Associations of Industries, Chambers of Commerce and Industry, and Government may give due consideration in using this tool to increase efficiency at the enterprise level.

Author's discussion on "Unborn Enterprises" is a valuable part of the book. Preparation of a realistic Project Report by a team of competent experts is an essential pre-condition for the success of an enterprise. An enterprise burdened at its initial stage with permanent high-cost factors will hardly be able to compete in the market and any cost reduction effort later by the enterprise will not touch even the periphery of these problems. Co-ordination is necessary at the installation stage; application of PERT will be helpful in project planning and control and controlling project cost. Experiences of the Public Sector enterprises as shown in statements I-VII are very lively indicator of faulty project planing. Entrepreneurs of "Unborn Enterprises" will be greatly benefited through a study of this portion of the book.

The author discusses at length the need of an expert like Management Accountant in an organisation, his functions, position in the organisation, relation with other experts in the organisation. Management Accountant should be at the receiving end of not merely accounting information, but also that concerned with different technical and functional areas like engineering, personnel, marketing and finance. He is expected to play the role of adviser to the top management, and as such, should not be burdened with Budget and standard cost routines. We should try to locate a person who with his training, experiences, aptitude, inquisitiveness and analytical mind will thoroughly understand the problem, scrutinise it, analyse, arrange, present and interpret the data in a manner that balanced decision-making becomes an easier task.

In the last two chapters, the author dwells on Decision Theory and Decisional Techniques. Though the theory has been treated quite elaborately, all the techniques discussed have not been

given proper coverage. Application of D.C.F. technique has been brilliantly exposed; discussion on the concept of the technique would have been useful. PERT deserves an elaborate discussion. A deeper discussion on Operation Research with a case study would be useful to enlighten the reader as to the efficacy of this technique in decision making. The discussion on Synergy effect and its importance in decision on diversification and expansion may inspire inquisitive reader for a deeper study about the technique. Inclusion of case studies from Indian industries is an important feature of the study.

In the context of increasing enterprise activities and complexity of problems, decision-making is becoming a difficult as well as an expert job, and the Mangement Accountant with his expertise and knowledge can play a very important role in guiding top management in this respect. The author has driven home this point very effectively.

—NC CHAKRAVARTY

FUNDAMENTALS OF SOCIAL SURVEY AND RESEARCH METHODS, by Dr S Dandapani, Published by: Scholars Foundation, Delhi; Pages 91, Price : Rs. 8

The environment of change which we are currently witnessing in India has a great relevance in the context of social considerations which have become uppermost in the strata of our society. To make these realistic there is need for undertaking surveys based on sound research methods. In this direction the fundamentals of social survey in research methods which take into account sampling, questionnaire, codification, processing of data and writing of reports will have to be analysed and applied keeping in view the nature and the type of problems.

Social research in our country has to be divested with the discovery of social values, formulation of social policy in planning and increasing productivity as a means to prospercty. Fulfilment of these objectives will call for a critical analysis of the groups which will have to be backed by the analysis of the projections, source of data and the processing of such data based on research techniques for determining the yardsticks for follow-up action, and assessment of possibilities of their application.

Dr S Dandapany's book on "Fundamentals of Social Survey and Research Methods" is a unique venture of its kind which has fulfilled a long-felt need of codifying the various stages of research methods in a scientific and yet in a simple manner for serving as a useful guide not only to the research students but also to the planners, administrators and the field workers.

In the entire presentation, which is of a high order, the sequencing of subjects for a person who does not have enough research background, however, appears to be slightly confusing. Likewise, the inter-relationship of various topics also needs to be exemplified.

—DR A N SAXENA

SMALL INDUSTRY PROCEDURES HANDBOOK, by KK Mehan, Published by: Productivity Services International, Bombay; Pages 208, Price Rs. 22.50.

The emergence of small scale industries as a significant sector in the national economy particularly during the last decade and a half has brought to the fore the need for further accelerating the pace of various extension services including those which are directed towards building up new entrepreneurship. This has assumed new dimensions particularly for those cities/towns and rural areas which hitherto have remained exclusively dependant on agriculture as a source of income. In these areas the entrepreneurship is latent particularly because there is an illusion among them about the exercise involved in setting up an industrial unit and partly it is their ignorance about the potentialities which exist in these areas for this purpose. The 'Small Industry Procedures Handbook' by Mr K.K. Mehan certainly fulfills, if not fully, to a considerable extent a long-felt need of having an authoritative book for making an entrepreneur conversant with the various procedures and formalities involved in

planning and implementing a project in small scale industries sector. Although the Small Scale Industries Development Organisation of the Government of India, various State Governments, Associations of Small Scale Industries and the like have been bringing out booklets on various aspects of the procedures involved in setting up a small scale industrial unit and facilities which are available for the purpose, Mr Mehan's effort has to be commended for presenting all these aspects in a consolidated form.

The book is broadly divided into seven sections. The first three sections deal with the definition and scope of small scale industries, various steps for the planning of a project and general pattern of assistance. A creditable attempt has been made to give a list and functions of various Central and State Government agencies and also non-official organisations, etc. which are engaged in promotional work for the development of small scale industries. Not only there are a number of agencies for providing assistance to the entrepreneurs, there is also multiplicity of application forms which are to be filled in before an entrepreneur gets all the facilities necessary for bringing a unit into production. It is in this context that Mr Mehan in various sections of the book has described certain useful guidelines for a layman, particularly residing in a smaller town who is desirous of setting up an industrial unit. However, the treatment of the subjects like supply of raw materials and financial assistance from various institutions including the nationalised banks deserved analysis in greater detail. The author, for instance, has not made a mention of the new outlook given to a policy of providing financial assistance to small scale industrial units following the nationalisation of 14 major commercial banks in the country. In fact, he should have mentioned in the beginning itself that "the entrepreneurs are well-avdised to make an effort for knowing the latest policy and procedure in getting a specific assistance in this regard."

One of the main difficulties faced by prospective entrepreneur is the choice of right type of industry for himself. Although the Handbook guides him in the preparation of project report and selection of location, etc., the utility of the handbook would have increased further if proper guidelines for market and demand surveys, identification of locally-available raw materials suitable forindustrial processing had been added. Nevertheless, all prospective entrepreneurs and those already in industry who desire to expand or diversify their production activities would find this handbook very useful. It can also be recommended for extension workers in industrial development as a useful reference book.

—DR JD VARMA

SECRETARIAL PRACTICE IN INDIA, JC Bahl, Publishers: N.M. Tripathi Pvt. Ltd., Bombay 2, Pages: 654, Price Rs. 16.

The ninth edition of the book published in April 1971, after the abolition of Systems of Managing Agency and Secretaries and Treasurership, has been thoroughly revised and brought uptodate with much improvement over the previous editions and provides in a single volume full information on all aspects of Company Law and Secretarial practice.

The author has dealt with the subject of Secretarial Practice most exhaustively topicwise, making each chapter complete in itself, with addition of specimen of standard Secretarial Forms and forms prescribed under the Act, for easy reference, for complete procedure to be followed.

The special chapters on specimen of important resolutions and on foreign companies and addition of original circulars and reports of prominent companies and 4 appendices makes the book an authoritative guide for company administration and a moderately priced ready reference for company secretaries.

—CC SUTARIA

FARM PRODUCTION CREDIT IN CHANGING AGRICULTURE, BM Desai and DK Desai; Published by: Indian Institute of Management, Ahmedabad, April, 1971; Pages 104; Price not mentioned.

Tremendous is the influence of farm credit in Indian economy and as such, according it a proper place becomes crucial for the whole planning process in the country. Ever since the Report of the Rural Credit Survey Committee (1954), there has been a noticeable change in Indian agriculture in many directions. In fact, there has been a change in the total complex of Indian economy, both industrial and agricultural. Now the role of the Government has been increasing in many spheres. Major commercial banks have been nationalised and now they are reckoned with as an important source of agricultural finance for raising agricultural productivity and for bringing about permanent improvements in agricultural operations.

Simultaneously, a new strategy in agriculture has been made possible by two factors viz., technological and psychological. While the former relates to the emergence of the new fertilizer-responsive seed, the latter involves a general change in the attitude of the cultivator towards the adoption of the seed and the fertilizer. In the background of such changes, the present book under review thoroughly examines the factor of farm credit in its various ramifications . Investigation was made by the Centre for Management in Agriculture at the Indian Institute of Management, Ahmedabad into the problem of credit needs pertaining to farmers of Baroda district in Gujarat. This study was financed by the Ministry of Food and Agriculture, Government of India. Its total sample size was one district, four talukas, eight villages and forty-eight farmers. Both the survey and the case methods were used in the collection of empirical data that we find in abundance in the seven chapters of this book.

The characteristics of sample farmers were studied by classifying them into different groups according to farm sizes. As the major accent was on studying the use of existing credit and the demand for additional short-term credit which meets working capital requirements, the farmers were classified according to the availability of working capital. Keeping this classification as a control, factors like size of farm, soil types, irrigation facilities, family size, ownership of farm machinery and equipment, age, education, caste and occupation were examined thoroughly.

The anaysis revealed that the average credit available with farmers was less than the credit required at the optimum level of working capital, and as such, they had additional credit absorbing capacity. The additional credit demand per acre did not, however, exceed Rs.190 in any case. At the same time, the existing availability of working capital including credit with the farmers was not inadequate to meet the technological changes in agriculture. In this context, it would be worthwhile to know that as per the estimates of the All-India Rural Credit Review Committee, 1969, the annual demand for credit shall be of the order of Rs. 2,400 crores by the end of 1973-74. As against this, the estimated availability of credit in 1967-68 was around Rs. 570 crores which meant that supply of credit required to be increased by about Rs. 1,830 crores within a period of six years.

For meeting the new challenges of agricultural credit, no one will dispute when the authors suggest that the executives of the credit agencies should assume an unconventional role in that they need to be more than a mere supplier of credit. "To be specific, they will have to be a catalytic agent of development. Further, the credit executives would need to formulate the policies on a disaggregative basis." That is to say, instead of following a 'scale of finance' rigidly, the credit needs of farmers should be found out taking into consideration their available resources and also assuming that a farmer would be induced to adopt new technological changes.

For meeting the requirements of working capital, i.e., short-term credit, the cooperatives follow the crop loan system for which the Reserve Bank of India has evolved scales of finance. The authors find this system as defective in as much as the credit need is fixed only on average basis

which is rather impractical. Therefore, they with the cooperatives to shun their rigid attitude. So far as the banks are concerned, their insistence that the farmer should be an owner-cultivator for the grant of short-term credit, has stood in the way of making farm credit as a factor in development. The study points out that the loaning policies pursued by the cooperatives in the district of Baroda, especially for short and medium-term loans, were not in conformity with the guidelines provided by the Reserve Bank of India in its manual. They were too aggregative, rigid and did not take into account the requirements and repaying capacity of farmers adequately. The long-term credit policies also suffered from these weaknesses. The credit policies of the commercial banks were, by and large, flexible but farmers did not like the insistence for contribution to the tune of 25 per cent of the purchase price of the materials or equipment for which loan was demanded.

An interesting observation is that more developed areas tended to receive more credit than the less developed areas. The authors, therefore, conclude that along with the disaggregative approach in loaning policies, if credit agencies would shift their emphasis from the well-developed areas to the less-developed areas and from 'rich' to 'poor' farmers, this would help in decreasing the income disparities without impeding agricultural development. However, to me this suggestion does not seem to be convincing as production is not just a function of finance; rather a number of other factors are equally important. Besides, what guarantee is there that credit to poor farmers shall not be dissipated for non-productive purposes? And then, more credit to them at the cost of rich farmers is no solution for reducing income disparities which problem, in fact, must be solved in the totality of our economic structure.

—NAVIN CHANDRA JOSHI

FOREMAN IN INDUSTRY, HJ BAKHRU, Published by : Bambay Productivity Council, Bombay. Pages 28, Price : not given.

The title "Foreman In Industry" is reproduction of a long article published earlier in the News letter of Supervisory Development (Vol. VII, No. 2). The Bombay Productivity Council deserves praise for recognising the need for a comprehensive but brief guide book for foremen in Industry. Publication of this article in the form of a booklet is a good service, as the News letter has a limited circulation.

The author has dealt with the concept of a foreman, his job and authority and his position in the organisation. Besides discussing the general function of a foreman, he has covered some of the important functions in detail which relate to cost control, development of foreman and performance appraisal.

While a strong point of this booklet is that it could be considered a good checklist of functions of foremen. its weakness lies in the fact that some of the points which needed elaboration have just been listed. Probably the author presumes that our foremen can elaborate these points in the light of their experience. It does not therefore. fulfil the needs of those who expect promotions to the cadre of supervisors or foreman but do not possess the requisite experience. Perhaps, the revised edition of this booklet will take care of this aspect. The author may also consider the possibility of adding a chapter on problems of supervision.

The author has admitted in the introduction of the booklet that status of Supervisory Personnel is considerably weak in Indian Industry but he has not discussed the factors which are responsible for this situation.

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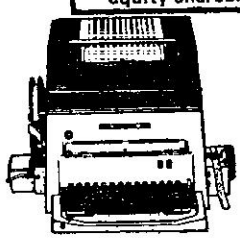

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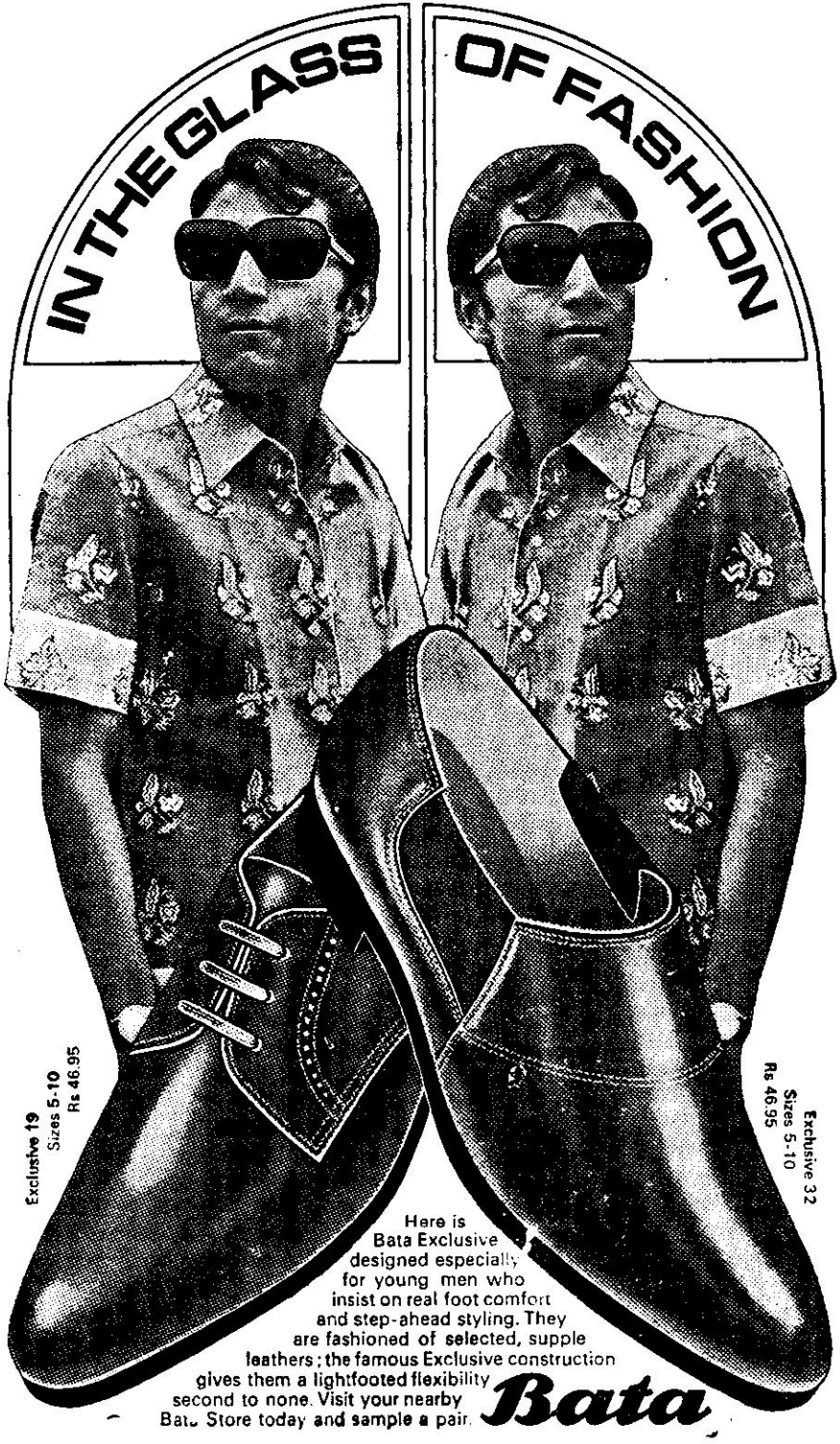
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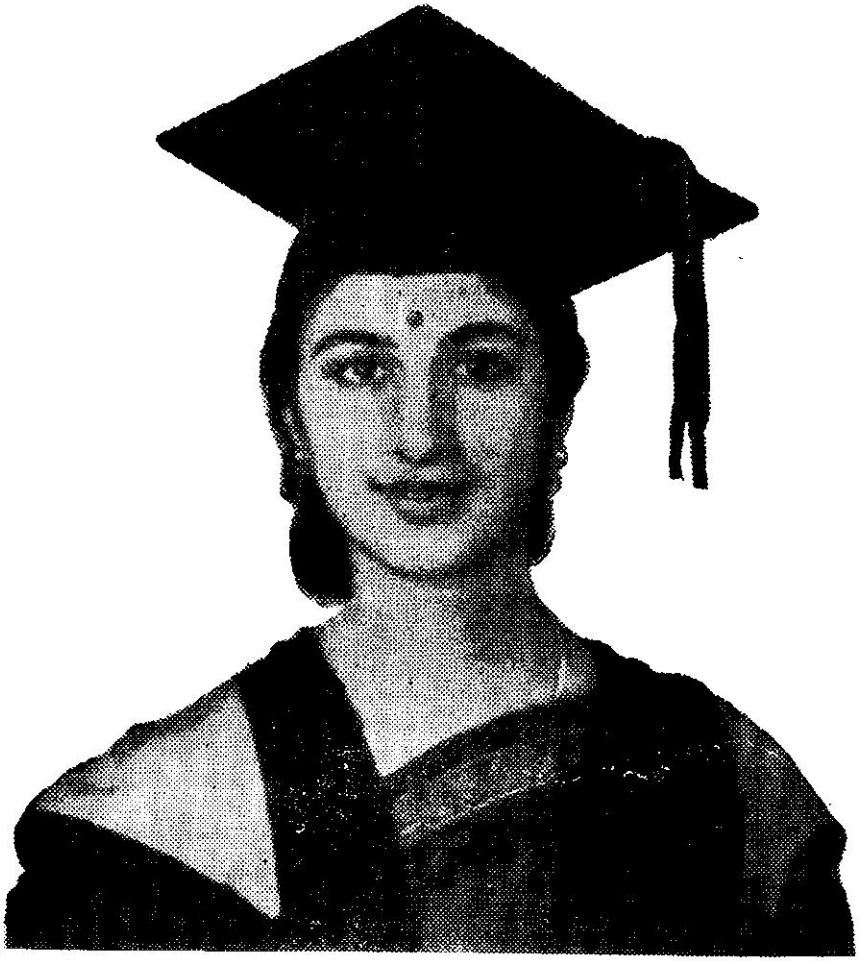

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