

Editor : Vol. No. Oct.-December
VS CHOPRA XII 3 1971

PRODUCTIVITY

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Maximisation of Capacity Utilisation and Productivity

Moinul Haque Choudhury*

There is need to make optimum utilisation of the resources at our command—whether it is machinery, equipment, materials or labour. Dependence on imported know-how and equipment also cannot be continued for long. The industry must find its own feet and sooner the better. In this context, our engineers, scientists and managers have a crucial role to play.

For optimum utilisation of our manpower resources, deep involvement of the workers is very essential. To achieve this goal, industrial units can follow the British model of productivity agreements at the unit level, which can create a congenial climate for increasing production. For deriving an all-round advantage in terms of cost, output, quality and fuller utilisation of the scarce resources, the need is for making greater use of productivity techniques.

IT needs no gainsaying that the hastening of the process of development in our country squarely hinges on the pace of our industrial development. It is also true at the same time that there are many stumbling blocks in the way of our progress in this direction, for instance, lack of adequate capital resources, machinery and equipment, equitable and rational distribution of raw materials and so on, and that we have no other alternative but to make the best use of whatever we have in our hands.

The question of under-utilisation of the installed capacity in our industries has been agitating our minds for quite some time. Many of our industries, chiefly textiles and steel-based industries, went through certain production diffi-

culties as a result of which, coupled with low investment, the rate of increase in the industrial output tended to decline. However, given the will and the effort, it will be possible to achieve higher levels of production in a wide range of industries.

All those concerned with the situation will have different versions to tell as regards the various factors that prevent us from maximising utilisation of the potential. The management will have its own reasons to advance. The labour leaders would analyse the situation differently, and so on. It cannot be said that these different versions will have no validity at all. But if we decide to keep our objective of social good in view, all these differences would automatically disappear. In fact, the success of an enterprise today is increasingly judged by the contribution it is able to make to the public good and not merely by its profitability index. This has been realised even in the home of the private enterprise—that is U.S.A.

*Based on the inaugural address by Mr. Moinul Haque Choudhury, Union Minister for Industrial Development and President, National Productivity Council of India, at the Seminar on Maximisation of Capacity Utilisation and Productivity organised by the Federation of Indian Chambers of Commerce & Industry, in New Delhi on 30th August 1971.

Factors Responsible for Low Utilisation of Capacity

Some of the impediments that are responsible for the low utilisation of the capacity in various industries, are said to be raw material shortage, paucity of bank credit, labour unrest, transport bottleneck, power shortage and so on. It is also likely that too many Departments and Corporations are dealing with the industries, allocation of raw materials control and regulation, etc. The Government is, however, quite alive to its responsibility in these matters and it is doing everything possible to ease the situation through various measures, including initiating, for instance, steps for better coordination between the various Departments which need to be consulted in issuing Letters of Intents/Licences and the Departments and Corporations which plan import and allocate raw materials. Unless it is done, our rate of growth will not stimulate. In fact, some streamlining is absolutely necessary. Further, imports of raw materials, components and spare parts, where these were found indispensable, have been allowed on a more liberal scale than ever before. Yet, in the ultimate analysis, the industry has to find its own feet. In this context, we have to make optimum utilisation of the resources at our command—whether it is machinery, equipment, materials or labour. A recent experience bears testimony to this important aspect.

A recent survey by the Ministry of Irrigation and Power showed that one-third of the construction equipment had been lying idle for quite some time for want of spare parts and components awaited from abroad. Now, this is a lesson for us.

Need for Self-Reliance

Dependence on imported know-how and equipment not only robs us of our valuable time, foreign exchange and production capacity, but also causes hardship to all concerned. Our engineers, scientists, and managers have a special role to play in avoiding recurrence of such situations. Not that they have not done so until now,

All they have to do is to put a little more vigour into their efforts.

Recently, some distinguished Indian scientists, on their own, pointed out in a meeting with the Planning Commission that foreign collaboration in technological fields had a stifling effect on Indian initiative, and pleaded for developing indigenous technological endeavour to the maximum extent. This is the right spirit in which we have to approach all our problems. Industries too have to lend a hand in this by making a larger provision in their budgets for research and development. As things are, the amount spent by them in this direction is pitifully small. It is simply because of these considerations that the Government intends to give importance to such industries in the Fourth Plan as provide for import substitution and export promotion.

Besides these somewhat technical aspects of the problem, there are also other factors of similar nature which have prevented us from exploiting our production capacity to the full. Lack of adequate cost-consciousness, for example, is one. Obviously, the existence of a seller's market has prevented our manufacturers from evincing interest in the need for reduction of costs. Even the quality of their products has not been up to the mark. Perhaps many of them do not realize that lack of quality does not pay in the long run. They must also dispel their misunderstanding that quality control adds to the costs; scientific analyses have shown that it actually reduces the total costs, for it brings in its wake significant economies in production and distribution. They should not feel shy of making full use of the knowledge and expertise accumulated by organisations like the National Productivity Council in these spheres and achieving optimum results.

Productivity Agreements for Optimum Manpower Utilisation

So far as the question of making the fullest use of our machinery and equipment is concerned we can proceed without any qualms of conscience. But, when it comes to the question of making the optimum use of our manpower

resources we have to be very careful, for, workers are not machines. At the same time, their deep involvement in the achievement of our objective is very essential. This has to be done by providing proper incentives to them to give of their best, and also training them according to the needs of the situation. When the workers put in their best efforts, it also devolves on us to share with them, in an appropriate manner, the gains accruing as a result of such efforts. It is being realised that no tailor-made formula for determining the extent of their contribution, along with those of the other factors of production, is readily available. Perhaps no single formula may also be available in the near future, as the quantum of the share of each factor of production is bound to differ from industry to industry. In fact, the National Productivity Council, which is a tripartite organisation representing employers, labour and government, has been working hard for some years now to arrive at an agreed approach and it is hoped that it will soon succeed in presenting a national consensus. And yet, even if we cannot produce a nationally acceptable formula immediately, we can at least try to follow the example of countries like Great Britain where Productivity agreements at the unit level have helped a great deal in solving this problem and creating a congenial climate for increasing production. Some industrial units in India have also found this system workable to the satisfaction of both the management and workers. We must go for such agreements in a big way.

Productivity Techniques Offer All Round Advantage

Of the total cost incurred in the manufacture of a product, as much as 60 to 70 per cent is accounted for by the materials cost. Therefore, if we could economise on our materials resources through their efficient management, rather than economize on labour, there would perhaps be no need to get into trouble over layoffs, retrenchment, etc., and this would also suit our conditions under which unemployment has to be avoided at all costs. It is true that in many instances, the lack of fuller utilisation of the capacity has been due to inefficient running of the units, and this has given rise to the phenomenon of the so-called "sick" units. But it cannot be said that the

For deriving an all-round advantage in terms of costs, output, quality and fuller utilisation of our scarce resources, the need is for making greater use of productivity techniques.

workers have no obligation in all these efforts. Unless they too realise their responsibilities and put in their best in exploiting the production potential fully, this would go against their own interest.

For deriving an all-round advantage in terms of costs, output, quality and fuller utilisation of our scarce resources, the need is for making greater use of productivity techniques. With each improvement in operations through skilled management comes a lower manufacturing cost and better quality which, in turn, bring increased earnings to the workers and a lower selling price for the consumer. With the reduction in the selling price, the consumer is enabled to buy more products in quality and in variety, and to lead a better life. This is, what can be called, real progress.

Some economists have estimated that it would take us many decades to catch up with the industrially-advanced countries. We need not take such a pessimistic view. In fact, having built up in our country a sound infrastructure for industrial growth, if our entrepreneurs, managers, technologists and scientists pull their weight together, we can succeed in reducing this "development gap" in a much shorter time. □

Excess Capacity and Factor Productivity: Some Considerations

S Venu*

The purpose of this paper is to analyse the semantics of the term capacity, the correlation between capacity utilisation and factor productivity and the implications of the 'capacity-productivity nexus' for economic growth. The first part of the paper examines the various meanings attached to the term capacity and seeks to distinguish between capacity and *capital* utilisation, a distinction which, in the writer's opinion, is vital for a clear understanding of the subject. Subsequently, productivity concepts are brought into the argument for inter-linking purposes, discussing in this framework the reasons, real or imaginary, for the prevalence of under-utilised capacity. The conclusions are that no single 'villain of the piece' can be identified as a constraint on capacity utilisation nor can we postulate a correlation between *overall* factor productivity and capacity utilisation.

INDIA offers a fascinating environment for a study of industrial growth. Since independence, manufacturing activities have gone up very rapidly. Yet, the economy is passing through several travails of supply bottlenecks and foreign exchange bottlenecks, culminating in what is now called the 'crisis of unutilised capacity'.

At the outset some basic concepts need clarification. Following Laurence Klein** capacity may be defined as "an index combination of all fully utilised factors including others as well as capital stock". He goes on to define capacity output as "production flow associated with input of fully utilised manpower capital and other relevant factors of production".

Some further definitions now emerge:

Capacity Utilization Ratio—measure of *realised* to *potential* output.

*Planning Manager, India Tobacco Co. Ltd., New Delhi.

**Econometrica, 1960

Capital Utilisation Ratio—measure of *utilised* to *available* inputs of capital.

Labour Utilisation Ratio—measure of *utilised* to *available* inputs of labour, allowing for differences in skill.

General Utilisation Ratio—Percentage of *available* factor stock which is *utilised*.

Technically, we use the *flow* approach when we speak of capacity utilisation in terms of machine or manhours. Capacity utilisation indexes based on output make use of an explicit production function but more usually the basis for estimates of utilisation is an examination of output series.

The output series method of estimating capacity utilisation is also open to various manners of criticism. Output can be at lowest average *variable* cost or lowest average *total* cost if one wishes to emphasise total operations. This has

no relation to the demand for output. Nor has this method any relation to value-added (VA) in industry which is more relevant for assessments of capital/capacity utilisation. Given factor and commodity prices, the ratio of VA to aggregate output will be stable. Hence differences would be unimportant when establishing an index of capacity in use. However, even in this case a firm producing a component previously bought would record *no* final rise in output although *value-added* would have risen. Thus, 'productive capacity' as popularly known would have an imperfect connection with any technical measure of the productive capacity of all machines *final* and *intermediate*. The concept of capacity remains an 'elusive will-o-the-wisp' and it is against this background that further analysis must proceed.

Causes of Idle Capacity

Economic development depends on additions to capital. The shortage of capital equipment is regarded as a barrier to growth. Paradoxically, in many Less-Developed-Countries (LDCs) the existing stock of capital is idle. The installation of equipment does not lead to positive savings and investment in productive physical capital.

In terms of the Harrod-Domar model
 $g = OCS$

where g is the growth rate, O the marginal output-capital ratio and S is the marginal propensity to save.

If capital is unutilized X proportion of the time so that $0 < X < 1$, the rate of growth becomes $g = XOCS$ and less output emanates from a unit of output.

Underutilisation means lower growth unless it is offset by an increase in capital productivity or reduction in consumption. In the LDCs a reduction in the rate of growth is regarded as most likely.

Increasing utilisation will mean:

- (a) raising current output in the short-run.
- (b) raising rate of growth of output in the long run.

If, as a result of greater capacity utilisation, more output is produced per unit of output, it would be correct to postulate a definite direct correlation between capacity utilisation and factor productivity.

Finding of FICCI Survey

Many surveys have been undertaken of the degree of unutilised capacity in Indian industry. Many seminars and discussions have been held, the latest by the Federation of Indian Chambers of Commerce and Industry (FICCI). This body reported thus after a survey of 200 industries in different sectors:

A survey of capacity utilisation undertaken by the FICCI in respect of 200 engineering and chemical and other industries in 1969 and 1970 shows that the number of industries utilising 50% or less of their capacities rose from 71 in 1969 (36% of the total) to 78 in 1970 (39% of the total). It is also revealed that the problem of idle capacity is faced mainly by the engineering industries. On the whole, the consumer goods and chemical industries have recorded a higher ratio of capacity utilisation.

Out of the 66 machinery and transport equipment items analysed, production was less than 50% of capacity in respect of 38 items in 1969 and 35 in 1970. Thus, over 50% of the industries in this group utilised only 50% or less of their capacity. In the consumer goods sector, out of 46 industries surveyed there were 9 industries which utilised less than 50% of their capacity in 1969. It was about the same in 1970. At the same time, over 40% of the total number of these industries utilised 75% or more of their capacity. In the fertiliser and chemical industry, out of 81 items, units in only 27 items utilized less than 50% of capacity in 1970. It was 26 in the previous year. About 40% of the total number of industries in this group utilised 75% or more of the installed capacity.

What are the various causes of idle capacity? FICCI's survey revealed the following:

Reasons for Under-Utilisation	Units which have reported idle capacity due to respective reasons	
	No.	Percentage
Raw material shortage	30	60
Fall in offtake	11	25
Power failures and shortages	6	12
Transport bottlenecks	5	10
Paucity of working capital	5	10
Labour troubles	4	8

Raw material shortages are mainly in the areas of steel (both stainless and other varieties), non-ferrous metals, alcohol, methanol, cotton and oilseeds. Power shortages ensue from inadequate supply in some States and defective distribution in areas where power supply is adequate, e.g. in Mysore State.

Constraints to Capacity Utilisation

It must be remembered that the term capacity in the Indian context refers to that amount of production authorised by the fiat of the Industrial Licensing Policy. Capacities were, till recently, fixed on a shift basis. Multi-shift working necessitated application to and sanction from the Government for being effective. Thus, official constraints did act as a braking factor. Currently, capacity is being interpreted in terms of 'optimum utilisation of resources'. This is a step forward, but the term optimum is by itself nebulous. Moreover, with investments below Rs. 1 crore being in the de-licensed sector, there is always a temptation to put up sub-optimum plants to avoid the rigours of licensing.

Another official and vexatious constraint not adequately stressed is the rigour of the 'anti-monopoly environment'. Firms with capacity to spare cannot advance their production. New units are licensed but a time-lag is inevitable be-

fore they utilise their capacity. From the balance of payments aspect, the new units often represent a strain greater than that caused by any repatriation by the existing units. The fresh entrants need capital equipment from abroad apart from recurring imports of spares and equipments. Both Gross and Net National Product are dampened, not enhanced.

Statistics on excess capacity do not segregate those areas where technological constraints or 'determinism' force investment to run ahead of demand. This applies in spheres like petrochemicals and heavy engineering where there is considerable 'lumpiness' of investment. The interest of the firm is in *potential* and not present demand. Some attribute the 'glut' in fertilisers to pure Hayekian over-investment. The lumpiness argument on Hirschman's lines would be more appropriate—growth through alternating bouts of bottlenecks and gluts. As a sidelight, it would be interesting to point out that Hindustan Machine Tools' capacity was unutilised during certain periods due to high rejection ratios to preserve quality. This cannot be taken as a case of pure excess capacity as the social gain of better quality provides a 'Hicks-Kaldor' compensating variation to any loss of production. This is an instance of the *real* input-output ratio and *real* factor productivity *improving* with lower capacity utilisation. Technological changes result in changes in relative price shifts. These, in turn, alter relative effective demand. One wonders if the various studies effected so far have considered this proposition.

Productivity vis-a-vis Capacity Utilisation

If, as a result of greater capacity utilisation, more output is produced per unit of input, it would be correct to postulate a definite direct correlation between capacity utilisation and factor productivity.

But a note of caution needs to be sounded at this juncture. Assume 4 machines out of a total of 10 machines are idle because of lack of spares. 6 machines produce 60 units of output. Productivity per machine (lumping together labour

and capital as a homogeneous input) is 10. Assume all 10 machines get started, and the previously idle 4 machines produced 30 units. Aggregate production of 10 machines is 90 units and the per machine factor and productivity drops to 9 as against 10 previously. It would be more accurate to say that extra production will result reducing the loss of resources, otherwise incurred. The danger of linking a 'macro-productivity' concept to an essentially 'micro' framework lies in the fact that inter-machine or inter-factor differences are concealed.

The Indian Institute of Public Opinion has published its findings on labour productivity* for the period 1950-66 indicating that labour productivity has increased by 2 percent every year in the sixties. Since the period covered was the pre-recession era, there was probably less of redundant capacity and a similar exercise for the period of 1966-71 would be of interest. The methodology of multiplying gross output by one hundred and dividing by the index of workers employed, is open to doubt. The question of quality of equipment or capital is not considered. So too, the 'Productive' capital concept employed needs rescrutiny. The unanswered question is the behaviour of capital productivity and the direction of its movement.

In regard to the capital output ratio and its correlation to capacity utilisation the ratio C/O should not take into account the impact of depreciation on estimated value of capital installed 10 years ago and over. Gross Profit Margin (GMP) includes depreciation and other costs. Second, a lower C/O reduces the difference between GPM and *net* measures post-depreciation. Third, it is often forgotten that capital coefficients relate to fixed assets with no allowance for working capital requirements which go *up* with rising utilisation.

Guidelines for Future

What should be the accent of industrial licensing policy and what is the suggested methodology for the future researchers?

*Quarterly Economic Report No. 68.

It is obvious that the weight of demand is falling on investment outlays. Access to raw materials means demands for capacity creation exaggerating excess capacity. This waste is aggravated by the absence of 'linkage' in import substitution.

The basic tenet should be that new investment should not be sanctioned until all existing capacity is used up. Doctrinaire considerations should be consigned to the back-benches. If some concentration or diversification of the larger houses helps capacity utilisation, this should be encouraged.

Indiscriminate proliferation of new entrants into sectors where 'natural' oligopoly should prevail results in a real contribution to output of zero. The same raw materials could be better utilized elsewhere in existing spheres.

Currently, the licensing process is aware more of supplies and technical features rather than the structure of industries and nature of demand.

The following guidelines are suggested for constructing a detailed regression model to analyse the structure of excess capacity:

- (1) Exports as percentage of domestic production;
- (2) Competing imports;
- (3) K/Y, the capital-income ratio or the ratio of real value of assets to value-added;
- (4) Built-in excess capacity;
- (5) Sectoral factor productivity vis-a-vis capacity utilisation. For example, the consumer goods sector is working at a higher capacity than the other section. How has this been reflected in *relative* factor productivity?

On these lines we can build up a theory of *elasticity of utilisation* in the developing countries, based on empirical research. □

Some Aspects of Productivity

KSV Menon*

An attempt has been made in this paper to survey some of the literature on productivity in general and the various concepts associated with the measurement of productivity in particular. In this endeavour, various dimensions of output and input, which are the major elements involved in the exercise of measuring productivity, have been highlighted and complications and complexities examined and explained. In a survey article like the present one, the author owes a debt of gratitude to a number of authors whose works have been consulted and cited, and even to those whose names have not been specifically indicated. Without claiming any originality to what is presented in this article, it seeks to piece together all the relevant concepts in a coherent and connected way, scattered in various books and articles published on the subject during the last three decades or so.

THE term 'Productivity' may be defined as the ratio of output to any or all associated inputs. The concept of economic activity as an input-output process is perhaps the most basic one in the science of economics. It is, however, vague and imprecise. Several difficulties emerge when one attempts to specify the inputs and outputs involved and define the nature and extent of transformation implied and indicated. Many of these problems arise from the heterogeneity of both inputs and outputs. There are numerous kinds of inputs and outputs and it is the condensation of this multi-dimensional structure into manageable proportions without loss of essentials that would put to test one's analytical apparatus and dexterity and skill.

The reduction of many dimensions of input and output to a single measurable one can only be done by multiplying each diverse quantity by a valuation co-efficient or price. This would, however, entail the problems associated with index number. Even assuming no price change—a heroic assumption indeed—the questions con-

nected with the money value of input and output would still remain. From the point of view of the income distribution and allocation problems, inputs and outputs should be defined so that their measure is the same. The aim is to allocate all output to those who contribute input, possibly with some provision for 'surplus value' and transfer payments and to allocate all input, however, employed, to the various forms of output.

Moreover, the composition of input as well as output varies over time. A given quantity of output, with given technical knowledge, can usually be produced with differing combination of inputs. The actual combination used will tend to be the least-cost combination at relative input prices. This (combination) is subject to change as a result of changing relative input prices, changing technical knowledge or changing output, if returns to scale are not constant. Changes in factor combination mean that ratios of output to input, even to a major class of input cannot be used as measures of changing productive efficiency. Such partial productivity ratios are revealing as measures of saving achieved

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over time in the use of particular inputs per unit of output. Changes in the partial productivity ratios are, however, affected by factor substitutions reflected in changing input combination as well as by changes in productive efficiency generally.

To measure the net saving in factor inputs and thus the increase in productivity, it is necessary to relate the output to all associated inputs. The effects of factor substitution cancel out in the total productivity indices. In order to determine changes in the aggregate output and factor inputs, and thus productivity, it is necessary to combine unlike types of output and inputs by weights that indicate their relative importance. Economists, like J. R. Hicks,¹ hold the view that for purposes of productivity analysis, outputs should be weighted by unit factor cost, and inputs should be weighted by unit factor combination (price). This implies that the values of outputs are proportional to the values of the factor services required for their production and the unit values of the inputs are proportional to the shares of the value of outputs which they obtain for their services. Under competitive conditions the prices of factors represent the relative values of their marginal contribution to output in equilibrium.

The Price Factor

On the assumption of competitive conditions, factor price may be interpreted as representing the marginal value products of the various types of factor inputs, on the one hand, and the relative marginal disutility of work or saving, on the other. The marginal products indicate what the producer can afford to pay for the quantities used, while the marginal disutilities indicate what he has to pay in order to induce people to work rather than to enjoy additional leisure, and to save and invest rather than to enjoy additional consumption or liquidity. Although productivity analysis has to do with physical volume of output and input, one cannot get away from the psychological elements involved in the mutual

determination of prices of both outputs and inputs since relative prices are necessary to aggregation.

Perhaps the most serious problem of measurement is introduced by variations in the relative prices of outputs and inputs. The latter, in perfectly competitive factor markets, are utilised up to the point at which the values of their marginal products are equal to their prices. So their prices indicate the ratios at which units of the input may be substituted for one another at the margin so long as the relative prices and marginal rates of substitution are constant, use of factor price weights yields an unambiguous net change in the total volume of inputs. If relative prices change but factor proportions in real terms remain constant, a change in total input can also be measured precisely.

Productive Efficiency

But, if there occur relative changes in both factor prices and proportions and these are inter-correlated to any significant extent, the degree or even the direction of change in total input may be ambiguous. That is, it may not be clear whether producers have merely shifted position on a given isoquant, that is, have changed factor proportions under the existing technical knowledge. There is, of course, no ambiguity as to direction if the same or a larger volume of output is produced by a similar quantity of one or more of the inputs, and no more of the others. But if one decreases and another increases, while their relative prices change in inverse relation, the direction of movement may also differ depending on whether base period or given period price weights are used. The same problem is encountered in aggregating different types of output when there have been relative changes in quantities and prices.

Although one may define changes in factor productivity as changes in productive efficiency, this is a broad term which needs further clarification to give it more definite meaning. Productive efficiency may change as a result of technological innovation, changes in scale of output and changes in the rate of utilisation of capa-

¹Hicks JR: "The Valuation of the Social Income" *Economica*, May 1940.

city. It may also reflect changes in inputs of 'intangible capital' designed to increase the quality of the input of the tangible factors and such changes as not readily susceptible to measurement.

Concept of Inputs

The above discussion points to the need for a clear and fuller analysis of inputs in general and two basic inputs in the production process, namely, capital and labour, in particular. It is in this context a precise idea of 'input' as understood in economics becomes useful and relevant. "Input is the time flow of services of the human and non-human factors available for use in the productive process; the result of the product services is the output."² There are thus three dimensions to the various factor inputs:

- a. the stocks of the primary factors available for use in production.
- b. the time periods (usually hours) in which units of the factor-stocks are available for use in production, in terms of which the flow of services can be measured and their compensation or cost computed.
- c. the output or income resulting from the joint use, of which the shares accruing to each factor for its contribution to production can be used to weight the service-hours.

It would obviously defeat our purpose if we measure inputs in terms of their result in the productive process alone, since we would have a measure of output itself. But the changing efficiency of the inputs is revealed by comparing the available service-time of the real stocks of the factors, in 'standard efficiency units', weighted by their unit shares of output (income) in a base period, with their actual output in a given period. An ideal measure of input is thus act of any changes in quality over time, as it must be in order to have a basis for getting at efficiency changes through comparison with output.

By weighting the available service-time of the factors by their base period comparisons, we obtain a measure of the resource which would have been produced had the technological and other conditions of efficiency remained the same in the base period. By dividing this measure into the actual output in successive periods, we obtain a measure of the changes in the efficiency with which factor services are utilised in the process of production.

Capital and Labour : The Basic Inputs

This brief discussion on the concept of inputs in general takes us for a detailed analysis of various types of inputs, mainly, as noted earlier, capital and labour. The theory of capital has been, and continues to be, one of the perplexing and complex areas in which economists have yet to dig new and newer grounds and reach some sort of agreement. Much water has already flowed under the bridge and is still flowing in a way, on the various aspects of capital, for instance, its definition and measurement. In this study, we are, however, primarily looking at the problem from an operational angle and that is why little attempt has been made to view the issue purely on a theoretical plane.

In a paper presented at the 1953 Conference on Income and Wealth,³ Prof. Edward Denison set forth three possible methods of measuring capital. The first measures capital by cost. The second measures it by the capacity of the system as a whole to produce output. The third measures it by the contribution which the capital specifically makes to total produce. Denison strongly favours the first method. He feels that the second is not interesting, although it might be feasible statistically if certain arbitrary conventions were adopted. The third method, he believes, is completely beyond any hope of accurate, independent measurement. Furthermore, the last method would necessarily lead to an unchanging productivity of capital. Thus Denison prefers the first one.

2. Kendrick John W: 'Productivity Trends in the United States', National Bureau of Economic Research.

3. Edward F. Denison: "Theoretical Aspects of Quality Change, Capital and Net Capital Formation", National Bureau of Economic Research.

Even the valuation of capital at cost is not straight-forward. If the price of producing capital goods did not change over a period of years, the gross addition to the capital stock in any year would be equal to the value of the gross capital formation in that year. Unfortunately, however, the price of producing capital goods is needed to deflate the current price data. It is in arriving at appropriate price deflators that most difficult conceptual problems of this method become apparent. Although Denison wishes to exclude his index of the output of capital those quality changes in capital goods arising from such things as improvement in design and service ability, he does not wish to exclude changes in productivity in the production of capital goods.

The crucial problem is the separation of design improvements from changes in the cost of production. that is, increases in productivity of capital goods. The most ambiguous problem arises in a situation where changes in the design of a machine both reduce its cost and improve its functioning. One is faced with two alternatives: (a) the cost of producing the machine has fallen, but the quality of capital is unchanged or (b) the cost is unchanged but the machine is now a different one that represents less capital. Thus if there is any change in the functioning of the machine, we are forced to decide whether or not, it is still the same machine. The decision in turn determines the measure of the quantity of capital produced.

It should be noted that the index-number problem arising from cost-reducing technical changes are different from the normal index number problem, the latter would exist even in the absence of technical change in the cost of producing capital. The problem arises, because although we might not be able to reproduce exactly the products made earlier, say, in 1900, the reverse is not true. The valuation of capital stock in 1900 as if it could have been produced in 1900, therefore, necessarily involves the assumption that price indexes for the use of capital goods that are present in an unchanged form in two periods, say, 1900 and 1960, are representatives for products which did change. This assumption is, of course, likely to be invalid, because the new-

To measure the net savings in factor inputs and thus the increase in productivity, it is necessary to relate the output to all associated inputs.

ly-introduced capital goods tend to be those for which the cost of production has fallen fast. The price index based on 1900 would, therefore, be relatively too high and the resulting quantity of capital too low.

Another consequence, as Denison points out, of adherence to the cost concept for measuring capital goods is that the principle of valuation that would be used for the output of capital goods are different from those commonly used for consumer goods. In measuring the volume of consumer goods we attempt to include quality changes as a part of output, where this measure of capital output tries to exclude it. Denison, however, is inclined to minimise the importance of this consideration. He suggests that quality change excluded from the measurement of capital goods will eventually show up as additional production of consumer goods, and that as long as changes in the quality of other factors of production cannot be taken into account, neglecting such changes in measuring the output of capital goods scarcely seem a critical weakening of the income estimate.

A final problem in the interpretation arises in estimating the net value of the capital stock. The measurement of the capital stock not only requires valuation of newly produced capital goods, it also requires consideration of what has happened to the existing stock of capital. Denison would value capital consumption at base year cost for the particular types of capital goods is discarded and that it should be handled as a deduction from gross capital consumption.

His rationale is that 'net capital formation'—the net improvement in the capital position in the economy—should be equal to the differences between (a) the contribution to production by new goods and (b) the contribution which could have been made by the displaced capital goods.

On the other hand, a different treatment has been proposed by John W. Kendrick.⁴ He suggests:

"..... as non-permanent assets age, their contribution to net declines, this is the result of declining gross output capacity, increasing maintenance and repair costs, and creeping obsolescence. Obsolescence results in the reduction in the rate of return of old equipment, not only when the installation of new equipment leads to reduced product prices or higher factor prices, but also when the old equipment is utilised less intensively or in less productive activities. Empirical and theoretical considerations suggest that these effects may be assumed to occur gradually over the life time of groups of capital equipment."

It might be questioned, however, whether such considerations are relevant to the concept of capital discussed here. In view of the decision to exclude productivity improvement from addition to capital stock, it seems incongruous that decreases in the efficiency of the existing capital due to ageing should be so carefully taken into account just as there is logic in saying that improved design of capital goods is not more capital but an increase in its efficiency. So also it is perfectly reasonable to say that the efficiency of capital varies with its age, and that deductions from the quantity of capital to make the productivity of existing capital a constant over its life consistent with the desired concept.

Furthermore, as Kendrick implies by his inclusion of 'creeping obsolescence', the ordinary capital consumption allowance would considerably

exceed the actual physical deterioration in a capital good over its useful life. Changing such obsolescence against existing capital is allowing for quality changes that have not occurred but are only expected to those resulting from changes in the technical design of capital goods to be produced in the future. The same technical change that improves the quality of new capital will make the old obsolete. Kendrick's treatment of addition to the capital stock does not count the increases due to technical changes in new equipment, but it does take into account the reduction in the relative quality of the existing capital stock because of the increased technical efficiency of new capital equipment which could be constructed. Again, therefore, the treatment of new and old capital does not seem to be parallel.

A more consistent treatment would seem to require that if efficiency increases are to be eliminated from the measurement of the capital stock, efficiency decreases must also be eliminated. Capital should not be deducted from the total stock until its retirement, despite the fact that the producers may, for financial reasons and in order to derive a meaningful profit figure, amortise it over its life. This procedure would carry Denison's method a little further, deriving not investment in each period as gross investment minus discards.

To summarise, conventional measure of real capital to avoid a concept based on the cost of production rather than capacity, partly because of ease of measurement and partly because one of the major purposes of developing real capital data is the analysis of productivity changes. "Cost" in these terms is not simply the deflated value of the inputs, it is not intended that increased efficiency in production of capital should reduce the amount of capital produced. This means that changes in the cost of producing capital must be analytically and statistically separated from changes in the efficiency of utilisation of capital. Such a separation, however, requires a physically measurable unit of capital, and this, in turn, cannot be established without a consideration of the quality and function of capital equipment. Any attempt to separate quantity and quality without considering functions is

4. Kendrick John W: "Productivity Trends: Capital and Labour", *Review of Economic Studies*, Aug. 1956.

doomed to be arbitrary and subjective. It would perhaps be possible to derive a real capital measurement independently in terms of the quantity of input factors (labour, resources and savings), but this approach does not appear to have much support.

Time and technical change also create problems in the interpretation of the conventional measures of real capital stock. The thesis that real capital can be measured by what it would cost in the base year to produce the given year's stock is not meaningful if the technical changes make the comparison an impossibility. If the most recent year is chosen as the base year, the comparison may be possible, but this may produce a trivial and uninteresting measurement. Finally, in evaluating the net capital stock, one may question the practice of deducting a capital goods which actually retired from service. Such an allowance is in fact an attempt to measure the decrease in the quality of the equipment, whether from physical deterioration or from potential technical obsolescence. Such changes in quality are intended to be excluded from this concept of the quantity of capital.

Denison rejected his second method—measuring capital by capacity not only because it makes the concept of productivity of capital tautological but also because it posed serious problems of measurement. There are many circumstances, however, in which capacity is an extremely useful tool of analysis.⁵ Industry studies have long worried about capital co-efficient asking what amount of capital would be required, with existing technology to obtain a given increase in capacity. Such studies are important for problems of economic development and developing portion of input-output matrices. They are also useful in analysing the effect of a change in demand for specific products on the capital goods industries.

For growth models, also, capacity measurements are extremely important since such models

involve an estimation of the impact of an increment of saving and investment on future stream of income, saving and investment. Recently, capacity measurements have also been used for analysing short-run fluctuations in income and employment. The underutilisation of capacity for the economy as a whole has various repercussions on the level of investment, which in turn affects the level of income and employment. Both private and government agencies are now engaged in making capacity estimates for various sectors of the economy, and in view of the obvious usefulness of capacity as a basic concept in economics, it does not seem reasonable to suggest that efforts to obtain better capacity figures should be abandoned.

This does not, of course, mean that changes in capacity can be identified directly with what we have considered to be capital formation. Changes in capacity can also result from such things as research and development expenditures, government expenditures on education and health and other expenditures which may carry with them a social product conducive to quality improvement.

Domar⁶ has suggested two approaches for measuring the stock of capital. The first one would define the problem with some precision and then select the proper definition of capital. Thus for one type of production function it may be desirable to eliminate changes in the quality of capital itself, for another this method may not be needed. Similarly, if the stock of capital is treated as a source of future productive power, depreciation of one horse-shay should be deducted even if this instrument is equally useful to its very end. But from the capital productivity point of view, no such change may be made.

The second approach is even more pragmatic. Take the existing figures, manipulate them and look around for suitable uses for them. Domar cites a few examples:

1. The stock of capital at original value of acquisition, with or without depreciation. This
6. Domar E.D. : Comment on 'Richard's paper (*ibid*)

5. See, for instance, Richard and Nancy Ruggles, "Concepts of Real Capital Stocks and Services", in "Output, Input and Productivity Measurement" National Bureau of Economic Research (1961)

will not do for estimates of capital productivity, but it is a standard measure of capital in accounting, financial and legal circles.

2. The stock of capital deflated by a price-index of inputs. Technological progress either in the production or in the quality of capital goods is not eliminated. For the study of capital productivity, this concept may not be useful, but it can estimate the magnitude of social effort going into capital formation.

3. The stock of capital deflated by the price index of capital goods. This would eliminate change in the production of capital goods, but not in the quality of capital goods themselves.

4. Stocks of capital deflated by a price index in which quality changes of capital itself have been accounted for. The result would be a 'pure' input of capital, very useful from the productivity point of view, but as shown by Denison, quality changes are hard to define, let alone measure.

5. Capital stock as an inventory, in which goods are weighted more heavily than old ones. The proper weighting could take care of almost anything, including technological change, depreciation, and obsolescence, but where would these weights come from? A well-developed second-hand market could give a set of weights, but in its absence this method remains merely a good wish.

Defining Capital

With this background, it may now be pertinent to look for some empirical studies where the problem of 'capital' has been dealt with from an operational angle. There are various cases in India as well as abroad, where a workable definition of 'capital' was to be adopted and put into use. In 1948, the Committee on Profit Sharing examined, *inter alia* the question of a fair return on capital employed. The committee adopted the definition of capital employed as paid-up capital plus reserves (including all future allocations of reserves) which are held for the purposes of the business as the basis for computing the total capital employed. Reserves in this

context were to exclude depreciation reserves and include only those reserves built out of profits on which taxes had been paid. The Tariff Commission's (which enquires into the cost structure of industries for providing protection in suitable cases) definition has varied from time to time from industry to industry.

Between 1924 and 1952, the then Tariff Board, used to classify assets under two categories namely, fixed capital and working capital. Fixed capital was defined as the value of the gross fixed assets or the gross block of the units. In the pre-war period enquiries, the value of the gross block was taken at its replacement cost while in the post-war enquiries the value of the block was placed at the original cost without deduction for depreciation allowance. As regards working capital the usual practice of the Tariff Board was to equate it to the aggregate cost of production of a certain period which would enable the unit to maintain uninterrupted production, the period varying from industry to industry.

The concept was, however, clearly defined only in the 1958 Enquiry on Cement Prices. According to the revised definition net block plus working capital constituted the total capital employed. Under the new definition, the Commission merely reduced the value of the fixed capital employed in business from gross block to net block, thereby reducing the value of the total employed funds by the amount of depreciation funds. The reasoning behind the adoption of the new definition of capital employed was that only such of these capital assets which are actually used in production should be taken into account. Therefore, such items as assets employed outside the business including loans to and investment in other companies, work-in-progress relating to assets which have not gone into production and intangible assets like 'goodwill' were excluded. A departure was sought to be made by applying standard costing but of not much success.

The Damle Committee which enquired into the structure of oil prices in 1961 computed capital employed as net fixed assets plus current assets minus current liabilities and used it as the basis for determining the fair return for the mar-

keting companies. A much wider definition of capital employed is adopted under the Electricity (Supply) Act, 1948. The return is calculated on the capital base which is broadly represented by the cost of fixed assets (excluding those financed from depreciation fund), including intangible assets, cost of works-in-progress, the average cost of stores plus reasonable cash and bank balances. The Labour Tribunals defined 'capital employed' as paid-up capital plus reserves used as 'working capital'. The same definition was adopted by the Bonus Commission also while considering fair return on capital to be allowed as a 'prior charge' for the purpose of bonus formula. (In the case of foreign companies, where business was confined to trading and/or who had no paid-up capital in India, the Bonus Commission computed capital employed for the purpose of return as the sum of net fixed assets plus current assets minus current liabilities.)

The Central Statistical Organisation (C. S. O.) uses the concept of 'capital employed' as consisting of fixed capital and working capital. The former comprises land, buildings excluding those under construction, improvements to land and other construction, transport equipment, other fixed assets such as furniture, fixtures, etc. Working capital consists of stocks of materials, stores, fuels, semi-finished goods including work-in-progress, and finished products and by-products, cash in hand and at the bank and the algebraic sum of sundry credits as represented by (a) outstanding-factor payments namely, rent, wages, interest and dividend; (b) purchase of goods and services, (c) short-term loans and advances, and sundry debtors comprising amounts due to the factory on accounts to sale of goods and services and advances towards purchase and tax-payments. Long-term loans and debentures including advances by proprietors and working partners are excluded.

Measuring 'Labour' Input

Having thus delved into the concept of capital as an input, another equally important concept, which is nothing but human capital, may be considered. "Labour," says an I.L.O. publication, "in the most general sense, is an

effort—mental or physical—applied during a certain time."⁷ In most studies on productivity, attempts are made to consider two main classes of labour: direct labour, generally defined as labour engaged directly in production; and indirect labour, comprising the various workers on the plant who are necessary for production but whose contribution is indirect. Typical man-hour classifications include production or process-operators, machine operators, and workers engaged on activities such as metal working, fabrication, assembly, sub-assembly or finishing. Indirect manhours generally include supervision, maintenance, the handling of materials, shipping and receiving, inspection, plant protection, control functions in the plant, and other categories related to but not assignable directly to production.

In a study undertaken by H. Jerome⁸ under the auspices of the National Bureau of Economic Research, different types of labour considered are: (1) operating labour, (2) auxiliary labour, (3) embodied labour and (4) indirectly required labour. Operative labour is that required directly in a particular process, such as the operation of a buck-moulding machine. Auxiliary labour is that required in the plant for such operations as oiling, inspecting, adjusting and repairing the machine—in short, all plant labour that is necessitated by use of the machine but is not considered as engaged in its direct operation. Embodied labour is the labour applied to the production of the machine itself and the materials of which it is made, the materials used in machine repairs, the power, oil, grease and other materials, if any, consumed in the operation of the machine. Indirectly-required labour is the labour required beyond the manufacturing stage for transportation and marketing.

Since all the above concepts except that of 'embodied labour' are self-explanatory and easy to comprehend, detailed discussion only on the latter may perhaps suffice. However interesting this concept may be, it is nevertheless somewhat

7. International Labour Organisation : Methods of Labour Productivity Statistics, Geneva. (1951)

8. H. Jerome : Mechanisation in Industry, N.B.E.R. (1934)

remote from the notions commonly used in labour productivity measures, and especially from actual possibilities of any concrete measurement. When this idea is extended, it becomes practically identical with a man-hour cost analysis of the production, taking into account all costs entering into the prime cost of a product. In the present knowledge of labour productivity, it appears that data covering embodied labour can only be of a very approximate nature. Thus Foursatie J.⁹ suggests that the 'embodied labour' be estimated on the basis of the money cost of the machines, divided by the hourly wage rates of the labourers; while such computations may be useful and sometimes necessary for economic purposes, they do not at present fall within the scope of a direct analysis. It is only when detailed measures of unit labour requirements for many industries, products and especially processes have been perfected and standardised that it will be possible to include embodied labour in the measures and comparisons of labour productivity.

On a closer scrutiny it will be revealed that the units of measurement of labour input that are available for comparisons over time may or can be reduced to the average number of persons employed and the total number of hours worked. Differences between the movements of the two arise from changes in average hours of work. Intelligent choice or even discussion, requires information concerning two aspects of working hours: First, what is the relationship between hours of work and real cost—"disutility" of labour? Second, what is the relationship between hours of work and output?

If disutility varied proportionately to hours worked, man-hours would provide an approximate index of real cost of labour. If disutility did not vary at all with hours of work, employment would provide such an index. Only if the percentage increase in the total disutility of work is less than half the percentage increase in working hours increase, would employment be the better measure of changes in total disutility.

Usually it is supposed that, after only a few hours 'work' a week, the marginal disutility of an hour's work increases as hours are increased; certainly it is never assumed that it declines. On the other hand, the disutility of the first hours' work in the week and possibly to a lesser extent, in each day is certainly high, since the mere necessity of going to work interferes most with one's freedom to do so as he will, and also carried with a heavy overhead in time spent in going to and from the work place, changing clothes, etc.

If the disutility of the first-hour were sufficiently high related to subsequent hours, the conditions in which employment represents total disutility better than man-hours would be met; the most important distinction would be between working and not working, rather than in the number of hours worked.

It can reasonably be assumed that man-hours are a better measure than employment of changes in the disutility or real cost of labour and employment is a better measure than man-hours of effective labour input. From the first proposition, it may be concluded directly that man-hours is the better series to use as the labour input component of a series representing the total real cost incurred in producing the national product, and hence in computing output per unit of real input as a measure of the efficiency of production in the economy.

From the second proposition, it can be inferred that the differences between changes in output per man and output per man-hour may be thought of as measuring, though very crudely, that part of the increase in output per man-hour which is the result of shortening hours (whether because of the stimulation it provides to improve management or of its effects on the efficiency of other types of labour). Output per man may accordingly be viewed as a measure of labour input that is adjusted for one type of quality change.

If it is correct to suppose that much of the past increase in output per man-hour is simply the result of shortening hours, it follows that,

9. J. Fourastie: "*Le grand Espoir du XX^eme Siecle*" Quoted in "Productivity Statistics", I.L.O.

for long-term projections based on historical experience, projection of output per man will be preferable to that of output per man-hour if the future rate of hours shortening is different from that in the past. John Kendrick has weighted man-hours in each industry by base year average hourly earnings to obtain a measure of what he calls 'labour input' to obtain 'total factor input', the series used to measure overall productivity.

It is, however, argued by Denison¹⁰ that, to measure changes in productivity, Kendrick's approach is not appropriate; the shift of resources from industries in which labour is less productive is one more source of greater productivity in the economy, not something to be eliminated. The calculation is nevertheless valuable comparison of output per man-hour with output per unit of 'labour-input' in Kendrick's sense provides a useful measure of contribution of industry shifts to past increases of productivity, and hence also a useful tool for projections. Other similar calculations based on such factors as occupation and education, would be useful in the same way.

To sum up, the choice between man-hours and employment in part depends on a conception of what productivity indices should try to measure. No formulation is going to be perfect from every point of view, but it is necessary to try to get at shifts in firm's production function within the context of a market-oriented economy. Man-hours seem more consistent than employment with a firm approach. If quality changes are in fact associated with hour-shortening or if hour-shortening induces productivity and capital changes these adjustments can be made explicitly. The use of man-hours is a straight-forward measure of input. It is easy to understand, whereas the idea that employment is a measure of labour input is adjusted to "quality change" to a wider audience.

Apart from theoretical consideration, the form under which the data are available in the

undertakings gives the basis of most of the practical concepts of man-hours worked. Rostas has pithily put the problem thus :

"In estimating output per worker, we may have in mind either the workers employed in producing the particular product who are on the book or the workers on the pay roll or the workers actually at work. Workers on the book may include persons who have left the industry altogether. Workers on the pay-roll will probably include persons who are absent for part of the week, those who left during the week, or were taken on during the week or those who went on holidays during the week—all of whom worked therefore only part of a week. Workers on the pay-roll may or may not include those on holiday for the week. Workers actually at work would exclude both the absentees and those on holiday and make allowance for these working only part of the week.

On the other hand, in estimating 'output per man-hour' there will be differences between productive hours and hours actually paid, and the latter, at least for time workers, include payment of time spent in meal-breaks and other non-productive time. The widest concept is 'output per man-year' exclusive of absentees and those on holidays and this is the most useful concept when "estimating national incomes or labour requirements. In measuring productivity in the technical sense, output per worker actually at work or output per production man-hour are relevant; while measuring costs of production, 'output per man-hour actually paid for, is perhaps the appropriate concept."¹¹

The differences and different uses, of the two general concepts outlined by Rostas as output per man-hour and output per man-year have been further clarified as follows:

"While the concept 'man-hour' of work is definitely circumscribed in the sense that

10. Denison EF: "Measurement of Labour Input", in "Input Output and Productivity Measurement" (*Ibid*).

11. Rostas L: "Comparative Productivity in British and American Industry", quoted in "Method of Labour Productivity Statistics."

every hour consists of 60 minutes, the concepts 'man-week' and 'man-year' are ever-changing because over a period of years the standard work week may vary in the number of man-days it contains and the man-days in turn may vary in their man-hours content."¹²

This short analysis shows that in measuring labour productivity the choice between man-hours or employment as a measure of labour will depend on the object in view. Thus, when measuring productivity with the object of determining the changing volume of output in relation to the time actually worked, the productive capacity of labour, or the cost of production labour inputs, it is better to use the man-hour concept. When measuring productivity with the object of estimating man-hour requirements, employment possibilities, future national income, etc. the concept of output per man is more appropriate.

With this theoretical background, one may look at some empirical studies where the concept of labour as an input in the production process has been applied. A survey on empirical plane would reveal the fact that in measuring labour productivity both employment and man-hours have been adopted, depending upon the object in view. For instance, Kendrick used man-hours worked as the measure of the flow of available labour services (labour input). It is, however, not a direct measure of input, but a measure derived from estimates of the employed stock of human resources and the average hours worked per person per year indicating the rate of utilisation.

When weighted by average hourly compensation in a base period, labour inputs indicate for a given period but the employed manhours would have contributed to output if productive efficiency had been the same as in the base period. He further observes that since average hourly earnings differ among different "quantities" reflecting different contributions to product and thus different 'quantities' of labour

service, man-hours should be estimated and weighted separately for each occupation. But estimates of employment and hours are generally available over time only on an industry basis; so industry average hourly compensation estimates are used as weights.

In most of the I.L.O. studies on productivity, both man-hour and employment concepts have been used, depending upon the nature of the study and the availability of data. The Labour Bureau, Simla, computes labour productivity as the ratio of total production to total employment. The studies undertaken by the National Productivity Council on Productivity of certain industries, 'employment data' has been used. From empirical studies in India, it appears in this country, presumably due to the lack of data, employment is the most commonly used as 'labour input' in measuring labour productivity.

Output Measurement

We have so far dealt with the problems associated with inputs, namely, capital and labour and have seen how they can be and are used in measuring productivity. Another equally-important factor in productivity measurement is 'output'. Our next concern is, therefore, to discuss as briefly as possible the issues connected with 'output' measurement.

The physical volume of output may relate to the final goods and services entering national product or to the intermediate products that are outputs of some industries and the inputs of others. In either case, it is necessary to define the product units in terms of which physical volumes are measured. It is easy to define types of products broadly; but, strictly speaking, each quality of a given type of product should be distinguished if its physical characteristics and price differ at all from those of other products.

Specification of most goods and services is generally feasible. In some cases it may be difficult to visualise the unit underlying the payments for certain types of services, particularly in the financial area, but close analysis can usual-

12. *Ibid.*

lly produce working definitions. In other instances, the product may not be standardised if produced to the order of requirements of particular customers. If both standard and custom-built goods are produced by an industry, the value of the latter can be deflated by the average price of similar standard items.

Another problem posed is that characteristics of many products change over time. Old models are abandoned and new models are introduced. In measuring production from the viewpoint of productivity analysis, the important question is whether the revised units of a product absorb a different volume of resources than the old units. If so, the real factor-cost weights of the new units should be adjusted by a ratio representing the proportion of factor cost required by the new model to that required by the old in an overlapping time period.

Another question is quality changes. This, however, is not a serious one from the point of productivity analysis although it has profound influence on 'welfare economics'. There may be some effect on productivity as the proportion of resource inputs devoted to product development changes over time. In some industries, this proportion is tended to increase—a development that would impart some downward bias to the productivity ratio insofar as the associated quality improvements are not counted in output. A relative shift of production towards higher-quality goods within product families does increase real product; but productivity is not affected since the larger output is approximately offset by the larger volume of factor inputs required to produce the higher-valued product mix.

New products also create some problems. The occasionally changing 'weight' may be expected to take care of this problem.

The Central Statistical Organisation¹³ uses the term output to mean 'the aggregate value of products and by-products manufactured for sale,

work done for other customers and sale value of goods sold in same condition as purchased and is adjusted for the difference in stocks of semi-finished goods at the beginning and at the end of the survey year.' Value added by manufacture represents that part of the value of the product which is created in the factory and is computed by deducting from gross ex-factory value of output, the gross value of input. "Inputs" in this context means the gross value of materials and fuels etc. consumed, work done by other concerns, products reported for sale the previous year but used for further manufacture, incidental expenditure on purchase of materials etc., non-industrial services purchased. Non-industrial services purchased include amounts paid on account of audit fees, accounts and bank charges, legal expenses, insurance charges, local rates and factories licenses, etc. From an operational angle, these concepts are self-explanatory and can, therefore, be easily computed for the purpose in view.

Measurement of Productivity

So far we have been concerned with the various concepts associated with the measurement of productivity. An attempt has been made in the paragraphs that follow to discuss some aspects of the "measurement of productivity" in its various dimensions. Let us first take up the question of 'labour productivity'.

'Labour Productivity' measures fall roughly into two categories. First, there are the physical productivity measures which show changes in the labour time required to produce a fixed composite of goods and services. These measure changes in technical efficiency alone. Second, there are the gross productivity measures which take into account shifts in relative importance of component sectors with different levels of output per man-hour, as well as changes in physical productivity and shifts between sectors, changes in material requirements per unit of output. Since they reflect the effect of changes in resource allocation, the gross and net measures may record changes even when there is no movement in the productivity of component sectors.

13. Annual Survey of Industries

Measurement of productivity becomes increasingly difficult as one proceeds from the consideration of the production of a single independent worker to that of an industry including many plants manufacturing related but different products.

Data for the measurement of physical productivity should exclude the physical quantities of various goods produced, the unit man-hour required in their production; when unit man-hours are not available physical quantities are combined using weights which are assumed to be proportional to this variable. In order of preference, substitute weights which would be used are unit labour cost, unit value added and unit value. In practice, these weights are used in reverse order at the commodity level.

Gross productivity measures generally are derived by deflating production values by appropriate indices. The latter should be sufficiently detailed to relate to the value of output in question. Deflated value series are sometimes used as approximations of physical productivity measures. Net output measures are based on aggregate money value added. These measures require the same data as the gross output measured and also information on materials and services consumed, with appropriate deflators.

Although theoretically it may thus be possible to measure labour productivity, a closer examination would show that it is not such an easy affair. Only when the quantity of labour contributed to the output is the sole factor which has changed will the productivity of labour vary in relation to labour alone; this case is rare. In many cases factors other than labour may exert their influence on productivity changes.

L. Rostas¹⁴ has pithily put the issue thus :

“Increase in the output of a worker should be identified with harder work, or a lack of increase in productivity with slackness on the part of workers. This may be one of the many determining factors, and in certain circumstances it may be an important one but, in the main, changes in the output of a worker are measurements of general efficiency. They show the combined effects of a large number of separate though inter-related influences, such as technical improvements, managerial efficiency, the flow of material and components, the relative contribution of plants at different levels of efficiency as well as the skill and effort of workers. When it is found, therefore, that the output of a worker in a man-year is increasing, this increase may be attributed to any or to the joint effect of all these factors.”

It is obvious that the data on labour productivity do not measure the specific contribution of any single factor in production, be it labour, capital equipment, management or any other component in the whole process; they register instead the combined results of all the distinct but inter-related influences that determine output per man-hour. Yet, equally the long-term gains in efficiency stem mainly from the advance of science and technology and its application to production. While the action of all the various factors is often blurred in the over-all picture shown by productivity data, certain factors may often figure prominently under certain conditions.

The measurement of productivity becomes increasingly difficult as one proceeds from the consideration of the production of a single independent worker to that of an industry including many plants manufacturing related but different product. The case of the single independent worker seems simple—in most instances, his output and the labour he contributes can

(14) L. Rostas : “Output a Head”, in the *Times*, 10th November, 1945, Quoted in I.L.O. cited.

easily be defined. Special problems arise for 'non-manual' workers. Production of the supervisor of a group of workers is still more difficult to define.

The next level is that of the group of workers. Here the productivity of labour is a consequence of a number of combined factors. The ability of the supervisor may have as much influence on output as the individual efficiency of each worker. In most cases, however, the production remains easily definable, since the group is normally assigned a complete job; it might even sometimes be easy to define the production of the group than that of each of its workers.

The measurement of the labour productivity of an entire workshop will encounter many of the difficulties involved in measures for large units. Management influence is increasing; "auxiliary labour" contributes to production. Production itself may already be heterogenous and thus will raise the problems of addition. When a large undertaking is considered, heterogeneity of production becomes a major difficulty.

Management intervention, specialisation and division of work, the establishment of standards, recruitment policies, the building up of stocks, etc. introduce many problems which are ignored at the job level. Hence, the productivity of labour of an undertaking becomes a complex concept.

At the industry level too, the measurement of productivity is sufficed with several difficulties. A number of units constitute an industry. The accounting methods adopted may vary from one unit to the other; the product differences, the utilisation of capacity, the management practices, the production techniques, etc. may also differ from one another. All these are problems which are not easily amenable to any precise quantification. Nevertheless, attempts have been made in India and abroad to estimate trends in productivity in various industries. Studies so far made, the methodology adopted, the various concepts applied, comparability of the results of the studies so conducted, etc., are areas which one can probe deeply. □

PRODUCTIVITY MOTIVATION

"If there is one thing that modern psychology makes clear, it is this: men cannot be motivated successfully to work hard or to learn well, simply by putting the screws upon them. The starvation theory of wages may or may not have been abandoned in actual industrial practice, but it is certain that other theories of social punishment, and of economic pressure, other theories that men will work hard and well only when they are compelled to, by economic or legal necessity are still very popular. But the analysis of our system of economic and social prestige, as well as the findings of psychologists make it clear to any realist that men work hard and learn well only when they have been trained to work for increasing rewards.

"In order to make underprivileged people anxious to work harder and willing to bear more responsibility on the job, our industry, business, and government must convince them that they can get more out of life than they now get."

—From *Industry and Society* by William Foote Whyte

Role of Productivity in Asian Economic Growth

Dr PC Mehta*

Nearly every country in developing Asia is making a massive effort in economic development. This process of economic growth is closely linked with and heavily dependent on productivity. Often growth is assumed to be equated to the quantum of investment. Unless, however, investment is productive and generates an adequate return, it not only fails to lead to growth, but becomes a burden on the economy, decreases the amount of resources available for future investment and cumulatively may decelerate growth.

FREQUENTLY, the concept of productivity is restricted to mean labour productivity. Truly speaking, productivity is a measure of the output obtained from a given input of resources of men, machines, money and materials. This wider concept of productivity is particularly relevant in developing countries where resources such as capital, machinery and technical skills are more scarce than labour.

In spite of considerable diversity in many respects there are several common features amongst the developing countries of Asia which would permit a common examination of the problems of economic growth. Industrially and economically, Asia is markedly backward and underdeveloped. With one-third of the world's population, this continent accounts for less than 2% of the world's industrial output. In spite of

the determined efforts in the last decade or two for economic development, the rate of advance has been slower than in the developed countries, thus increasing the division of the world between the rich and the poor. Most countries of Asia are heavily populated. Asia has about 55% of the world's population but only 20% of the total world area. What is more alarming is the high rate of population growth of 2 to 2.5% as against about 1 to 1.5 per cent in the developed world. Another common feature is the predominance of agriculture in their economies. In most Asian countries, 50 to 80% of the population depends on agriculture as against 10 to 20% in advanced countries. Yet, the total domestic agricultural production barely meets the country's requirements. Low level of literacy and education is yet another common feature in most of Asia. Thus, the problem of Asia is the urgent need for rapid economic development of countries characterised by low industrial and agricultural output, large populations with high rate of growth, abysmally low per capita income and standard of living, and a largely illiterate population. It is against this background that one needs to exa-

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The article is the abridged version of the essay by Dr Mehta which won a prize in the International Essay Contest organised by the Asian Productivity Organisation Tokyo as part of Asian Productivity Year-1970 celebrations.



mine how present levels of productivity could be raised without which there can be no hope of economic development.

If we accept the wider concept of productivity, one must necessarily examine not only the measures adopted within individual production units for improving productivity, but must also study the impact on productivity of government policies, facilities of education and training, social and living conditions and other factors which are largely outside the control of the individual industrial unit.

Agricultural Productivity

As already mentioned, agriculture occupies a predominant position in the economy of developing Asia. The low levels of productivity in agriculture are strikingly illustrated by the fact that U.S.A. with 6% of its people engaged in agriculture not only can feed its own population but has a sizable surplus whereas developing Asia with 10 times the relative manual effort, cannot produce enough to feed her own people. This disparity becomes even more alarming if we consider that the average diet in Asia is substantially poorer. The urgent need for increasing food supplies in developing Asia has been stressed by Mr. Takeshi Watanabe, First President of the Asian Development Bank. He says : "The cherished dream of the developing countries is to realise economic diversification. However, shortfalls in agricultural output prove seriously damaging to attempts at economic diversification. Insufficient agricultural production frequently brings rising prices which in turn increase the input costs to manufacturers. Further, agricultural shortfalls cause a drain in the already depleted regional foreign exchange resources. In a region in which the majority of developing economies are agrobased, continued agricultural shortfalls sap the purchasing power of the agricultural community, thus precluding the growth of the essential domestic market and thereby stagnating industrialisation.

Methods for increasing agricultural productivity such as use of high yielding seeds, intensive

application of fertilizers and pesticides, irrigation, efficient soil, water management and flood control are well-known. The effectiveness of these methods has been amply demonstrated in developing countries. In fact, substantial progress has been achieved in increasing food and total agricultural production during the post-war period in almost every developing Asian country. For example, taking the period 1952 to 1957 as 100, the index of agricultural production in 1964-65 was 33 to 55% higher in the various countries of Asia. However, considering the low levels of production in the base years, the rate of increase in production is far too inadequate even to maintain pre-war levels of per capita food supplies.

The main problems in effective use of available technical know-how for increasing agricultural productivity can be briefly summarised as follows :

1. Very low current levels of availability of required inputs such as fertilisers, pesticides and water supply coupled with limitations of financial and other resources required for production of these inputs in required amounts in a short time.
2. Difficulties of communication regarding advanced technology to large numbers of illiterate, conservative farmers scattered over a wide area.
3. Limited capacity of individual farmers for the financial investment necessary for better inputs.

Let us examine these three factors in some detail. In the early years of their development process, most of these countries gave a heavy weightage in their development plans to setting up of heavy industries and of large irrigation-cum-hydroelectric projects. Being very long-term investments, these projects have failed so far to contribute, to the economy, a return proportional to their magnitude. Demands of agriculture did not receive as much attention as they deserved. Thus, the inputs available for an agri-

cultural revolution are inadequate even after several years of national economic planning. For example, even today India has irrigation for only 16% of its land under cotton whereas the corresponding figure is 70 to 100% in U.S.A. and U.S.S.R. Similarly the Asian countries produce 2%, 7% and 4% respectively of nitrogenous, phosphate and potash fertilizers though they have 20% of the world's land.

Difficulties of Communication

Adoption of scientific methods of farming would be hastened if information about modern farming technology and resultant benefits can be communicated effectively to the farmers. With the large numbers of farmers spread over geographically vast areas, the problems involved in communication are very severe indeed, especially because widespread illiteracy precludes the use of any form of written literature. Audio-visual methods are the only available means for mass communication. Thus, more serious attention needs to be given to developing an efficient network of radio broadcasting, television and other methods of audio visual communication. Such a network system could convey the message of modern science on many problems such as agriculture, family planning, health and public hygiene. In setting up and maintaining such a network it may be possible to associate private firms engaged in manufacture and distribution of consumer goods since these firms would already have well-established and extensive contacts with many villages.

With the introduction of land reforms in many countries, the land holding of the average farmer is extremely small, his earning is very limited and potential for savings non-existent. The majority of farmers do not have the necessary finances even for subsistence farming, let alone for the substantial amounts of money required to be invested for modern agriculture. In Japan and Taiwan, a properly managed agricultural credit system forms an important element of the integrated farm programme which has significantly improved agricultural productivity. When credit is closely tied to the marketing of crops, collection problems are greatly

reduced, permitting the expansion of a reasonably profitable and relatively safe banking operation. Supplies of inputs are also furnished to producers through these credit institutions. The contacts with farmers at the time of negotiating credits are used with advantage for effective dissemination of information regarding use of fertilisers, seeds, equipment etc. The leverage which granting of credit offers is used effectively to spread modern agricultural practices. Setting of such a credit system which involves provision of marketing, farm extension work and granting of credit requires considerable knowledge and experience. Training opportunities in the functioning of such multipurpose credit systems are restricted. Establishment of such training centres in each country would be extremely worthwhile.

Limited Availability of Inputs

It was seen earlier that the resources of these countries are inadequate to increase supply of inputs such as irrigation, fertilisers and pesticides at the speed required. In countries like India, no direct taxation is levied on agricultural incomes, partly for political reasons and partly also from a fear that such a step might adversely affect efforts for increasing agricultural productivity. It seems untenable, however, that the section of a community which is getting the direct benefits of the country's efforts for increasing agricultural productivity and hence incomes, should make no contribution to these efforts even if this contribution is to be utilised for further increases in farm productivity and income. Reluctance to tax high agricultural incomes may also lead to wide income disparities in village creating the distinct danger of rural unrest. The concept of rural debentures once proposed by Mr. L.K. Jha deserves serious attention since the amount raised through such debentures from a rural community can be used in the community itself for providing the resources required to raise agricultural productivity.

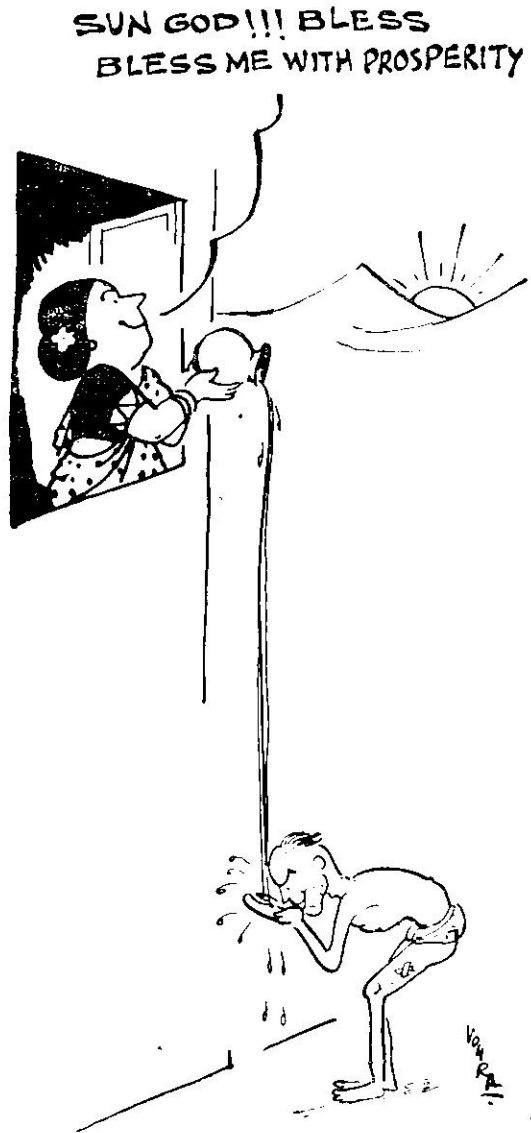
Simultaneously with steps to increase agricultural production, more thought needs to be given to an equally-important associated pro-

blem, viz., storage and preservation. It has been estimated that losses due to spillage, damage during storage, etc., amount to as much as 5 to 10% of the total output of food crops in India. Better methods of packing and handling, adequate transport arrangements, judicious location of warehouses to minimise distance and cost of storage, are all important aspects in the drive for high agricultural outputs.

Productivity in Industry

Turning our attention to industry, the heavy emphasis on industrial growth in the development plans of most Asian countries has resulted in a substantial increase as well as diversification of industrial production. The Asia of today is no longer a producer, exclusively of consumer goods, but can take legitimate pride in the building up of several heavy and sophisticated industries such as iron and steel, engineering and machine manufacturing, heavy and fine chemicals and petro-chemicals. Closer examination of this apparently impressive achievement leads, however, to disturbing conclusions. For one thing, the gap between the advanced and the developing countries has widened. A common index to assess industrial growth of a country is its level of energy consumption. Expressed in kilogram of coal equivalent, energy consumption in Asia is about 350 units as against about 3000 in Western Europe and 9000 in America. What is even more disappointing is that in spite of so many years of economic planning, the growth as measured on a per capita basis is very low. For the period 1958 to 1965, the growth in per capita product at constant prices is 8 to 10% for Ceylon, India, Philippines, and South Viet Nam, giving a real growth rate in per capita product of just 1 to 1.5% per year. The corresponding figure for Iran, South Korea and Pakistan is 3%, and for Thailand 5%, whereas Taiwan has achieved the highest growth rate of 7%. Thus, in many countries of developing Asia, the benefits of industrial and economic progress have been considerably eroded by growth of population and by inflation.

Why is it that most Asian countries, despite their intensive efforts and massive investments



have failed to achieve a significant improvement in the living standards of their people?

Firstly, it must be recognised that setting up of a few pockets of even highly-advanced industry in an under-developed country does not necessarily lead to an overall technological or econo-

mic growth. This is clear from the examples of some of the Arab countries as well as the state of Bihar in India. A second equally important aspect is of social justice, of gradually narrowing down of the inequalities in the earnings of different sections of the society and of ensuring that the benefits of industrial and economic growth will be distributed fairly over the nation as a whole and not restricted to any one section of the society. Thirdly, industrialisation in developing countries must increase to a substantial extent employment opportunities. To meet these problems all these countries follow some system of economic planning at a national level in which the rates of economic development to be achieved, quantum of resources that should be raised, allocation of resources to various sectors of industry and the relative share and place of private and public enterprise are determined by the State. The State has played a major role during the post-war development to support, foster and hasten the process of economic growth. Legislative and fiscal policies have been implemented to protect the interest of labour and to restrict growth of economic monopolies. Small-scale industries have been systematically encouraged to increase employment opportunities.

Emphasis on Public Sector

Within this broadly similar policy dictated by common economic problems and objectives, the ideologies and attitudes and policies of the government differ from country to country in major respects. For example, countries like India and Ceylon with a socialistic ideology have given a progressively smaller share to private enterprise in their economic plans, have generally looked at private enterprise with suspicion and mistrust, have not widely utilised the accumulated managerial skills in private industries for efficient management of state-owned industries and have often allowed ideological considerations an overriding importance in essential economic decisions. The public sector enterprise has expanded from basic industries and infrastructure to other areas in which private capital could readily have been found for investment. In contrast to this, Taiwan, South Korea and Malaysia have developed a mixed economy

with a bias in favour of the private sector. Government policies have been to establish by public enterprise those basic industries for which private enterprise was not forthcoming and then to transfer these to private companies. It would be worth examining if this policy has resulted in greater concentration of economic power or wider disparity of wealth and incomes than what are obtained in countries such as India and Ceylon.

In this context, Professor Galbraith who is a supporter of the social objectives of countries such as ours says: "In nearly all non-communist countries, socialism, meaning public ownership of industrial enterprises, is a spent slogan, that is no longer a political programme but an overture to nostalgia." The President of the World Bank, Mr. Eugene Black, commented: "If real benefits of industrialisation are to be obtained, Governments should undertake industrial ventures, if at all, only as a last alternative and only after a full examination of other alternatives that exist. However, effort should be made to put the venture into the hands of private capital and private management as quickly as possible."

One may wonder why the concept of State ownership of industry which appears unobjectionable in principle has given such a poor performance in practice in countries following a socialistic policy within a democratic framework of Government. The problem can be traced mainly to questions of accountability, delegation and decision-making processes. Procedures for accountability have to be followed which would permit effective and periodic appraisal of the performance of these enterprises without making plant-level management answerable to legislators, politicians and bureaucrats in their day to day working. Proper delegation of authority and responsibility has to be effected to permit freedom of action and to encourage initiative without losing overall control. Decision-making processes have to be streamlined and shortened. Evolving policies and procedures which are necessary for efficient management of giant public sector industries would require a depth of managerial experience which

governments of developing countries may not possess and would demand time and attention on a scale which they are unlikely to be able to spare, occupied as they are with the multifarious and complex problems of poor countries wishing to develop rapidly. Another significant question is the relative emphasis between capital and consumer goods industries in the development plans. It is believed that establishment of capital goods industries would generate a higher long-term growth potential whereas setting up of consumer goods industries will achieve short-term growth at the expense of long term development. In this context, it is important to remember that nations which have long lived at or below the subsistence level and whose aspirations have been awakened by political independence will not indefinitely bear the increasing burden of providing resources in the hope of long-term prosperity alone, if they do not receive at least some tangible benefits in their life-time in return for the hardships that they are asked to accept for the future generations. According to Mr. Jha, it would be advisable to keep the capacity of capital goods production in a country below the rate of capital formation in the economy.

Concepts of Social Justice

Application of concepts of social justice has also varied considerably in extent in different countries.

In his book 'Public Enterprise and Economic Development', Professor A. H. Hanson says: "The real danger in India as in many countries, is that excessive concentration on fairness of distribution may inhibit the expansion of wealth available for distribution. In India, today, the most socially significant form of inequality is that which divides the employed from the unemployed whose number unfortunately is increasing in both industry and agriculture and among both educated and uneducated. Both political and social considerations point to policies which by maximising growth, maximise employment. This would go further towards remedying inequalities than pursuit of equalitarian ideologies at all costs, without consideration to the social losses exceeding the social-gains."

Increased Employment Through Small Industries

Promotion of small and medium scale industries would answer the needs of increasing employment, reducing urban concentration and a widening base of entrepreneurship and industrial ownership. Such a development will take place rapidly only if modern science and technology permeate villages. The choice of manufacturing scale for a particular industry can be based primarily on economic considerations rather than on sentiments or ideologies. There are several industries where scale of production and level of technology are only marginally significant in determining cost and quality of production, and in which the high cost of capital may be more than compensated by low labour costs. Systematic economic analysis should permit working out of minimum cost decisions for various industries and defining relative intensity of capital and labour, and consequently the optimum scale of production and level of technological sophistication. The State must take the responsibility of providing to small and medium scale industries facilities such as technical and managerial training, quality control, inspection, technical and information services, etc.

Need for Efficient Management

Turning our attention to the contribution of plant level management in improving productivity, several studies have shown that the quality of management plays an important role. For example, in a study conducted by a UN Economic mission in textile industry of South America, it was concluded that of the large variation in productivity between textile mills in the different countries studied, approximately two-thirds was due to various factors directly related to and resulting from the quality and effectiveness of management. Only one-third of the productivity difference could be attributed directly to superior machinery and technology employed. Numerous Indian studies on productivity and operational efficiency in the textile industry also lead to a similar conclusion. Under nearly identical conditions of machinery, raw materials and product mix, the index of production in spinning

varied between mills from 76 to 103. Similar large variations have been observed for labour productivity as well as the efficiency of material utilisation. These studies clearly show the improvements in productivity that can be achieved without substantial capital expenditure by increasing the organisational efficiency.

One of the most vital areas in improving management effectiveness is the establishment of an efficient management information and control system. Unless the right information is supplied in the right form to the right person at the right time, either deficiencies in performance will not be brought out or else the information will be only of historical value and not lead to corrective action. Maintenance is another management function which deserves much more serious attention than it generally receives. Neglected maintenance results often not in a total breakdown of the machine, but in a gradual decline in its productive efficiency which can remain undetected for a long time. In as much as developing countries with limited resources cannot afford to adopt the same high rate of obsolescence as the developed countries do, it is of some importance that preventive maintenance schedules are observed more strictly to get maximum value from existing machinery for a longer period. More systematic methods of personnel management would also help in creating an environment in which the individual's goals are identified with those of the organisation. Wider application of many modern management methods for inventory control, work organisation, production planning, materials handling etc, would contribute significantly to increasing productivity.

Research and Development

The weightage given to research and development in the advanced countries has produced fantastic increases in labour and machine productivity. The importance of research for economic development has been recognised also by most developing countries which have invested substantial amounts on research. There are, however, significant differences in the pattern of research management in the developing and developed countries. In the former, industrial research is done by industry within industry where-

as in the latter it is generally carried out outside industry by research laboratories financed and run by government agencies. Industry's expenditure on research is negligible. For example, of the total amount spent on research in India, industry's share is less than 5% as against a figure of about 50 to 60% in U.K. and U.S.A. To a large extent, the apathy of industry in developing countries towards research is because of the existence of a virtual seller's market. For successful applied research, selection of worthwhile research objectives, critical appraisal of research results and decisions regarding development, all demand effective participation between the research scientists and industrial managers. Suitable methods must be established to encourage such a participation.

Choice of research projects must take into account the technological and economic conditions prevailing in the country and not merely follow current trends in the advanced countries where the economic conditions are completely different. Choice of applied research programmes must consider cost benefit ratios, technical feasibility, chances of success, ease and extent of application in industry, factors that may vary widely between developing and developed countries. It may often be found that modification of machines and technologies to achieve modest increases in productivity is economically more viable and a more immediate need than designing and developing totally new high speed machines or technologies. In a consideration of priorities for research in developing countries the need for increasing agricultural productivity must rank high. Extensive surveys of industrial raw-material resources would also receive high priority. Research for substitution or more efficient utilisation of imported materials and for exploitation of indigenous raw materials including their beneficiation would also seem to be economically urgent. Export-orientated industries must receive high priorities for research since cost reduction, improvement of product quality and product development will enable higher foreign exchange earnings for the country.

Education and Training

Education is another field in which more thought needs to be given to establish suitable

long term policies. A serious obstacle in achieving rapid and widespread increases in productivity in developing countries is the static nature and stagnant mental attitudes of their traditional societies. With given technology, implements and tools, there is a significant scope for increasing productivity if the man who uses them has a questioning attitude, open mind and some innovative skills. To achieve these qualities, however, would require a major transformation of the society since it involves changes in basic human attitudes, firmly set over several generations. Education should be able to fulfil this colossal transformation in the values and attitudes of society.

A policy for education can be conceived from social as well as economic points of view. Social considerations would demand that opportunities for education up to the highest levels should be available equally to all citizens as their fundamental right. On the other hand, the economic point of view would aim at optimising the utilisation of available resources for the specific development objectives of the society. A better balance between University colleges, polytechnic and trade schools needs to be achieved in relation to the expected demands of manpower with different levels of skills and knowledge. Simultaneously social attitudes which place a premium on the stamp of a university degree even in vocations which require more of skill than of knowledge would need to be changed.

The problems of rural education do not appear to have received much thought. Rapid and all-round increase in economic growth and productivity will be achieved only if the bulk of the population which in developing countries lives in villages is exposed at least to some extent to modern technology and better work methods. The programme of college and university education, teaching basic sciences intensively does not achieve this objective for daily rural occupations such as farming, cattle and sheep rearing etc. The result is that the section of village youngsters who receive benefits of higher education migrate to cities in search of jobs, increasing on the one hand problems of urban concentration and on the other impoverishing villages of their best talent.

Housing and Health

Lastly, we should consider other aspects of living conditions such as housing and health which have a significant long-term effect on productivity. Concentration of industries in urban areas and the accompanying unplanned growth of cities have greatly accentuated the housing problem in recent years. The living conditions available to most workers in cities must have a cumulative detrimental effect on the energy and productivity of the worker, who is likely to develop a despondent and resigned attitude towards his future devoid of any urge to work harder and improve his living standards. A hope for the solution of the gigantic problem of providing better housing for industrial workers may possibly lie in two directions. Firstly, dispersal of industry in rural areas can be encouraged through more effective incentives. Equally important is research to develop designs for cheap but adequately comfortable houses. The scope for using cheap and plentiful resources such as straw, agricultural wastes and clay for designing houses does not seem to have been fully explored.

In the field of health, most developing countries have made considerable progress in eradicating malaria, and many other major diseases. Much more needs to be done for providing better sanitation and living conditions for people, and for increasing the appreciation of preventive measures. Family planning programmes which have been recently taken up as intensive campaigns will also contribute directly or indirectly to improve health. The success of these programmes will depend primarily on the effectiveness with which mass communication on a gigantic scale can be accomplished besides providing necessary service centres and trained personnel. The problem in many ways is similar to nationwide retail distribution of consumer goods in which promotion of consumer demand, supply of goods according to consumer needs and preferences, and getting feedback of consumer responses, play an important part. Perhaps, these campaigns can usefully adopt many of the techniques employed by industry and business for effective retail marketing of consumer products. □

Management Training and Productivity

AP Saxena*

Ever since its inception, the National Productivity Council has made rapid strides. From general exhortation and platitudes on productivity, there has been discernible shift to more specialised field services. There is today greater awareness of the significance of productivity techniques. The growing public sector calls for the need among other things of a planned programme of management training of their personnel. No doubt, a few agencies in the Government are engaged in the area of management training to various levels of government personnel. However, the government personnel who need exposure to management training programme is very large indeed and therefore much more needs to be done. Today, the prospects of growth in management training, especially in the Government are wide and challenging.

EVER since the issue of Government of India's Policy Statement on Productivity in 1958¹, the productivity movement in the country has moved ahead with great strides and success. The declaration enunciating the principles of Productivity movement considered it necessary to eventually launch the productivity drive in all spheres of the nation's economy.

Since 1958, some of the objectives of the Productivity movement have appropriately undergone a discernible shift. To quote the NPC Chairman's observations 'general exhortations and platitudes on productivity have now given way to more specialised field services in conformity with the managerial and technical requirements of business, industry, agriculture and

administration'². The Annual Report of the National Productivity Council for 1969-70 also reports these hopeful changes. It states "initial resistance to draw out new ideas is no longer there. The various sectors of the economy have become quite aware of the significant contribution of productivity techniques in improving the productive efficiency... The NPC has contributed significantly to the creation of a demand both for productivity techniques and productivity specialists."³ The developments in the area of productivity in the country are thus significant and noteworthy.

It is necessary to recall at this stage that the productivity movement in India is largely based on tripartite cooperation between the Government, the employers and the workers. The role of the Government in the movement has not only to be of a continuing and sustaining nature, but it has to be all-pervasive and unique. Today, against the background of plans and programmes

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1. See Policy Statement dated 10th January 1958 at the Inauguration of the National Productivity Council. Quoted in 'Productivity—An Elaboration of Basic Policies and Programmes for Stimulating National Productivity in India', National Productivity Council, Jan. 1969.

2. *Ibid*, See Foreword by Chairman

3. *12th Annual Report 1969-70 National Productivity Council, New Delhi.*

for national development, the activities of the Government permeate far beyond the traditional approach of law and order administration. The sheer size and complexity of Government operations itself is a situation which has to be recognised. In a way, therefore, the operations of the Government interlace both horizontally and vertically any possible fabric or design of productivity movement.

The Government Sector

The continuing growth of the public sector undertakings adds yet another dimension to the growing size and role of the Government. The latest annual Report of the working of industrial and commercial undertakings of the Central Government (other than departmental undertakings) reports the operation of 91 Central Government enterprises involving a total investment of 4301 crores.⁴ The report of the Department of Company Affairs for 1970-71 indicates the existence of 302 Government companies with a total paid-up capital of 1820 crores.⁵ It is not merely the number of companies, and the size of investment that is particularly noteworthy. What is more important is that many of these companies in their operations have an immediate, either direct or indirect, impact on the developments in industry, agriculture, business or administration, and thus on Productivity.

The principles of Productivity movement as indicated in the Policy statement lay stress on 'efficient and proper utilisation of the available resources of men, machines, materials, etc.' In addition, the principles also indicate the need for appreciation of the management principles implied in the achievement of these tasks. Obviously, the accomplishment of these tasks, among other things, involve the need for a planned programme of management training. As an apex organisation for promoting the productivity movement, the National Productivity Council

The need for management training in the Government for achieving the broad and urgent goals of productivity cannot be overemphasised.

has been seized of this and has over the years promoted a number of training programmes addressed to various levels and dealing with different areas in management. For example, during 1970-71, ranging from management development to small industries development, the NPC presented nearly 222 training programmes covering 3702 participants.⁶ This is by no means an ordinary accomplishment as far as the quantity and quality of this training is concerned. 'The changes in the content, presentation and application of the programmes have been promoted by experience gained over the years and the changing pattern of demand'. It is important to note that the NPC is planning for a further expansion of training programmes in the area of management.

In the light of the foregoing comments, the need for management training in the Government for achieving the broad and urgent goals of productivity cannot be over-emphasised. Apart from being pledged to develop the movement, in many other ways, the impact of trained government personnel can be marked as far as productivity is concerned. It is, therefore, necessary to discuss some issues in the development of management training in Government, with special reference to the requirements of the productivity movement.

Training in Government

The interest of the Government in the matter of training has extended over the last several decades. A number of State Governments' Reports and other Committees have from time

4. *Annual Report on the Working of Industrial and Commercial Undertakings of the Central Government, 1969-70 Ministry of Finance, New Delhi.*

5. *Report 1970-71, Deptt. of Company Affairs, Govt. of India, New Delhi.*

6. *Report 1970-71, Ministry of Industrial Development, Govt. of India, New Delhi.*

to time stressed the need for planned, systematic programmes of training of various levels of Government personnel⁷. The Five-Year Plan documents have successively laid stress upon the need for greater training in the Government⁸. More recently, the Administrative Reforms Commission through its various reports and study teams has reiterated the need for training in the Government at various levels and in a broad variety of areas⁹. A part of the Government's thinking in the area of training was formalised in 1968 through the creation of a nucleus Training Division in the Ministry of Home Affairs. The Training Division has since completed three years of its existence and is presently located in the Department of Personnel in the Cabinet Secretariat. The Division is mainly concerned with the formulation and coordination of training policies and programmes in the field of administration and management, in sponsoring training programmes for officers of various levels besides assisting in training matters a few selected training institutions. The functions of the Division can be broadly summarised 'to include assistance in the development of training policies and programmes at the Central and State level as well as coordination of training programmes and activities especially in the field of administration in the Central Government'. This necessarily includes the need to oversee training arrangements in order to ensure that suitable programmes are framed in accordance with well defined policies. The efforts have also to take note of the requirements of training literature for use in the Central and the State training institutions. Finally, there is need to collect information regarding training programmes elsewhere, both in the country and abroad.¹⁰

As a conscious policy and in terms of the recommendations made on the subject from time to time, the Training Division has laid stress on the production of indigenous training literature and development of suitable programmes in the area of management and public administration at the Indian Institute of Public Administration. For example, during 1970-71, 18 programmes covering 446 middle level personnel were presented at the I. I. P. A.¹¹. In addition, a number of management training programmes were also held at the National Academy of Administration, Mussoorie and a number of other Central and State training institutions. For example, the National Academy of Administration recently promoted a set of training programmes covering the important issues of 'Management in Government' and 'Economics in Government'.

The above references are by no means exhaustive but at best an illustrative mention of a part of the activities being undertaken in the area of management training by a few agencies in the Government. As briefly mentioned earlier, the size of the Government apparatus is today wide and far reaching. The number of Government personnel at various levels who would necessarily need exposure to management training programmes is very large indeed. The Census of Central Government employees as on 31st March 1969 indicates the strength of Gazetted officers in the Central Government alone at nearly 50,000¹². The increasing dispersal of these large numbers throughout the country adds a minor dimension to the problem, pointing towards the need for local and regional development of management training capabilities. Related to the question of numbers is also the existing diversity of interests and background among this large population which needs systematic programmes in management training.

7. *Reports of the Administrative Reforms Committee* Kerala (1958), Andhra Pradesh, (1960), Rajasthan (1963), Bombay (1948) etc. For an indexed summary, see 'State Administrative Reforms Committee on Training' Training Monograph No. 7, Training Division, Govt. of India, May 1970.
8. See 'Five Year Plans and Training', Training Monograph No. 1, Training Division, Govt. of India, June 1969.
9. See 'Administrative Reforms Commission on Training', Training Monograph No. 2, Training Division, Govt. of India, June 1969.

10. For details see *Annual Review 1968-69, & 1969-70*, Training Division, Govt. of India (mimeo)
11. See *Seventeenth Annual Report 1970-71*, Indian Institute of Public Administration, New Delhi, Oct. 1971.
12. *Census of Central Government Employees* (as on 31.3.69) Director General of Employment and Training, Ministry of Labour and Employment and Rehabilitation, New Delhi, Jan. 1971 (mimeo).

Change in Attitudes

Here, it would be appropriate to *identify* some major issues in management training in the Government, specially those which have a bearing on the subject of productivity. First and foremost is the whole question relating to the need for changing attitudes, especially insofar as they relate to current management developments. It needs to be accepted that within the limitations of time any management training programme has indeed a difficult task in attempting to bring about attitudinal changes.

The subject of attitudinal change becomes important in the context of modern management techniques and their application in our environment. It is the experience of many management trainers to frequently face stiff resistance from trainees in accepting squarely the validity of some management techniques as applied to the Indian scene. While a number of participants attending management training programmes initially accept the intrinsic merit of management techniques, a few have a sense of lurking disbelief whether the techniques can be applied effectively in their own job experience. It can be argued that this type of indifference or a posture of cynicism, can be taken care of by a trained trainer, but the existence of such a problem in the area of management training cannot be disregarded. The merit of applying management techniques for purposes of productivity can thus lose its primary thrust in case a body of functionaries have a questioning approach towards (their) application in our environment.

Trained Trainers

Another significant issue in the area of management training relates to the lack of availability of trained trainers, fully developed and with experience in the area of management training who can stimulate and generate a degree of planned learning¹³. The background capability of a trainer, his previous experience and the in-

Management techniques which have a special validity for productivity can suffer a serious blow if a trainer in the field of management is unable to articulate the pressing need for acceptance, validity and eventual application of the techniques.

struction method and training technique applied can be determining factors for the larger success of a management training programme. Yet another ability of a trainer worth mentioning is the trainer's comparative approach in management—an approach which will recall the comparative advantages and disadvantages of a tool or technique. Management techniques which have a special validity for productivity can suffer a serious blow if a trainer in the field of management training is unable to articulate the pressing need for acceptance, validity and eventual application of the techniques in the country. The role of the trainer in promoting management techniques, specifically relevant to productivity, would be not *per se* to impart extra knowledge, but to develop abilities and outlook so that the immediacy of productive gains, *via* the techniques, can be appreciated. Why a technique works, how it works may not be vital information even though appreciation would help. What eventually matters as an objective of management training programme is rather that the technique *does* work and identify the best approach to a problem leading to improved performance and greater productivity.

Training Literature

In addition to the lack of trained trainers, is the continuing constraint of inadequate training literature. A body of management literature with a primary bias to our problems, our needs, and our limitations is yet to emerge effectively enough so as to promote and influence management training. A number of factors are responsible and need to be kept in view. Training

13. See for details:
A.P. Saxena: *Management Training for Trainers*, Training Monograph No. 3, Training Division, Govt. of India, August 1969.
A.P. Saxena: 'Development of Trainers', Training Monograph No. 10 Training Division, Govt. of India, March 1971.

material as are available now, are drawn mostly from foreign experience and have, therefore, little applicability to our institutional framework. The need to prepare specific material drawn from a source applicable to the Indian environment, specially in the Government, is therefore, important. Acquisition of new management skills of direct importance to productivity, e. g., Work Study, Inventory Management, Project Formulation, Programme Planning, Information Systems, Capital Budgeting and Economic Decision-making would in the years to come imply the need for more elaborate and intensive courses of training. This necessarily underlines the importance of the preparation of training material, specifically suited to the requirements of such management training programme. The material as available now can be more properly termed as 'a general literature' on the subject and, therefore, is often out of focus in specific management training programmes. What we need is a set of precise and brief volumes which can make the subject easily assimilable. The excellent training pamphlets and volumes published by National Productivity Council from time to time are worth noting here in this connection.

The development of suitable training material has also some short-term and long-term aspects. In the short-term perspective, the need is to organise a body of literature on specific subjects with a view to meeting the requirements of management training programmes in selected areas. The long-run emphasis can be on preparing analytical and empirical studies that may seek to examine the complex process of decision-making and the need for better management training. This will necessarily involve bringing together specialised institutions like the Institutes of Management, The Administrative Staff College, the Institute of Public Administration, other Government bodies and, of course, the National Productivity Council.

Conclusion

Finally, even though to a much smaller extent now, there is the problem of "selling" more concept-based management training programmes. It is frequently noted that while technique-based

management training programmes are able to attract with reasonable success a number of participants, the concept-based programmes have promotional difficulty. At the same time, it cannot be denied that some of the concept-based programmes may be essential as part of management training and productivity. Perhaps with passage of time and greater all-round awareness, this problem may take care of itself. Here again, there is challenging scope for promotional effort on the part of Government agencies and institutions with nation-wide network like the National Productivity Council.

Today, the prospects of growth in management training, specially in the Government are wide and challenging. Government's increasing realisation and interest in such training is a welcome development. In fact at the highest level, there have been pronouncements stressing the need for training in Government¹⁴. The future pattern of growth of our industrial base has serious implications *vis-a-vis* the whole productivity programme. The role of management training to achieve the goals of productivity, and thereby accelerate the planned programmes of industrial development need hardly be emphasised. With this background, management training will be no longer a disinterested pursuit of knowledge, but instead will be 'directional' and 'objective-oriented'. This may appear as a difficult task, more so, in the light of some of the problems mentioned above. However, with increasing Government support there are encouraging signs of development all over. In fact, a part of the efforts of the Government can be effectively supplemented by various other institutional and private sources. All these sources together can effectively cover a large and desirable cross-section of personnel all over so that, through management training, the objectives of productivity become meaningful targets. Yet, this accomplishment can only take place if some of the issues in the area of management training and productivity are adequately appreciated along with the efforts needed to resolve them. □

14. *Presidential Remarks of the Prime Minister, Seventeenth Annual Meeting, Indian Institute of Public Administration, New Delhi, Oct. 22, 1971.*

Development of Productivity Indices: Efforts Made by Labour Bureau

Importance of productivity as a factor in economic development and the need for its measurement for economic and social analyses are well recognised. The Fourth Plan lays great stress on the need to reduce costs and to improve productivity levels by better utilisation of scarce resources, particularly priority sectors like exports. In this context, the need for developing proper productivity measures is highlighted for assessing progressive changes over time in the utilisation of various resources in production. This paper describes attempts made in India to develop productivity indices.

IN broad terms, productivity represents the relationship between output in physical terms with the resources (also in physical terms) expended on its production and thus it connotes the efficiency of utilisation of the resources in the production of goods. In practice, productivity measures have been usually worked out with reference to individual factors of production such as, "Labour" and "Capital", with the object of knowing whether the resources in question were better utilised or not, or in other words, how the cost per unit of output in terms of the particular factor changed over time. No doubt, these partial productivity measures are useful in determining requirements of individual input factors on the basis of any anticipated output; but in view of the fact that these measures do not reckon with the role of other factors of production explicitly, even though they are greatly influenced by these other factors, such partial productivity measures fail to assess the overall efficiency of production.

From the standpoint of judging the overall efficiency of production, the use of one or the other "partial productivity measures" singly might be misleading. The concept and measure-

ment of total productivity, in which the output is related to the totality of all input factors, are, therefore, expected to be more appropriate for assessing the overall efficiency of production. If all the factors of production could be suitably combined to bring out correctly an overall measure of the entire complex of input factors, the relationship between total output and this overall measure of all the input factors will show the combined net result of efficiency of utilisation of each of the individual factors of production. This will be a useful supplement to the individual factor productivities. Attempts have, therefore, been made in India in recent years to derive measures of total productivity in selected industries by taking into account two major factors of production namely, tangible capital and labour.

The Labour Bureau initially worked out productivity indices for nine selected industries in respect of "labour", "capital" and "materials" inputs. Recently, the scope of the work has been expanded to cover 38 industries (accounting for over 80% of the total manufacturing indus-

*Paper prepared jointly by the Central Statistical Organisation, New Delhi and Labour Bureau, Simla.

†Refers to all forms of tangible capital such as land, buildings, machinery, working capital, cash in hand, as distinguished from organisation/management/technology which are sometimes designated as intangible capital.

Labour input may be measured by the total man-hours put in by these workers, or the effort content of the workers.

try). Moreover, total productivity indices on the basis of "labour" and "capital" productivity indices have also been worked out annually for the period 1947-1963. The conceptual and other difficulties faced in this study are briefly mentioned in the following paragraphs.

Labour Input

Labour input may be measured by the total number of workers engaged, the total man-hours put in by these workers, or the effort content of the workers. The first measure means a stock approach to the labour input. It takes into account only the stock of labour in use, rather than the flow of labour service emanating from the workers engaged. Variation in the output on account of changes in the number of working hours per day, rest days in the week or leave during the year brought about through social welfare measures are not taken into account; as a result, this approach suffers from severe limitations.

The second measure of labour input, i.e. man-hours, takes into account the flow of labour input, as it is measured in labour-time unit. As such, it does not suffer from the limitations arising out of variation in the labour time put in by the workers in employment. Separate man-hour figures are available by sex and broad age-groups, that is, for adults and children. An attempt has, therefore, been made to take into account the difference in efforts made by the workers of different sex and age on the basis of

their relative earnings in the base year. Limitations of available data do not, however, permit differences of skill, training, education, health, etc. of the workers to be taken due account of.

Ignoring the category of "Salaried Staff" from the scope of labour input might introduce some bias in the input index, as this category contributes largely for the overall technical efficiency, quality of supervision and organisation. This category of 'Labour' has over the years generally increased in relative importance as compared to "production" workers. However, the contribution of such non-production workers is, to some extent at least, realised through the contribution of the 'production workers'. One way to include the labour input by this category will be to aggregate the man-hours put in by this category of workers with that by wage earners on the assumption of homogeneity of all labour input. The Labour Bureau has, however, attempted to take into account quality/skill differences among the two groups of labour by giving differential weighting of index of man-hours put in by the salaried staff and the index of man-hours put in by wage earners on the basis of their respective compensation in the base period.

Capital Input

The problem of estimating capital input bristles with a number of difficulties arising mainly out of the heterogeneous nature of capital equipment in form and uses, as also of different types of capital employed such as land, machinery, tools, transport equipment etc., working capital comprising inventories of materials, stores, fuels, semifinished goods, and cash held in bank. Conceptually, the flow approach for estimation of capital input seems to be desirable rather than the "stock" approach. Approximations to the 'flow' of capital services are provided by machine time worked, or total electricity/motive power consumption by all equipment, or weightage of the value of individual items of machinery by the respective electricity consumption. Adequate data are not available to pursue these concepts in practice. In view of the limitations, the stock

approach to measurement of capital input has been adopted in the Labour Bureau Study.

In this approach also considerable difficulty is experienced in estimating the value of capital input at constant prices. All stock of capital is not added at one point of time and as such, the value of stock is subject to variation on account of price changes which cannot be eliminated if due regard is not paid to the variations in the quality and technology embodied in the various capital equipment from time to time. In addition, there is a qualitative deterioration of old machines, which lose their productive capacity with time and require greater expenditure for repair and maintenance. The best solution appears to be to deflate the stock of capital net of depreciation by the wholesale price index relating to the 'machinery' group. This, however, involves the usual index number limitations and also the assumption of comparable price trends of covered and non-covered items of machinery.

The case of land and buildings, though a part of capital input, stands on a different footing. For reducing the value data to constant prices, current price data of land and building materials are needed, or as a proxy, figures relating to index of value of construction during the comparing period with reference to the base period. In the absence of any such data, rent index has been used for deflating values of land and buildings.

The component "Cash in hand or bank or with creditors (net)" has been treated by deflation by the 'General' wholesale price index number to reduce to constant value terms.

Total Factor Productivity

The labour and tangible capital input has to be combined thereafter on the basis of unit factor compensation during the base period to arrive at the total factor input at constant price. The ratio of index of total net output in constant base-period prices to the index of total factor input arrived at in the above manner would give the total factor-productivity index. Symbo-

The problem of estimating capital input bristles with a number of difficulties arising mainly out of the heterogenous nature of capital equipment in form and uses, as also of different types of capital employed.

$$\text{lically, total factor-productivity index } P = \frac{Q \times 100}{aL + bK}$$

where Q, L and K are the net output at constant prices, labour input and capital input respectively, and 'a' and 'b' are the relative returns per unit of labour and capital input during the base year.

The above method of combining the labour and capital inputs on the basis of a weighted arithmetic average is most commonly adopted. However, a geometric or a harmonic average of the two inputs have also the necessary theoretical justification derived from the basic assumption as to the nature of production function. While combining the inputs of labour and tangible capital with a view to deriving the total factor inputs at constant prices, the relative returns per unit of labour and tangible capital input during the base year have been used as weights. The implicit assumption is that the aforesaid input factors were eligible to unit factor compensation in proportion to their respective factor productivities. Although such an assumption might hold good in a perfect competitive market economy, whether it will be valid in actual situation for different Indian industries seems to be doubtful. Use of inappropriate weights for measuring the total factor input could thus be one of the major limitations of the overall measure of total input factors.

Besides, tangible capital and labour inputs, other factors such as technological progress and efficiency of organisation and management are expected to have considerable influence on the level and quality of production. Any measure of total factor input which does not take into account the aforesaid factors (which are sometimes designated as 'intangible capital') will, therefore, be subject to unknown and possible large margins of error.

Computation of the Productivity Indices by Labour Bureau

Productivity studies in the manufacturing industries were undertaken by the Labour Bureau in pursuance of the recommendations of the Second Five-Year Plan. The studies undertaken were essentially industry-level studies for which the basic data already collected by the Central Statistical Organisation (Industrial Wing) under the Census of Manufacturing Industries (C.M.I.) upto 1958 and thereafter under Annual Survey of Industries (A.S.I.) were made use of. In the initial stages the work done by the Labour Bureau endeavoured to measure the partial productivity of labour, capital and material inputs. Since any one of the said such measures does not individually indicate change in total productivity nor does it measure progress exclusively attributable to the performance of the concerned factor, the Labour Bureau called the index numbers so constructed as "Indices of Utilisation of Labour and other Inputs". The results of such studies covering 9 industries, viz., Jute and Cotton Textiles, Sugar, Paper and Paper Board, Matches, Glass and Glassware, Ceramics, Cement and Edible Hydrogenated oil for the period 1947 to 1961 have been published by the Labour Bureau and the same now extend upto 1964.

Owing to the replacement of the C.M.I. reports by those of the A.S.I., the classification of industries has undergone some radical changes and only in nine industries data were found to be comparable; and eventually this has necessitated the building up of a new series of productivity indices with 1960 as the base year. As such, it has been decided to build productivity indices

for about 38 industries (vide Appendix—I) as classified in the reports of the A.S.I. on base 1960=100. Selection of these 38 industries has been made on the basis of joint importance of employment and value added by manufacture. The study of these 38 industries would cover about 80% of employment and value added by manufacturing process under all the industries covered by the A.S.I. In the new series, attempt is also being made to construct the index of 'Total Factor Productivity', taking into account the complex of labour and tangible capital inputs besides compiling the individual factory productivity indices.

The Labour Bureau has considered it appropriate to use the concept of net output for productivity measures at industry level. This is based on aggregate of value added at constant prices ensuring that it is free from duplication, and presents real activity in the manufacturing process. At first, indices of labour, raw material and capital inputs are estimated (as they are considered basic factors of production) at base year prices and thereafter the indices of inputs are combined with appropriate weights proportionate to factors prices of base year. The five-year moving average of the index of total productivity has been used by the Labour Bureau to smoothen out the short-term fluctuations in the index and to bring out more correctly the general trend observed during the period under study. The resulting indices of total productivity and the factory productivity in the 9 industries for which comparable figures are available since 1947, reduced to 5 years' moving averages, are presented in the Appendix II.

In conclusion, it would bear repetition that productivity is the cumulative result of the operation of a large number of factors such as technical improvement, rate of operation, degree or efficiency achieved in different processes, availability of raw materials and components, labour relations, skills and efforts of workers and efficiency of management. Correct measures of total productivity should take into account all the aforesaid factors. However, due to limitations of data and other practical difficulties involved in the measurement of some of these

factors, it has so far been possible to construct the index of total productivity on the basis of only two major factors of production namely, tangible capital and labour. On the other hand partial productivity ratios such as labour productivity or capital productivity are also not correct indicators either for measuring changes in the efficiency of the particular factor or of the general productive efficiency since each is influenced by the other factors and also by factor substitution. Care and caution are, therefore, necessary both in the construction of productivity indices and in their interpretation and analysis.

The productivity measures referred to above represent changes over time in average productivity levels in the "industry" as a whole. As productivity levels may differ, sometimes widely, among the various productive units belonging to the industry, it may be interesting to study the overall pattern of productivity among the various firms in the industry. This may provide necessary knowledge to the planners to judge how far, in important individual industries the output can be increased simply by gearing up the units which are very much lagging behind the leading firms. It may also help in analysing the causes for inefficiency and for formulating remedial measures.

A P P E N D I X—I

List of Industries Covered for Productivity Studies

(New Series:1960=100)

- | | |
|--|--|
| 1. Tea Manufacturing | 20. Non-Ferrous Basic Metal |
| 2. Iron & Steel (Metal) | 21. Woollen Textiles |
| 3. Railway Rolling Stock | 22. Heavy Chemicals (Inorganic) |
| 4. Manufacturing of Motor Vehicles | 23. Textile Machinery (such as spinning frames, carding machines, powerlooms etc. including textile accessories) |
| 5. Manufacture of Edible Oils (other than hydrogenated oil) | 24. Manufacture of Motor Cycles and Bicycles |
| 6. Electric Light & Power (generation, transmission and distribution of electric energy) | 25. Petroleum Refineries |
| 7. Cotton ginning, cleaning and pressing | 26. Iron and Steel Pipes |
| 8. Letter-press & Lithographic Printing and Book-binding | 27. Metal Fillings for shoes and leather articles and wearing apparel, weight and metal products except machinery and transport equipment—others |
| 9. Drugs and Pharmaceuticals | 28. Metal Containers and Steel trunks |
| 10. Railway Locomotives | 29. Soap and Glycerine |
| 11. Art Silk | 30. Jute textiles |
| 12. Cashewnut Processing | 31. Cotton Textiles |
| 13. Other Tobacco Manufacture | 32. Sugar |
| 14. Ships and Other Vessels drawn by power | 33. Paper and Paper Board |
| 15. Repair of Motor Vehicles | 34. Matches |
| 16. Iron and Steel structurals | 35. Glass and Glass Ware |
| 17. Cigarette | 36. Cement |
| 18. Iron and Steel Castings and Forgings | 37. Ceramics |
| 19. Tyres and Tubes | 38. Edible Hydrogenated Oil. |

JUTE TEXTILES

Base 1947=100*

Labour Productivity	Capital Productivity	Total Productivity	Five-Yearly Moving Averages		
			Labour Productivity	Capital Productivity	Total Productivity
100	100	100	—	—	—
94	91	93	—	—	—
70	61	66	85	79	82
81	69	76	81	73	78
80	73	77	84	71	78
79	73	76	90	75	84
108	80	95	93	77	86
102	81	93	101	77	90
98	75	89	106	75	92
116	77	98	109	75	94
107	63	85	113	73	94
124	80	103	113	71	92
122	70	96	111	69	91
94	63	80	117	72	95
107	69	89	121	72	97
137	80	109	127 (a)	75 (a)	104 (a)
147	80	113	—	—	—
148	84	116	—	—	—

*Baseshifted to 1947 from the new series on 1960=base linked at 1963

(a)—Average for 1960-1964

COTTON TEXTILES

(Base 1947=100)

Years	Labour Productivity	Capital Productivity	Total Productivity	Five-Yearly Moving Averages		
				Labour Productivity	Capital Productivity	Total Productivity
1947	100	100	100	—	—	—
1948	98	97	98	—	—	—
1949	77	72	75	110	98	106
1950	133	105	122	124	103	115
1951	142	117	133	139	110	127
1952	167	125	149	159	122	144
1953	173	129	154	171	130	154
1954	171	133	162	179	133	159
1955	183	143	170	122	132	160
1956	183	132	161	182	127	157
1957	183	118	153	176	121	152
1958	172	106	141	170	113	144
1959	155	105	133	160	102	134
1960	158	103	133	165	97	128
1961	131	80	108	140	92	122
1962	153	91	126	146 (a)	86 (a)	117 (a)
1963	145	80	112	—	—	—
1964*	136	76	105	—	—	—

*Base shifted to 1947 from the new series on 1960=base linked at 1963

(a) Average for 1960-1964

APPENDIX 2 Contd.

SUGAR
(Base 1947=100)

Years	Labour Productivity	Capital Productivity	Total Productivity	Five-Yearly Moving Averages		
				Labour Productivity	Capital Productivity	Total Productivity
1947	100	100	100	—	—	—
1948	96	80	85	—	—	—
1949	111	115	113	105	95	98
1950	107	100	103	107	89	94
1951	111	82	91	107	87	93
1952	109	66	78	118	88	97
1953	96	72	80	123	82	94
1954	167	118	133	126	79	92
1955	130	74	89	131	79	92
1956	129	65	80	138	78	93
1957	132	65	80	125	66	81
1958	130	69	84	129	65	80
1959	106	58	70	136	63	79
1960	149	67	85	139	71	76
1961	161	57	75	141	66	74
1962	147	43	65	15 (a)	60 (a)	78 (a)
1963	140	60	77	—	—	—
1964*	156	70	88	—	—	—

*Base shifted to 1947 from the new series on 1960—base linked at 1963.

(a) Average for 1960-1964

MATCHES
(Base 1947=100)

Years	Labour Productivity	Capital Productivity	Total Productivity	Five-Yearly Moving Averages		
				Labour Productivity	Capital Productivity	Total Productivity
1947	100	100	100	—	—	—
1948	93	100	97	—	—	—
1949	97	93	95	—	—	—
1950	94	112	104	97	98	97
1951	101	83	90	98	85	96
1952	105	88	94	101	92	95
1953	106	85	93	103	90	95
1954	111	83	92	105	85	92
1955	101	84	91	105	84	92
1956	102	80	88	108	84	83
1957	119	90	100	115	87	97
1958	143	97	110	116	87	97
1959	117	83	95	124	88	100
1960	138	89	105	134	90	104
1961	151	92	110	142	91	107
1962	161	95	114	148	80	108
1963	171	93	115	159 (a)	89 (a)	110 (a)
1964*	175	78	106	—	—	—

*Base shifted to 1947 from the new series on 1960—base linked at 1963.

(a) Average for 1960-1964

PAPER AND PAPER BOARD

(Base 1947=100)

Year	Labour Productivity	Capital Productivity	Total Productivity	Five-Yearly Moving Averages		
				Labour Productivity	Capital Productivity	Total Productivity
1947	100	100	100	—	—	—
1948	121	102	112	—	—	—
1949	87	62	74	107	76	80
1950	97	53	72	118	69	89
1951	131	65	91	105	54	74
1952	154	65	97	115	54	78
1953	56	23	35	127	58	84
1954	136	65	93	120	58	85
1955	160	74	105	122	54	80
1956	106	64	94	147	67	94
1957	114	46	70	162	68	99
1958	178	70	107	162	61	95
1959	214	75	119	134	64	102
1960	159	52	84	206	67	109
1961	257	79	130	212	65	107
1962	221	61	104	211 (a)	61 (a)	102 (a)
1963	208	56	99	—	—	—
1964*	212	53	94	—	—	—

*Base shifted to 1947 from the new series on 1960=base linked at 1963

(a) Average for 1960-1964

CEMENT

(Base 1952=100)

Year	Labour Productivity	Capital Productivity	Total Productivity	Five-Yearly Moving Increase		
				Labour Productivity	Capital Productivity	Total Productivity
1952	100	100	100	—	—	—
1963	106	87	92	—	—	—
1964	111	93	100	108	81	87
1965	116	63	73	111	74	82
1966	96	58	87	113	67	76
1967	115	2	72	115	61	71
1968	114	54	64	121	64	74
1969	121	64	76	130	67	78
1960	145	80	83	133	68	86
1961	145	75	87	133	73	84
1962	131	69	80	133 (a)	69 (a)	81 (a)
1963	145	71	84	—	—	—
1964@	99	51	59	—	—	—

@Base shifted to 1952 from the new series on 1960=base linked at 1963.

(a) Average for 1960-1964

GLASS AND GLASSWARE
(Base 1947=100)

APPENDIX 2 Contd.

Years	Net Output	Labour Input	Capital Input	Total Input	Labour Productivity	Capital Productivity	Total Productivity	Five-Yearly Moving Averages		
								Labour Productivity	Capital Productivity	Total Productivity
1947	100	100	100	100	100	100	100	—	—	—
1948	106	102	127	109	104	83	97	—	—	—
1949	149	96	144	111	152	103	134	143	111	132
1950	174	104	154	118	167	113	147	159	114	143
1951	204	106	132	113	192	153	181	187	126	164
1952	204	112	177	130	182	115	157	203	133	180
1953	270	112	194	134	241	141	201	241	145	202
1954	320	131	226	150	264	142	213	231	155	223
1955	414	127	240	159	326	173	260	321	177	253
1956	496	137	344	160	391	203	310	374	193	296
1957	514	134	240	169	334	193	204	417	219	332
1958	662	131	264	168	505	251	294	441	238	355
1959	810	169	371	206	479	269	393	565	288	444
1960	740	166	277	197	446	267	376	674	324	515
1961	1744	172	383	231	1014	455	755	689	324	522
1962	1750	192	451	267	911	390	655	689 (a)	310 (a)	511 (a)
1963	1234	207	493	237	596	250	430	—	—	—
1964@	—	—	—	—	476	197	341	—	—	—

@ Base shifted to 1947 from the new series on 1960=base linked at 1963

(a) Average for 1960-1964

CERAMICS
(Base 1947=100)

Years	Net Output	Labour Input	Capital Output	Total Input	Labour Productivity	Capital Productivity	Total Productivity	Five-Yearly Moving Averages		
								Labour Productivity	Capital Productivity	Total Productivity
1947	100	100	100	100	100	100	100	—	—	—
1948	163	142	131	139	115	124	117	—	—	—
1949	222	143	184	145	155	144	182	151	136	147
1950	290	150	175	156	193	166	186	174	143	165
1951	301	153	206	169	191	146	170	193	146	179
1952	310	143	229	163	217	136	190	206	143	187
1953	349	166	254	186	210	137	188	215	137	190
1954	371	168	281	194	231	132	191	228	135	137
1955	406	171	302	201	237	134	202	236	137	203
1956	463	183	332	217	253	139	213	245	137	203
1957	510	196	361	234	361	142	219	304	133	236
1958	549	215	401	253	245	137	213	304	138	236
1959	468	152	418	213	309	112	220	344	142	257
1960	1136	258	714	383	440	159	313	407	149	289
1961	1275	279	789	396	451	162	322	471	156	320
1962	1532	258	881	409	572	174	375	526(a)	166(a)	351(a)
1963	1692	294	992	465	576	171	372	—	—	—
1964*	—	—	—	—	592	164	375	—	—	—

* Base shifted to 1947 from the new series on 1960= base linked at 1963

(a) Average for 1960-1964.

HYDROGENATED OILS

(Base 1951=100)

Years	Net Output	Labour Input	Capital Input	Total Input	Labour Productivity	Capital Productivity	Total Productivity	Five-yearly moving averages		
								Labour Productivity	Capital Productivity	Total Productivity
1951	100	100	100	100	100	100	100	—	—	—
1952	161	103	103	103	156	156	156	—	—	—
1953	124	103	94	98	116	132	127	137	145	142
1954	177	102	105	106	164	169	137	152	166	161
1955	159	109	86	100	146	197	159	162	121	174
1956	184	104	90	95	177	204	194	183	201	194
1957	235	114	101	106	206	233	222	196	215	208
1958	249	111	107	109	224	224	233	213	231	224
1959	257	112	105	102	229	245	238	235	253	245
1960	283	124	117	120	238	242	236	241	256	250
1961	252	123	113	117	286	312	201	250	268	261
1962	309	130	124	126	238	249	345	251 (a)	284 (a)	273 (a)
1963	384	137	132	134	280	291	257	—	—	—
1964*					225	327	295	—	—	—

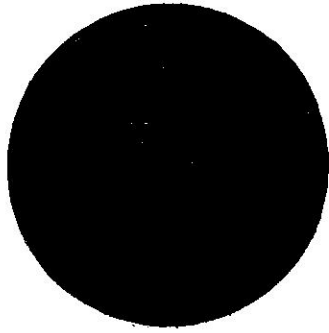
*Base shifted to 1951 from the new series on 1960=base linked at 1963

(a) Average for 1960-1964

Value of Human Resources

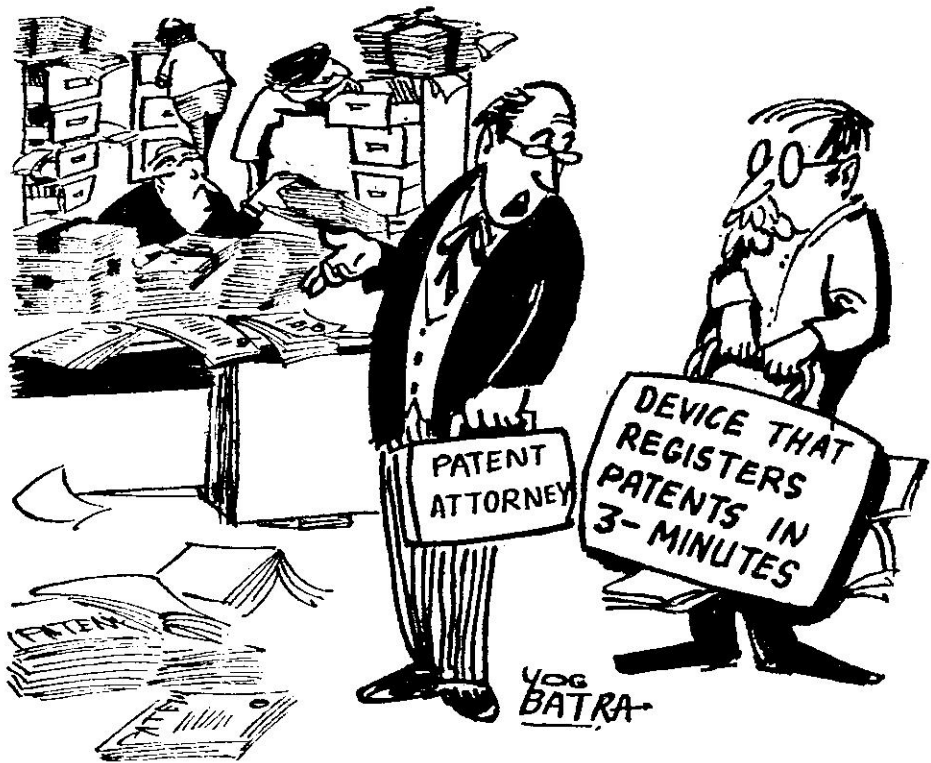
There are several different bases for estimating the value of human resources: Acquisition cost, replacement cost, and economic value, respectively, attempt to measure (1) what the resource cost; (2) what it would now cost; and (3) what its value is based on potential earning ability. Each basis has merit for different kinds of managerial decisions; each also poses special problems. Some of the categories are very difficult to estimate, such as value of experience or cost of acquiring experience. However, the utility of a human asset accounting model far outweighs the discomfort incurred by its scientific inexactitude.

—Management Review



cial Section

**PRODUCTIVITY
IN
OFFICE
MANAGEMENT**



He says it'll take three years to register this device!

(Courtesy: American Reporter)

Raising Productivity in Office Management

AV Deshmane*

Office Management today is the weakest link in the chain in practically every organisation. It is yet to be realised that the efficiency of an organisation depends to a very great extent on the efficiency of its office. The true role of an office is to act as a nerve centre. If this nerve centre is paralysed or becomes inefficient, the entire organisation suffers. It is, therefore, of paramount importance to ensure that the office is managed in the most efficient manner. In this article, the author identifies "sins of omission and commission", which are responsible for low productivity in office management.

PRODUCTIVITY, like love, is a many splendoured thing. It depends on management, men, methods, machines and materials. As all the decisions about methods, machines and materials are made by management and executed by men, in the ultimate analysis, productivity depends on management and men.

Productivity: Some Basic Considerations

The management has to identify the controllable and not so easily controllable factors of productivity. By 'controllable' are meant such factors which can be objectively studied, measured, changed and improved by following a set of principles or by applying scientific techniques. For example, the principles and techniques of industrial engineering, inventory control, financial control, value analysis, methods study, etc. will all help in increasing productivity, if they are properly applied. The principles and techniques of productivity which basically apply to methods, machines, materials and

money are easier to apply. Comparatively it is much more difficult to apply the techniques of productivity to man.

Man is not a strictly rational animal as economists had believed. The behaviour of man as an individual and as a member of a group is a fascinating subject of study. Men are governed by both rational and irrational thoughts, sentiments, emotions and motives. Action taken by one person may appear irrational and illogical to another, but the man who takes it believes that it is strictly logical and rational. A tall man falls in love with a short girl; a fair complexioned beautiful girl loves an ugly man; a mighty emperor like Edward VII abdicates the throne and marries a commoner who was a divorcee. The world laughs at them and says, "Love is blind". It is not. The fact is that the heart hath its own reasons which the reason doth not know.

This is exactly the problem with productivity also. Men and their motivation are for ever unpredictable and therefore, difficult to control by a set of rules and regulations. The limitation has to be realistically accepted. Nevertheless, a

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better understanding of men and their motivation will certainly help in increasing productivity. This field of study is enriched by the contribution of behavioural scientists. I am making only a passing reference to this vital subject but would like to emphasise that all the efforts to increase productivity will be futile if the human aspect is not given the recognition and the importance it deserves. To say that productivity will increase by payment of higher wages or incentives or better supervision is to display a lack of appreciation of the multitude of motives and forces at work.

I would like to concentrate attention on certain factors which can be controlled by the management rather than try to enter into a discussion of human motivation. My discussion of productivity is confined to the peculiar problems of office management.

Office Management : Weakest Link in the Chain

Office management today is the weakest link in the chain in practically every organisation. A vivid illustration of this fact came to my notice some time ago which I would like to narrate here.

The General Sales Manager of a very large and renowned company, Mr. Shah, was most upset because the promotion campaign for Four Diamonds, the new detergent powder, could not start at Bilaspur in time according to the schedule. He looked at the telegram he had just received. The telegram tersely informed him: "Girls ready. No stock of Four Diamonds". He called his Secretary, Miss Mary Rodrigues and said to her, "Send our Area Depot Manager at Raipur a telegram immediately and send a copy of it to our Area Sales Manager also". He dictated the telegram which read:

"Rush 12 gross promotion packs of Four Diamonds to Bilaspur".

He could not understand why there was no stock of Four Diamonds at Bilaspur. He had meticulously planned the promotion campaign at various towns. Yet things had gone wrong. Next morning, he received another telegram

from the Depot Manager at Raipur which informed him that there was no stock of Four Diamonds at Raipur Depot either. This sad news dismayed Mr. Shah. He picked up the phone and angrily asked the Factory Manager why stocks of Four Diamonds were not sent to the Raipur Depot.

The Factory Manager coolly said, "You never informed me to send them to Raipur".

Mr. Shah was furious and shouted, "Yes, we did inform you in advance. Just refer to my letter of 15th June."

The Factory Manager retorted, "I have your letter of 15th June before me. It only gives your tentative promotion programme. Why didn't you send me a letter of confirmation"?

Mr. Shah called Miss Mary Rodrigues in and asked her to locate the copy of the letter of confirmation. She was completely nonplussed and confused. "I did not send the Factory Manager a copy of your tour programme," she mumbled.

Mr. Shah growled, "Not my tour programme, you silly girl, confirmation of the promotion campaign. That's what I mean."

"Oh, I thought you were telling me about your hotel reservations and tickets. Nobody ever told me to send a letter of confirmation of promotion campaign to the Factory Manager."

"Didn't the sales office tell you anything? Don't they ever bother to follow-up? Haven't they got any systems at all? Do I have to do everything myself?" Mr. Shah yelled.

"I am sorry, Sir, but no one told me anything about confirmation. No one really knows what's going on in this place."

Mr. Shah sank in his chair feeling utterly frustrated and dejected. All the time, effort and money spent for planning the campaign, advertising and recruiting teams of canvassers was a sheer waste. The campaign for Four Diamonds had to be called off.

"I wish we could improve our administrative efficiency," mused Mr. Shah.

He learnt his lesson at a heavy cost which many managers have yet to learn. The lesson is the good old proverb: "The strength of the chain depends on its weakest link."

This is the trouble with many organisations. We come across senior executives with imposing titles such as Chief Industrial Engineer, Materials Manager, Production Controller, Financial Controller, etc. But oddly, the man in charge of the office is still at a comparatively much lower level: just a poorly paid Office Superintendent. We seldom come across a title such as Controller of Administration or Paper Work Controller! It is yet to be realised that the efficiency of an organisation depends to a very great extent on the efficiency of its office.

The True Role of an Office

The true role of an office is to act as a nerve centre which co-ordinates and controls the various limbs of the organisation. If this nerve centre is paralysed or inefficient, the entire organisation suffers. Consider any process or function of management: planning, organising, directing, executing, controlling or sales, purchase, production or finance. It will be realised that unless there is a very close and effective co-ordination, none of these processes or functions could be performed satisfactorily. The office receives information from a multitude of sources, processes it, stores it, transcribes it or reproduces it. If the office fails to perform these tasks promptly and properly, the organisation cannot run smoothly. It is, therefore, of paramount importance to ensure that the office is managed in the most efficient manner.

The efficiency of the office depends on an intelligent use of the resources, i.e. input. The largest single input is clerical and supervisory man-hours. Comparatively speaking, the total cost of machines and materials is much less than the cost of man-hours.

The true role of an office is to act as a nerve centre which coordinates and controls the various limbs of the organisation.

If we want to increase the efficiency of the office, we must, therefore, concentrate on the optimum utilisation on man-hours.

It is naively believed that the efficiency of an office depends on the output of the clerical employees only. Many managers moan the lack of discipline, the lack of sense of responsibility or the lack of initiative. There may be some truth in their view but it is also perhaps true much of the time of the office workers is spent in doing worthless work which need not be done at all. In other words, it is principally the management which is responsible for the unproductive use of the clerical man-hours and not the employees themselves. Recently, a study group of O & M experts examined the total volume of the clerical work performed in 9 leading companies in U.K. Their thorough scrutiny showed that as much as 20% of the work was utterly useless which could be eliminated immediately and a further 30% of work was of dubious value to the organisation. Just about 50% of the clerical and administrative work done in those companies was really worth doing. It is not known whether any such study has been conducted in Indian organisations. If such a study is conducted, it will perhaps reveal a more shocking waste of time.

Productivity in office management is low, owing to several sins of omission and commission. Some of the main 'sins' are listed below:

- (i) Failure to define objectives
- (ii) Disturb

Office management today is the weakest link in the chain in practically every organisation.

- (iii) Lack of delegation of powers
- (iv) Improper work distribution
- (v) Improper use of executive time
- (vi) Lengthy reports and letters.

Failure to Define Objectives:

Generally speaking, office work is carried out to comply with antiquated procedures without a critical review of the purpose or without the slightest attempt to evaluate the costs and benefits. For example, a leading company used to send dividend warrants by express delivery post. The motive behind this practice was indeed very laudable, but in reality express delivery letters did not reach the shareholders faster. In fact, there were a number of cases when the express delivery letters reached later than the ordinary mail. In another organisation, travelling allowances were calculated on the basis of costs incurred for travel by the shortest route. An officer stationed at Madras received telegraphic instructions from the head office at Bombay to proceed to a place about 300 miles away immediately. He travelled by the next available train in view of the urgency of the assignment. The difference in the actual costs incurred for railway fare and the railway fare on the basis of the shortest route was barely Rs. 4.50. His travelling bill passed through several levels of the hierarchy before it could be paid and was settled only after 2-1/2 years. One more example. In 1927, the Government of the erstwhile Bombay State wanted to construct a bridge at a particular place. One clerk and four peons were appointed to measure the water level, the span of the

bed of the river, the force of current, etc. Such reports were submitted daily. In 1928, the original site was found to be unsuitable and an alternative site was selected. Construction of the bridge was started in 1929 and was completed in 1931. On 1st January 1968, a well-known newspaper published the news that even though the bridge was in use for as many as 37 years one clerk and the four peons were still dutifully compiling and sending the daily reports of measurements taken at the original site. Nobody had told them to discontinue the reports; nobody had in fact bothered about the purpose or utility of the reports. They were received, initialled and filed for all these years.

This precisely is the tragedy of much of office work. A lot of people work hard and conscientiously, but their work is without purpose or benefit. A ruthless analysis of the purpose and benefit of every procedure, form and report will bring to light several instances of such meaningless work.

Distrust :

Systems and procedures of many companies are based on lack of trust. It is presumed that unless there are elaborate records, there will be a lot of frauds or confusion. For example, consider the inward and outward registers, or the time cards or the leave registers or the stationery indent forms. Many companies have abolished the inward and outward registers which in any case do not help much in locating lost or misplaced letters. Time cards have also been abolished by several progressive companies who trust the employees. Their experience has shown that the employees have justified the faith reposed in them. Instances of abuse of trust are very rare indeed.

Some companies have issued leave record to the employees who maintain them themselves and use them whenever they want leave, thus eliminating separate leave application forms and duplicate leave registers. Stationery is issued as and when wanted without maintaining any records.

Mutual trust can simplify not only the internal work of a company but can also reduce a good deal of correspondence as well as accounting work of purchasers or suppliers of the company. Some companies have adopted the sensible practice of sample checking of invoices below a certain value. Some companies have even started the practice of sending a cheque in advance along with the purchase order, especially for small value orders.

Lack of Delegation of Powers:

Work is enormously multiplied and delayed just because adequate powers are not delegated down the line. In one State, the Board entrusted with the Secondary School Leaving Examination used to appoint as many as about 20,000 invigilators who were paid on the basis of a fixed daily rate. All the invigilators used to prepare their claim bills at the end of the examination. These claim bills used to be certified by the Superintendent of the centre where the examination was held. Then, the Head Office of the Board used to receive and scrutinise all the 20,000 bills and issue money orders. It was hardly surprising that as much as a year used to lapse between the date of the submission of the claim and the receipt of the money. The invigilators naturally felt very disgusted. The Chairman of the Board solved this problem by taking the simple step of remitting the amount to the Superintendents in advance and authorising them to disburse it to the invigilators on the spot on the last day of the examination. Thousands of clerical man-hours which used to be wasted in scrutiny of bills and preparation of money orders were saved. Generally, there are far too many levels involved in settling even petty matters. A thorough organisational analysis is necessary to remedy such a situation.

Improper Work Distribution:

Very often highly paid staff are asked to do work which can be done equally competently by people at lower levels. A survey of the utilisation of the time of graduate engineers in a large organisation revealed that they spent about 40% of it in doing technical work fit for their level, 25% in paper work which could have been done



by ordinary clerks and another 25% of their time for jobs which could have been done by diploma holders and draftsmen and the rest 10% of time in travel. It is equally absurd to use highly paid personal assistants or stenographers to do routine copy-typing or stencil cutting or for running errands. It should be realised that much of the dissatisfaction of the office employees emanates from the fact that they are asked to do work which does not offer any challenge or provide them opportunities to use their special skills. It is, therefore, necessary to clearly analyse the components of work and ensure that it is done by the people at right levels.

Incidentally, how many times have you come across personal assistants or peons who have little work? Quite often, these are only expensive status symbols. Do you agree?

Improper Use of Executive Time:

Many executives not only waste time by trying to do things which they should leave to their subordinates but also because of lack of planning and organising their work and thoughts. In one company, the typists and stenographers were asked to maintain a record of daily output. One stenographer often showed the total output

*Effective use of executive time
can substantially increase
productivity in any organisation.*

at the end of the day as barely 3 or 4 letters or notes. When the O & M Manager questioned her, she ruefully said, "You are looking at the final output only, but not taking into account the number of drafts I have to type. My boss makes me type even five or six drafts before the letter goes out. Such bosses reveal not only their own incompetence but also a callous disregard for productivity in office. They do not plan their work systematically. They call their stenographers without getting all the facts and figures and ideas ready. They permit innumerable interruptions by visitors or telephone calls. They change priorities too often and generally live from crisis to crisis. Effective use of executive time can substantially increase productivity in any organisation.

Lengthy Reports and Letters: Eisenhower's Rule

The cost of verbosity is colossal. Eisenhower's Rule is worth implementing in every organisation. Eisenhower asked his immediate assistants and cabinet members to submit reports that were brief, factual and documented. The President was reported to have made this statement: "If you give me a half page report, I promise to read it right away. If you submit one page report I will read it some time today but not immediately. If you give me a two-page report, I will still read it, but I cannot say when. If you give a report longer than two typewritten pages, I will not read it." Story goes that cabinet members and assistants kept pouring heavy reports on

the President's desk. To see that what he meant should be adhered to, the President tore the first two pages of each report and kept them in his office for subsequent reading. The other pages he threw into the waste-paper basket.

Fatigue and Strain:

In a number of offices, lighting is inadequate, walls are shabby, ventilation is unsatisfactory. Even the chairs are often rickety. The whole atmosphere is full of dust, dirt and despondency. People may get used to such conditions but they certainly cannot contribute their best. Fatigue and strain impair their productivity. As a result, as against a few hundred rupees saved, thousands of rupees are wasted by the lower per capita output. Good working conditions are not a luxury, decent furniture is not a matter of prestige. These are the barest minimum requirements conducive to higher productivity.

Conclusion

In conclusion, I would like to say that higher productivity in office is primarily a responsibility of management. There is ample scope for it. The trouble is that the management does not concentrate on what it can control with comparative ease but often tries to control what is much more difficult, i.e. the behaviour of men. It will pay any organisation very handsome dividends if attention is focussed on some of the sins of omission and commission mentioned here. This list is by no means exhaustive but only illustrative. Productivity can be increased substantially in several other areas also by proper use of tools and techniques such as methods study, forms design and control, work measurement, etc. I have not talked of such tools and techniques because they are well-known.

My basic question is: Is there a true and sincere desire to increase productivity in office? If there is a will, there is a way. □

Factors Influencing Productivity in Office Management

SP Chandwarkar*

The factors having bearing upon the general level of productivity in Office Management could be identified and categorised into (a) organisational and (b) operational. Organisational factors cover the whole gamut of environment in which an enterprise operates. Operational factors represent methods, manner and means adopted for achieving the objectives of the enterprises. Between the organisational and operational factors, the former are by and large more important to ensure productivity in office management. Favourable organisational factors can still maintain a reasonable level of productivity, whereas well-greased operational factors can hardly be effective without the support of organisational factors.

IT was generally thought, not before long, that productivity in office management is one of those imponderables difficult to perceive. The subject was taken more or less as belonging to the realm of industrial and manufacturing lines. Perhaps, nothing more can drive home the point than the following words quoted from the excellent book "WORK STUDY IN THE OFFICE" by Harry P Cemach :

"When discussing work study with an old friend of mine, a man who has been an Office Manager for some 20 years, I mentioned that work study applications were by no means confined to the works, and that there was plenty of scope in offices." "Work study in the office?" he said. "My dear fellow, don't try to sell me that new-fangled bit of nonsense. Now, you chaps (and here he was referring to those of my colleagues whose work is concerned mainly with efficiency in production) may be all right in a factory. I admit you often get excellent results. But

an office is quite a different cup of tea. Stop watches could not do any good in my office, and I don't think they'd do any good in any other office either."

Complexities and broad range of modern organisational activities in Office Management make one sit up and take note of the deteriorating aspects of productivity which, perhaps, are the result of inadequate attention and a state of being taken for granted. The success of any enterprise, whether in the manufacturing or service lines, depends on the efficacy of the organisation and its ability to achieve the corporate objectives. An enterprise having efficient manufacturing line but not supported by an effective office management can but limp its way.

Factors for Raising Productivity

Productivity in office management is not easy to perceive. It is inherent in the culture of an organisation. Efforts to improve it cannot be made in isolation of the reactions generated by environmental and organisational climate. These efforts have to be continual. The results thereof are imperceptible for a greater period of the

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Paper Work is a Symptom

J Prasad*

Today, there is hardly any human activity, which is not accompanied by a piece of paper. The character of human organisations is reflected by the dimensions and pattern of paper work. Paper work and the function of office as a processing agency has become a symptom indicative of the behaviour pattern of managerial grid. Paper work problems require extensive and intensive treatment to eliminate the root causes. The O & M experts are busy making efforts to eliminate, reduce, improve and streamline paper work. According to the author, the root causes can be diagnosed by studying the prevailing management styles, organisational structure, the calibre and sophistication of managers and management information systems.

INDIAN mythology deified the principal functions of the society to provide inspiration and develop a code of conduct and discipline for the members of each vocation. Lord Chitrakupta represented the pen-pushing community and he ranked below Lord Vishnu but enjoyed equivalent status with other functionary deities like Lord Ganesh. Those days, this function was not primarily associated with paper work, because, paper did not exist plentifully, but the word '*Munshi*' represented, one who created and dealt with records. The stupendous task of updating all land revenue records, under the leadership of Todermull during the reign of Akbar the Great, would not have been possible without an army of well-trained and capable '*Munshis*' all over the country.

Availability of paper and growth of literacy has now turned everyone a '*Munshi*' since all literate persons these days have to write and keep some records, because there is hardly any human activity which is not accompanied by a piece of paper. A corollary to this statement may suggest that any activity which is not accom-

panied by paper is not human—the New Year Greeting Card is an example. Another variation to this could be: the less human the activity, the more and longer the pieces of paper in the accompaniment. These musings are not random thoughts, but indicate that the character of human organisation is reflected by the dimensions and pattern of paper work. It can be said that at the root of paper-problems lie, the prevailing management style, structure of the organization, calibre and sophistication of managers and the information systems network. Paper-work—and the function of office as a processing agency—is therefore a symptom indicative of the behaviour pattern of the managerial grid.

Generally, office procedures are developed anew to relieve executives of file work which consumes a disproportionate amount of time and attention, or to expediate flow of information or to reduce 'supposed' office overheads. 'O&M' specialists concentrate their attack on pieces of paper floating around to prove that there is a better way. 'O&M' specialists, systems analysts, form designers and records managers are alert to eliminate, to improve, and to streamline paper work which comes within their purview.

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But attacks on paper work are more often palliative, rather than curative, like doses of aspirin for simple occasional headaches. Serious and pervasive office problems, like continuing and recurrent headaches, require extensive and intensive treatment and sometimes deep incision to eliminate the causes, and achieve the desired improvements. In such cases, paper-work headaches have a common characteristics: they are symptoms and should be diagnosed for determining the genesis of the malady. A few examples would illustrate this.

Management Style

A management style which emphasises detailed and meticulous control in every area and which precludes even the smallest calculated risk, will necessitate recording, reporting, checking and auditing of every transaction. This will generate much paper work. The cumbersome governmental procedures and the procedures in vogue in most of the public sector enterprises are glaring examples of this phenomenon. In a particular state-owned enterprise, the cost of receipt and issue of mail was over a lakh of rupees a year. Further, it was observed that although the entries were up to date the dak Registers failed to locate a lost paper and yet did provide some surveillance for chasing papers when actually the purpose was to obtain a specific piece of information which might be conveniently available elsewhere. Amazingly, all this wasteful luxury was endured when stock registers pertaining to inventory movement worth several lakhs was in arrears by several months, and the physical balances generally disagreed with the 'actuals'.

Organisational Factors

Among the principal organisational factors which affect paperwork are span of control, centralisation/decentralisation, accountability, lines facilitation and communication and coordination. As a general rule, wide span of control generates less paper work than narrow, because wider the span, the fewer the levels in the organisation structure. Fewer levels mean shorter paper network and

At the root of paper problems lie the prevailing management style, structure of organisation, calibre and sophistication of managers and the information system network.

fewer accretions in the flow of paper. Typical of these accretions are the reviews, evaluations, revisions, reconciliations and transmittals, which are produced at each organisational level.

In the matter of centralisation and decentralisation of activities the pattern and extent of delegation of authority are basic determinants for paperwork in an organization. For example, where all purchasing activity is centralised in purchasing department, the amount of paper work involved will be lesser than would be required in an organisation in which the central purchasing department provides a specialised service for a number of branches or plants. If in this case the authority and responsibility for determining the requirements are vested in the branches, the extent of paper pieces flowing to and from central purchasing department will far exceed the quantity generated through a totally centralised purchasing system. In a totally decentralised organization in which each branch or plant does its own purchasing, the amount of paperwork in each branch may be less than in a totally centralised structure, although the aggregate of the entire paper work connected with purchasing may be greater. The pattern of centralisation or decentralisation of purchasing, including the continuation of both, will usually depend upon a number of factors, such as the nature of commodities procured, the market and source of



supply, cost and possible economies, and availability of competent purchasing personnel. Whatever be the pattern, it will affect the amount and kind of paper-work. The O&M man has, therefore, to design such an organisational framework as will reduce the cost of purchasing without detriment to the objectives of the organisation, with the least administrative expenditure (this may be higher than the existing cost).

Lines of Communication

The traditional concepts of authority and discipline have left a legacy which prescribe all actions and transactions must move through established and tightly drawn 'channels of organisation'—the written communications will flow up, across and down. The facilitations of communications permit within established parameters short-cuts across the organisational framework. Therefore, the amount of paper-work will of course be affected by the extent of facilitations which exist in the corporate structure.

Management Information System

The pen-pushing '*mumshi*' of the olden days was concerned principally with creation of records and its retention/retrieval. The 'need and thirst' for recorded information was rather limited because of the unsophisticated and simple means of production and distribution. Human ingenuity did develop systems in response to challenges—like the masses of humanity visiting places of pilgrimage. The remarkable ways of the 'Pandas' of the Holy places of Haridwar, or Varanasi in retrieving old records about the visits of the ancestors to the Holy place in the last century or even earlier, demonstrate the immaculate system of management information, developed by the unsophisticated people without much paper-work. The Panda's income depended upon linking the pilgrim's present visit with those of his ancestors.

The offices of today are required to produce information which is like 'light upto thy feet',

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of information-economics.*

to guide the fortunes of enterprises—whether it be in the matter of taxation or marketing of products. This requires that the 'information needs' be specifically determined so that timely, relevant and meaningful information along with related data continuously flows throughout the entire organisational structure. In the absence of a well-designed management information system, paper-work may continue to explode and accumulate despite the best efforts of O&M specialist. The repeated criticism about the ever-growing population of the so-called unproductive office-employees, is a cry in the wilderness, because apart from the traditional *munshi* each gainfully employed person contributes to the paper-explosion.

Great changes are taking place in the country in all spheres of human activity,—new philosophies and new technologies are proposed, tested and absorbed at a very rapid rate. The growth of knowledge has reached a point where it appears to become a burden, both because of the volume and lack of capacity to assimilate it. This calls for a study of 'productivity of knowledge', i.e. an appraisal of the information network. It is essential to extend the concept of Productivity to this 'under-developed' area of information-economics. This includes all who work with facts and figures—those who collect, process and interpret information. In the days of Taylor, this was considered to be an unproductive activity, but today the social progress—not merely industrial growth—is dependent upon

the efficiency with which we convert facts and figures into useful products, as knowledge for managerial decisions. They influence every administrative job, from the lowest clerical position to the seniormost. Therefore, both the cost and value of information, need be continuously assessed. Perhaps, some symptoms of human behaviour and conduct may reveal that at the bottom of the anomalies and mis-management, lies the unrevealed and unanalysed 'paper personality' of the executive.

The mounting labour trouble, and the indiscipline among members of an organisation (including the departmental heads) afflicts management development in the country, but this is also a challenge to be met. Symptom is taken as disease. Behind the labour trouble could be delayed decision on promotion or raise on salary, settlement of leave salary pay, Rising inventories and lack of utilisation of equipment may be due to lack of attempt to analyse and correlate data to determine profitable consumption patterns. Pieces of paper are not inherently bad or good, because its value is determined on the basis of the cost, but the purpose it serves. And because it seeps in all aspects of human activity, many managerial problems have an element of paper involvement—whether it be the simple business form or the men behind the system and procedures. The administration of the social service schemes like pension, life insurance and scholarships involving millions of beneficiaries spread out all over the country, requires an enormous amount of paperwork. It calls for a fresh look at the red tape', and innovation of new methods to turn the road-blocks into stepping stones for achievement of the objectives enjoined in the social schemes.

A new management style, nay, a new *PAPER PERSONALITY* for all individuals constituting a society need be developed to control the fall-out of 'paper bombs' if the limited economic resources are to be made available in adequate measure to all, and this would be a step in the march towards the *garibi hatao* movement. □

Romance of Management Files

OP Khetan*

There is a vast difference in the theory and practice of Management. The difference, if anything, is increasing every day. In theory we talk of something, but in practice, we just do the opposite. In this humorous article the author tries to bring out this difference.

ONE of the many 'good' things inherited by the Public Sector Undertakings from the Government is the system of 'Files' and 'Notes'. Some of the big Private Sector industries also seem to be infected by the system. And for many of us it is difficult to imagine how industry could be run 'efficiently' without this system.

It is not uncommon to hear remarks such as "He writes beautiful notes" or "He disposes off files very quickly" to convey that he is necessarily an efficient officer. This leads us to believe that this system of files which once originated in the Government as a 'means' to efficient administration is considered as an 'end' in itself these days. If this were not so our concept of efficiency would not have been the 'beautiful notes' and 'quick disposal of files' but whether the targets of performance are being achieved. We would then have to see whether it was neces-

sary for a particular file to exist at all, whether the decision was taken at the right level—no higher and no lower, whether such decision could not be covered by some rules and so on.

Why is it so? Why in many offices of the industrial undertakings, efficiency is synonymous with writing beautiful notes and quick disposal of files, irrespective of the fact whether industry operates at 50% of the capacity and whether it makes profit or loss.

The reasons are not far to seek. While it is true that the system originated because most of our Public Undertakings started as an offshoot from the Government Departments carrying the system also, we must also find the reasons for its survival and growth. The main reason seems to be that the system is admirably suited to the concept of 'accountability' existing in the Public Sector today.

The system of files, meticulous noting and approval and skin-saving correspondence

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ensures safety *vis-a-vis* Audit-paras, Parliamentary Committees, Vigilance and such other all-powerful institutions. It seems more important to keep them on the right side than to run the industry efficiently. You cannot be individually made responsible for the poor performance of your Plant, department or section. Even if you are, you can always find some scapegoat to hide the inefficiency. But if any individual decision taken in good faith happens to prove wrong after many years, it can only be defenced by the self-defending mechanism of files.

No wonder the subject of dealing with files has become an art in itself worthy of research and literature. The following are some of the rules in dealing with files. Though no formal institutional training is available in this area, on-the-job training has been going on successfully. These rules may need modifications depending upon the pressure of work, your position in the file hierarchy (to avoid tongue twisting, shall we call it 'filarchy'?), your own objectives, your present relationship with your superiors and subordinates and how you would like to have them in future, etc.

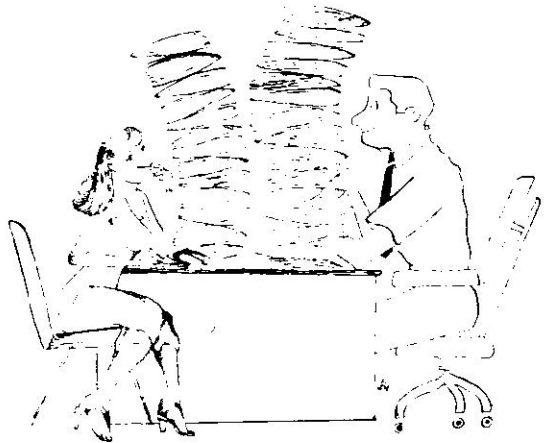
(a) Whenever the note put up by the next below officer deals with a difficult or controversial area, pass it to the next higher level for decision-making.

(b) Whenever you want to delay the decision-making the best thing to do is avoid giving such an impression is to raise some query. It hardly matters what the query is. One down and up movement will take care of the problem.

(c) If you are high up in the 'filarchy', many files will come to you for decision-making. In the critical areas it is better to let your advisers advise you what you really want and then you merely indicate your impressive 'yes'.

(d) Whenever an unpleasant decision is to be taken, let it be suggested by your subordinates and then you merely sign.

These are only a few samples from the vast compendium of file rules. But to be an 'effi-



You can't imagine how relaxed I feel now after I have got these files from the record room placed on my table. It was hell of a time to have no files last few days, everybody staring at me...well...the knitting design you suggested for my sweater is really wonderful but the colour—possibly...I mean...could you come this evening....

cient executive', you should have many more on your finger tips.

Files serve yet another purpose. They have become status symbol. The number of files you receive and the number of files lying on your table awaiting disposal show your status in the 'filarchy'. If you receive less files or if you are efficient at disposing off files still you must retain a reasonable number on your table to keep up your image of 'filarchy'.

One day I wanted to return home in time to take my family out. I went to the office early. Fortunately that day I had no meetings and few visitors. By 5.30 I was disposing off the last file. Suddenly then a colleague of mine entered the room and exclaimed in disbelief: "What! No pending files! Lucky man. I wish I had your job". I leave it to you to imagine my thoughts. □

The Guruvisits an Office



COME TO ME TOMORROW... I WILL
TELL YOU HOW TO MOVE PAPERS
AT ROCKET-SPEED



NEXT DAY...



STRICTLY CONFIDENTIAL
SECTION (OFFICE MANAGEMENT)

1. EVEN IF NOT NECESSARY
MARK THE FILES TO OTHERS
 2. DON'T COMMIT OR COMMENT
WRITE ONLY - PL SPEAK,
FORWARDED, RECOMMEN-
DED OR ONLY SIGN
 - CHECK SPELLINGS MICRO-
SCOPICALLY & SHOUT
LOUDLY
 5. SHOUT ONLY ON LENIENT
FELLOWS TO SCARE
AWAY OTHERS
 6. MAKE GREAT HUE &
CRY ON **MINOR**
MATTERS
- IN PRINCIPLE...

W.H.R.



....BUT CLEAN TABLE WOULD
MEAN THAT I DON'T HAVE
FULL DAY'S JOB... I MUST KEEP
'GHOST-PAPERS' TO JUSTIFY MY
JOB



Agricultural Productivity in Independent India

Dr MS Swaminathan*

The strategy adopted for agricultural development in India has paid rich dividends. The edifice of scientific agriculture built since independence are reflected in the rising productivity in agriculture. The next phase in the evolution of agricultural strategy, according to the author, should consist of a blend of a national euphenic policy and agricultural development designed for more jobs and income.

IN 1948, as a student of the Indian Agricultural Research Institute, I happened to listen to the lectures given by eminent experts at a Seminar specially convened by the late Shri Jawaharlal Nehru to develop a strategy to achieve self-sufficiency in food by about 1951. The gap between production and need was probably of the order of 10 per cent then. Each expert depending on his specialisation explained how this small gap could be easily bridged, provided his suggestions were implemented. Thus, the soil scientist pleaded for soil testing and fertilizer application, the plant breeder advocated the multiplication and distribution of seeds of new strains, the entomologist wanted pests to be destroyed and the rat expert mentioned that if all rats were killed, there would be surplus food in the country. However, in spite of so many possibilities being open for a rapid solution of the problem, the food outlook for India was still described as hopeless by many foreign experts as late as 1965. The Paddock brothers cheer-

fully predicted that Indians would be in the same fate from 1974 onwards as sheep being marched to a slaughter house. Where then do we stand now?

Strategy Since Independence

The strategy adopted for agricultural development in independent India can be broadly classified into three phases—general (1947-61), intensive (1961-65) and specialised (1966 onwards). The general strategy was reflected in the place given to agricultural advance in the Community Development Programme, the multipurpose Village Level Worker holding the key to advances in many directions. During this stage, much of the infra-structure needed for agricultural progress such as fertilizer factories, roads and irrigation systems was systematically built-up.

The initiation of the Intensive Agricultural District Programme (I. A. D. P.) in 1961 marked the beginning of an approach characterised by concentration of efforts and resources rather than their widespread diffusion. The initial phase of

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TABLE 1
Area, Production and Yield of the Important Food Crops

Period	CROP					
	Rice	Wheat	Jowar	Bajra	Maize	Potatoes
	1. <i>Area in thousand hectares</i>					
1961-62	34,694	13,570	18,249	11,278	4,507	365
1966-67	35,251	12,838	18,054	12,239	5,074	473
1969-70	37,680	16,626	18,605	12,493	5,862	511
	2. <i>Production in thousand tonnes</i>					
1961-62	35,663	12,072	8,029	3,645	4,312	2,477
1966-67	30,438	11,393	9,224	4,468	4,894	3,522
1969-70	40,430	20,093	9,721	5,327	5,674	4,093
	3. <i>Yield per hectare in Kg</i>					
1961-62	1,028	890	440	323	957	6,704
1966-67	863	887	511	365	964	7,440
1969-70	1,073	1,209	522	426	968	8,006

(Source: Directorate of Economics & Statistics, Govt. of India.)

the I. A. D. P. did not lead to the anticipated results, largely due to the fact that the package of practices recommended to farmers was deficient in one important ingredient, namely, a variety which would react synergetically with the rest of the package. It is this deficiency which was made good in the more recent phase beginning in 1966 with the initiation of the High-Yielding Varieties Programme. Not only were high-yielding varieties of wheat, rice, maize, *jowar* and *bajra* introduced in areas endowed with assured water supply, but also steps were taken to set up a Prices Commission to recommend prices which were both remunerative to the farmer and reasonable to the consumer and a Food Corporation which would purchase the grains produced at the prices assured by the Government. The edifice of scientific agriculture was thus built brick by brick and the fruits of this labour are reflected in the rising productivity of wheat, *bajra* and potatoes (Table I).

Studies by experts like Dr. P. K. Mukherjee and B. Lockwood reveal that irrespective of the size of holding, farmers in the Punjab and Tamil

Nadu have been increasing the proportion of their holding allotted to high yielding varieties (Table 2). This trend is also reflected in the statewise progress made in the spread of high-yielding varieties of rice and wheat, Tamil Nadu and the Punjab being in the lead respectively in these two crops (Table 3). The reasons for the uneven progress in the spread of the high-yielding varieties of different crops have been frequently discussed. Among the five crops originally introduced in the High-Yielding Varieties Programme, wheat can be termed a "low risk" crop because of an assured market, favourable prices, the absence of serious pests and the decentralised water management system possible. In contrast, rice and *jowar* are both "high risk" crops, exposed to many serious pest problems, marketing difficulties based on quality considerations and to either shortage or excess of water depending on the behaviour of the monsoon, thereby necessitating more integrated irrigation and drainage systems. In such crops, a greater degree of co-operative endeavour among farmers both in water management and pest control is needed. Post-harvest problems are becom-

TABLE 2

Percentage Area under High-Yielding Varieties to Total Area Under the Selected Crop*

State/Crop	Season/Year	Size Groups			
		Below 2 hectares	2 to 8 hectares	8 hectares and above	all sizes
Punjab: Wheat	Rabi: 1967-68	67.7	55.8	60.8	57.9
	" 1968-69	68.5	74.5	79.3	76.8
	" 1969-70	95.6	96.2	96.5	96.3
Tamil Nadu: Paddy	Kharif: 1967	65.2	55.4	77.8	60.9
	" 1968	67.9	51.5	31.5	48.1
	" 1969	57.5	54.3	68.8	58.4
	Rabi: 1969-70	74.9	78.6	67.9	75.6

*Data from Drs. P. K. Mukherjee and B. Lockwood

ing serious in many crops and are today probably limiting both the spread of high-yielding varieties of *bajra* and maize and fertilizer consumption. For example, some of the highest yield of maize in all-India trials are obtained in the Kulu Valley of Himachal Pradesh but if more maize is to be grown in this area, there has to be more roof area in the houses, since this is where maize is dried!

Future Strategy

Scientists like Dr. P. V. Sukhatme of F.A.O. and Dr. C. Gopalan of the National Institute of Nutrition have shown that the growing problems of protein-calorie malnutrition in India, particularly among children, can be solved only by producing more and cheaper food. This is because in cereal-based diets, under-nutrition is generally the mother of malnutrition and under-nutrition in turn is at present largely due to inadequate purchasing power arising from poor opportunities for productive employment. This situation leads us to ask what the next phase in the evolution of our agricultural strategy should be. In my view, the next phase should consist of a blend of a national euphenic policy and agricultural development designed for more jobs and income. Euphenics implies working for good and healthy individuals and a national euphenic policy should include attention to the nutrition of pregnant and lactating mothers and infants, extension of health-care

facilities in villages and promotion of intercaste and inter-state marriages as a means of getting the maximum benefit from the genetic potential in the country (an example of this is the small recent programme initiated in Tamil Nadu to foster inter-caste marriages).

A policy of agricultural development for more jobs and income has to be based on (a) increasing the efficiency of farming in irrigated areas particularly through integrated pest control measures and better water management systems, (b) development and introduction of ecology-cum-economics based crop cafeterias in both irrigated and rain-fed regions from which the farmer can choose the crop combination which is best suited for his capacity to mobilize inputs, and market and seasonal conditions, (c) greater attention to harvesting, threshing, storage, marketing and pricing and (d) detailed attention both to factors which can promote employment and those which are likely to decrease the employment potential of agriculture due to developments in other fields of technology. I shall conclude this article with two examples to illustrate the last point which involves dovetailing of research and development policy with perspective planning.

The areas characterised by the "Wheat revolution", now face a temporary labour shortage during harvest time. Two ways are open to meet the situation: mechanisation of harvesting or planned seasonal migration of labour from neighbouring

TABLE 3

Area under High-Yielding of Rice and Wheat in some States during 1969-70 (area in thousand hectares)

State	RICE		WHEAT	
	Total area	Area under H.Y.V.	Total area	Area under H. Y. V.
West Bengal	5,015	459	240	174
Andhra Pradesh	3,300	522	—	—
Tamil Nadu	2,695	1,142	—	—
Orissa	4,506	170	—	—
Bihar	5,492	324	1,145	437
Uttar Pradesh	4,533	561	5,378	1,640
Madhya Pradesh	4,310	209	3,176	150
Mysore	1,106	121	—	—
Assam	2,243	101	—	—
Maharashtra	1,392	185	865	152
Kerala	872	239	—	—
Punjab	—	—	2,162	1,418
Haryana	—	—	1,017	440
Rajasthan	—	—	1,254	288
All-India	37,680	4,342	16,626	4,910

Source: P. Kumar, *Margin*, 3 (4), 1971

dry farming regions. For example, it has been calculated by an expert that to harvest 1.5 million hectares of wheat and barley, either an adequate number of combines or 50,000 tractors and wagons capable of moving 150,000 unemployed labourers can be purchased. The advantages of the latter step need hardly be enunciated, since it will not only provide employment but also expose the migrating labour to the secret of good crops, and in addition will also provide tractors for other agricultural purposes.

An example of the potential threat to employment in the future in dry farming regions is the possibility of displacement of cotton by synthetic fibres endowed with easy-care proper-

ties. For example, in Brazil, a major cotton growing country, cotton consumption increased by only 30,000 bales during 1961-70, while man-made fibres increased by 210,000 bales during the same period. Production and processing of cotton are both labour-intensive and remunerative. What will be the fate of some of our dry farming regions producing cotton, if a similar development takes place? The research answer to this problem is to quickly breed varieties of cotton which respond well to physical and chemical processing methods which can confer on them the easy-care traits characteristic of polyester, nylon and polynosic rayon fibres. The sooner we start thinking on such lines, the greater is the possibility of the predictions of Paddock Brothers proving false. □

In order that people may be happy in their work, these three things are needed: They must be fit for it, they must not do too much of it; And they must have a sense of success in it.

— John Ruskin

An Approach to Total Marketing Concept

KN Sapru*

The fast-changing technology today poses a challenge to marketing experts to think in terms of long range planning. The total marketing concept encompasses planning, organising and carrying out of all marketing functions and activities in moving a production or service to consumer at most economic cost. For successful marketing, all ingredients of the marketing mix as well as those of administrative mix must match each other at any point of time. The author discusses the essential components of a comprehensive marketing plan incorporating the objectives and the action plan to achieve them.

MARKETING today in a very rapidly advancing and changing world has become a vitally important function within an organisation. The organisations' retention of profits for expansion or diversification and its survival in a rapidly changing and exceedingly competitive economy are inevitably related to the satisfaction of consumer wants and needs, the "Liquidity Preference" as Lord Keynes had put it a few years ago. The obsolescence rate of technology in today's world poses a challenge to the marketing specialists, not only to visualise the near future, but also plan for several years ahead for the changing consumer demands.

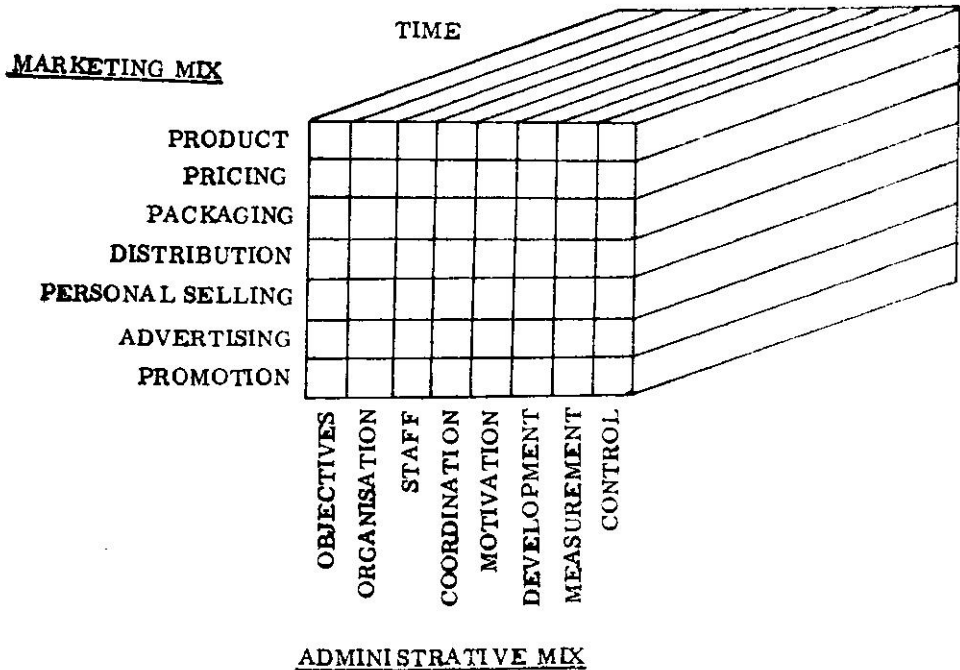
The diagram on next page illustrates the concept of the "Three Dimensional Grid" or Box applicable to marketing. The marketing mix forms the vertical arm, the administrative mix the horizontal arm and the time factor is the third arm:

The total marketing concept is the composite planning, organising and carrying out of all marketing functions and activities involved in moving a production or service to the user with a profitable volume at minimum expense. It is orientated towards the needs of the users on a national basis.

For successful marketing, every one of the ingredients of the marketing mix and those among the administrative mix should properly match each other at any point of time. With the passage of time, changes, both external and internal, are bound to take place. These have got to be taken notice of and perhaps even anticipated in advance so that the planning relating to the marketing mix and administrative mix can be done in advance and implemented in time.

Let us now briefly see what is meant by these elements of the grid. Policies and procedures relating to each of these elements must be clearly enumerated before embarking upon the formulation of any plan.

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Marketing Mix Elements

1. Product Planning:

- (a) Product lines available in respect of qualities, specifications, designs, etc.
- (b) Markets available: to whom, where, when and in what quality.
- (c) New Product Policy—research and development programme envisaged.
- (d) Branding possibilities:
 - (i) Selection of trade marks.
 - (ii) Brand Policy—individualised or family brand.
 - (iii) Sale under private label or unbranded.

2. Pricing:

- (a) Price level.
- (b) Specific prices to adopt (rounded, odd, even)
- (c) Price policy of product, e.g., one price or varying price, price maintenance, list price, etc.
- (d) Profit margins to adopt for Company; for the distributive trade.

3. Packaging:

- (a) Identification of packaging and labelling methods.
- (b) Display requirements.

4. *Physical Distribution:*

- (a) Channels to use between manufacturer and consumer.
- (b) Selectivity policy between dealers, distributors, whole-salers and retailers.
- (c) Sales efforts to gain co-operation of the trade.
- (d) Physical handling:
 - (i) Warehousing,
 - (ii) Transportation,
 - (iii) Inventories.

5. *Personal Selling:*

- (a) Emphasis on personal selling and the methods to be employed in:
 - (i) Manufacturers organisation,
 - (ii) Distributive channels.

6. *Advertising:*

- (a) Available funds or proportionate burden of turnover, to be placed on advertising.
- (b) Product image desirability.
- (c) Corporate image desirability.
- (d) Mix and types of media of advertising: selection for the trade; for consumers or populace.

7. *Promotions:*

- (a) Burden to be placed on special selling plans or devices directed at or through the trade.
- (b) Form of these devices for consumer promotion, for trade promotions.

Administrative Mix Elements

1. *Objectives* mean the targets of managements. The improved performance to which a marketing function or individual is committed

over a planned period. They may be clearly defined or be implied in management's behaviour; may be specific or general in nature.

2. *Organisation* is the way, the management work is delineated into tasks for individuals.

3. *Staff*—the men assigned with these tasks.

4. *Coordination*—interrelation of tasks to achieve managements' purpose.

5. *Motivation*—the devices designed to get the best from individuals.

6. *Development*—the training methods, formal or informal used for building up the ability of individuals to manage.

7. *Measurement*—the collection by personal observation, statistically or by accounting methods, data on performance of individuals or groups in achieving the corporate purpose.

8. *Control*—the use of measurement data for progress and performance appraisal.

Time Variable

Having identified these elements we now set about planning i.e. looking ahead into the future (time variable) and thinking how each will behave. Planning may be implicitly in managements' mind or explicitly expressed on paper. The plan period varies and it is putting these plans into practise that we start implementing the scheme.

It is impossible to generalise on what specific points company's plans should be built. No two companies face exactly the same problems or opportunities. But there are four elements around which any company can build what may be called a comprehensive plan that will lead to the benefits just discussed. These four elements are:

1. an appraisal of the company's or product's strengths and weaknesses in the market place;
2. a definition of the assumptions on which the company's plans have been based;
3. a statement of the goals sought; and

4. a list of the major programmes to be employed in achieving the goals.

Knowing the variable elements and then the process of setting objectives, developing plans of action to achieve the objectives, organising to put the plans into action and controlling and reappraising to determine whether or not the objectives, the plan and the organisation are working properly and in the right direction is a direct consequence of an understanding of this concept.

The marketing concept is thus the combination of three principal activities:

- (a) A factual marketing plan.
- (b) A functional organisational structure.
- (c) A professionally-managed operation.

The Marketing Plan

Two essential rules should be followed by the assigned individual when creating a Marketing Plan. These are:

I—Establish objectives.

II—Determine how these objectives are to be achieved.

Setting Marketing Objectives:

When creating his Marketing Plan, the assigned individual should decide upon a number of definite objectives for inclusion. All objectives must be realistic and require a detailed action plan, showing, where, how, when and by whom, they are to be achieved. As examples, some of the objectives for selection are given under:

1. Profitability:

- (a) as % improvement of previous performance in any form.
- (b) as % of sales.
- (c) as ratio of expenditure, etc.

2. Sales Volume:

- (a) in unit or cash volume.
- (b) as % improvement over previous performance.
- (c) by product group.
- (d) by geographical area, etc.

3. Market Standing:

- (a) as share of market.
- (b) by product quality or leadership.
- (c) by amount of field representation.
- (d) as a price target.
- (e) as number of customers in being.
- (f) by % reduction of customer debts.
- (g) as increase in stock turnover figure.
- (h) as some form of marketing effectiveness.

4. Productivity:

- (a) as sales per output of unit, branch office, sales team, period of time.
- (b) as sales per salesman, orders per sales call, calls per sale etc.

5. Innovation:

- (a) by establishment of better methods of marketing.
- (b) new pricing structure and systems.
- (c) new customer services.
- (d) more effective distribution.
- (e) better organisation.

Action Plans

For each objective, an Action Plan should be made out. This presents the current situation with certain assumptions and a course of action to be followed in each case as well as answering the questions—When? Where? How? By

Action Plan

No. 1

To achieve Objective No. 1.....

Item No.	Situation & Assumption	Action to be taken	When?
1.	1.1.1.....	1.2.....	1.3.....
	1.1.2.....		
	1.1.3.....		
2.	2.1.1.....	2.2.1.....	2.3.....
		2.2.2.....	

Whom? A number of Action plans linked together form the basis of the Marketing Plan. A typical Action Plan format would be:

wanted by what group of consumers, making decisions as to what prices to charge, selecting and managing channel systems, and managing the firm's promotion effort (the sales price and advertising).

Reviewing Performance:

Once the various Action Plans have been set in motion at the commencement of the planned period provided by the Marketing Plan, they should be regularly reviewed to ensure that "Performance meets Plan". If it does not, further action should be taken in line with the review on next page.

The primary task of marketing management is to understand the wants and needs of consumers—now and in the future. This ties to the definition of the firm's objectives which—both from a societal and a profit point of view—should consist of developing new and wanted products and effecting product improvements which contrast to that which seeks growth and profits from initiation or advertising expenditures which are designed to generate psychological product differences when none in fact exists.

Approach to Successful Planning:

So far, we have given a broad outline of the Plan in its formulative stage. Let us now examine the process of its formation, scope evaluation, organising for the job, implementation and the practical difficulties encountered in various situations. Three benefits arising from a well-conceived formal marketing plan are:

Objective

Since objectives centre around the wants and needs of the market, it is essential for the administrator to have an understanding of the culture, social customs and the life style of the people who comprise the potential market for his products. An appreciation of the organisation's strengths and weaknesses and a complete understanding of its rationale of existence is a must. Without being specific in its consumer orientation, Indian management inevitably falls back on vague, over-generalised definitions of consumer groups and their wants and needs with the result that the plans for research and development, product and product line, pricing, channels of distribution, personal selling and advertising are haphazard and poorly coordinated.

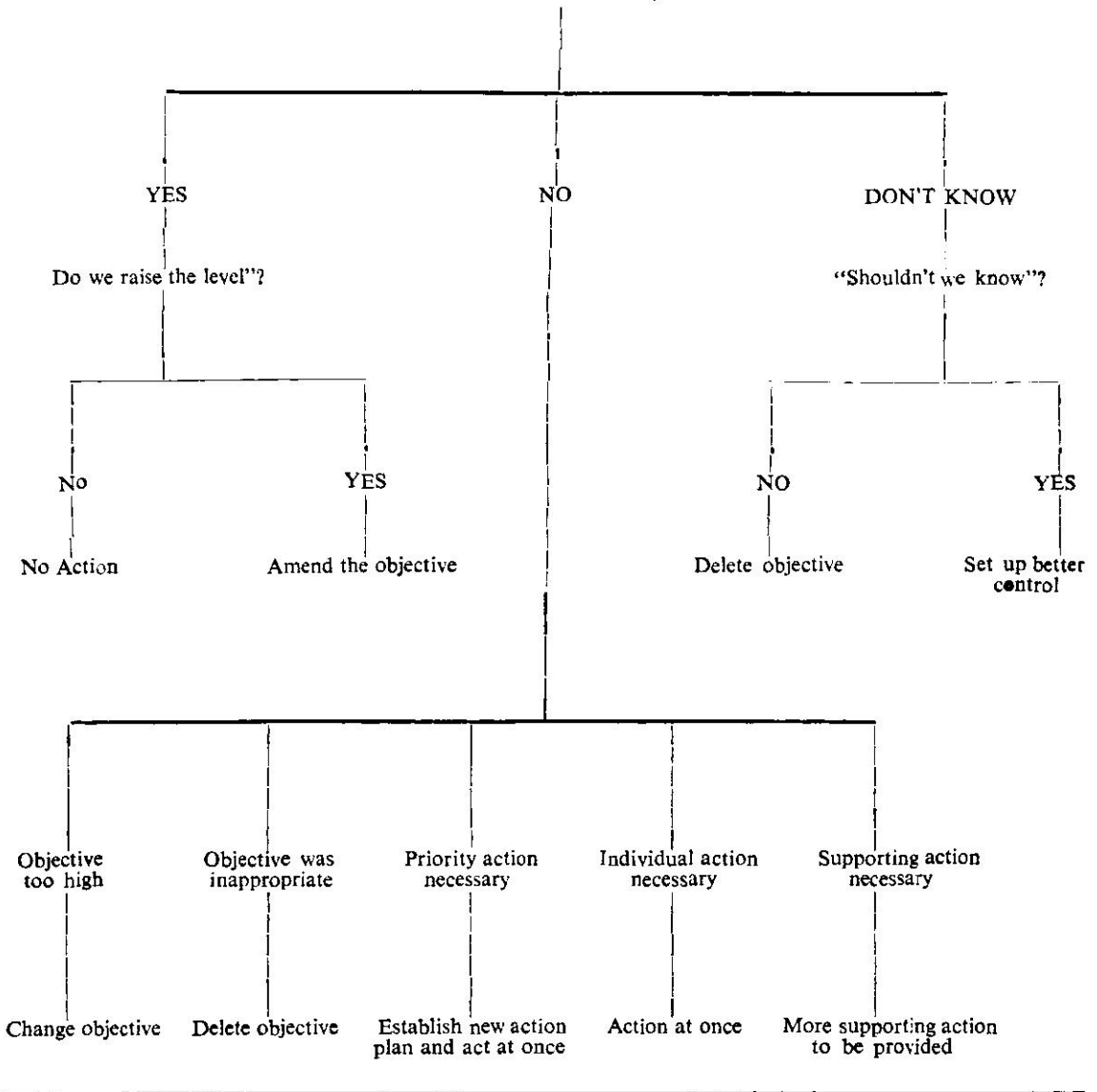
1. improved internal coordination and communication;
2. disciplined thinking on the part of planners which comes about by putting on paper any ideas.
3. A guidebook to refer back for decisions and to measure progress.

(a) Generic Use:

Marketing management consists of those activities which have to do with implementing the marketing concept. The operations of the marketing group are concerned primarily with identifying and servicing markets. This, in turn, involves performing such essential activities as specifying what products with what attributes are

The starting point in setting objectives deals with the *concept of generic use*. Indian companies

“Are we achieving this objective?”



must realise that they are not selling mere products, but rather the functions which these products can serve in satisfying a customer's needs. Phrased in these terms, companies sell nutrition, energy, comfort, self-expression

and intellectual development rather than biscuits oil, foam rubber, pens and textbooks. There is flexibility in this concept since the needs can be met by several other products. This means that objectives can be interpreted in different

ways by a competing company. Thus, a logical starting point would be to take present products and opposite each one state the end use(s) to which the product can be applied and the basic needs that the end use is attempting to satisfy.

Objectives have consequences. Emphasis on one aspect or another of the above will turn the company's activities in different directions.

(b) *Consumption Systems:*

Each product is part of some consumption system. This means that product is but one part of a set of inter-related parts. The totality of a system—which exists to satisfy some basic need—is such that one cannot understand any of the parts without comprehending the aspect of wholeness. It may be helpful to regard a consumption system as a series of steps which embrace one or more products plus certain different actions by the consumer relative to solving a problem. This “solving of a problem” or goal directedness is critical, since a failure to understand the nature of the goal and the standards set by the consumer to determine the expertise with which the goals are accomplished will inevitably result in a misunderstanding of the systems and its operating rationale. Typically, there are a constellation of goals; for example, a housewife likes to prepare meals to show that she is a dutiful housewife, to show her family that she looks after them, loves them, preserves them and so on. Systems vary substantially by social class groups.

It may be useful at this point to think of the consumer as operating a manufacturing process by which some end-product emerges. This would mean, of course, that a variety of systems would be in operation at any one time and that they would have some degree of relationship. It is important for the seller to go far enough in this thinking to relate one consumption system to any wider systems which have an important effect on the operation of the system in which he has an immediate interest. It is important to keep in mind that it is not only a consumer's viewpoint but there are other viewpoints which do interact; for example, the viewpoints of other members of the household, the viewpoint of the purcha-

The total marketing concept encompasses planning, organising and carrying out of all marketing functions and activities in moving a production or service to consumer at most economic cost.

sing agent, company engineer coupled with the viewpoint of the seller as interpreted by the buyer.

We can take, for example, the consumption-system involved in the use of a rain coat. Such steps are involved as removing the production from storage, transporting it to the place of use, putting it on removing, making it ready for storage (removing dust, drying etc.) and returning it to storage. Clearly the shape, size, colour, durability, protective features (against light dust, rain etc.) and so on can only be determined after a thorough study of the consumption systems involved. Knowledge of the consumption system will tell the seller that the consumer is acting in an orderly or purposeful way, according to his or her likes; that there are a series of inter-related steps which require decision-making based on knowledge, expectations, standards, and compatibility. The developing economies too frequently are prone to “borrow” products for local manufacture, which have been developed for use in consumptive systems which are in use in the more-affluent nations. Unfortunately, India is no exception to this fact. This means, of course, that scarce resources are committed to the production of items which do not readily fit in the Indian scene. The status derived from the use of “foreign” products frequently operates to “cover up” the mistake.

Productivity in Marketing

Dr Rustom S Davar*

Today when we talk about productivity, we generally think in terms of manufacturing or production, and how costs can be kept down or reduced to make our production activity less costly. However, one rarely talks about productivity in marketing in the Indian context. This is understandable in view of the prevalence of the seller's market in most commodities for a long time which has resulted in a lack of appreciation of the importance of marketing activities. It is only in recent times that the inflationary pressures and the recessionary trends, combined with the greater sophistication of customers, have forced some of our businessmen to become aware of the need for a more professional approach in marketing. Some of our products have already entered the buyers' market and the manufacturers concerned were suddenly faced with the problem of becoming marketing-oriented. Their response was to increase, and in some cases introduce for the first time, their advertising. In view of their uninitiation for so many years in organising marketing activities, the results can be described as amusing if we shut our eyes to the wastage involved through lack of productivity of their efforts.

MARKETING is no doubt challenging and exciting as the solution of marketing problems requires insight, experience and analytical abilities. The marketing manager has to blend a number of elements such as product planning, arranging effective distribution channels, promoting the product effectively, and arriving at the optimum pricing strategy. This he has to do whilst bearing in mind the interdisciplinary horizons in marketing. For optimum marketing, he must be aware of the useful contributions of social scientists such as psychologists, sociologists, anthropologists, economists, mathematicians and statisticians. Is it any wonder that businessmen in India have fought shy of increasing their marketing activities? They have, therefore, often argued with themselves that systematic marketing can be important only in a developed economy such as that of the United States of America. However, if we consider the aspect of productivity as applied to marketing and think in terms of optimising the use of the available resources, the importance of the strategic role which marketing can play in our economy will

become obvious. Let us therefore try to understand more clearly the meanings of the words "productivity" and "marketing".

Productivity and Marketing

The word productivity is generally explained with the help of words such as "inputs", "outputs" and "ratio". Let us look at it in a simple way. What we are really talking about is the securing of maximum results from the minimum of effort. If a company can produce better results from its marketing activities than another which employs the same amount of resources, we would say that the former was more productive or that there was higher productivity in its marketing operations. Therefore marketing management can be defined, from the angle of productivity, as

"the process of ascertaining consumer needs, converting them into products or services, then moving the product or service to the final consumers or users to satisfy such needs and wants of specific customer segment or segments with emphasis on profitability ensuring the optimum use of the resources available to the organisation".

*Principal, Davar's College of Commerce, Bombay.

Apart from consumer-orientation, this definition emphasises two important aspects, namely (1) profitability and (2) the optimum use of available resources. Now let us talk more specifically about certain facets of marketing in terms of productivity.

Size of Market

In India a common phenomenon seems to be that everyone wants an "all-India" market. Whilst large organisations such as Hindustan Levers, Union Carbide and Tatas should think in such terms, is it appropriate for small organisations to do so? Have we not come across examples of small manufacturers of torches competing on an all-India basis with Eveready and Jeep Torches which together control about 80 per cent of the market in India? Would it not be better for such small organisations to think in terms of smaller market segments, smaller market areas and try to make an impact in such smaller segment, with the help of their smaller sales force and marketing budget, than to dissipate their energy on an all-India basis? After developing such a small area and accumulating more resources through profitability of such operations, the small organisation can then think in terms of another small segment for extending its activities. In this way small organisations can, over a period of time, build up an all-India market. Concentration of their limited resources on limited areas would result in greater productivity of their marketing operations. Even in case of large organisations, experienced marketing men know that very often say about 80 per cent of their sales are generated from only 20 per cent of their customers. Would it not be better for them to concentrate more on this 20 per cent than to incur a disproportionate expense in satisfying the remaining 80 per cent? Of course, a note of caution here is in order. Too much reliance on too few customers can be dangerous as was evident in the recent recession where industries who relied heavily on Government orders were naturally hit the hardest. However, a careful pruning of the customers in terms of productivity, i. e., getting the maximum results from the minimum of effort, could reduce the number of customers towards whom the marketing effort is directed

particularly in case of industrial products.

Productivity of Advertising

In India, the extent of advertising has increased in recent years. This is all for the good as advertising is an important education medium and can help considerably in increasing the standard of living in our country. However, in view of our limited resources, the question of productivity or effectiveness of the advertising becomes of great importance in the Indian context. At times we come across advertisements depicting seminude women wearing men's shirts. However "sexy" the woman in the advertisement, is this the right type of advertising from the viewpoint not of morality but even effectiveness? We come across many advertisements which certainly have "attention value" in this sense. A limited research was done in this behalf by the author by asking groups of persons whether they remembered such an advertisement. The answer was immediately "yes". When they were asked further as to the product being advertised, some did not know, whilst others identified that a shirt was being advertised but very few, if any, knew the brand name of the product or the company which had placed this advertisement. Does this not constitute a waste in advertising? Are these companies just trying to sell shirts or is their objective to sell shirts manufactured by them? Are they thinking in terms of increasing the primary demand or selective demand for their own product?

Let us take another example, this time in terms of the advertising theme. The Tea Council was naturally worried as tea was not a popular drink in U.S.A. Coffee is the popular beverage there. A research was conducted and it was found that Americans associated tea with "foreigners (Britishers primarily), women and sisses". They thought of tea as being "good for the sick, nervous, depressed, feminine type of people". Is this surprising in view of the slogan used for many years by the Tea Council to promote the sale of tea? The slogan was: "Tired? Nervous? Try Tea". The slogan thus reinforced this image in the minds of the Americans that tea was for nervous and sick people. As a result of this survey the Tea Council changed its

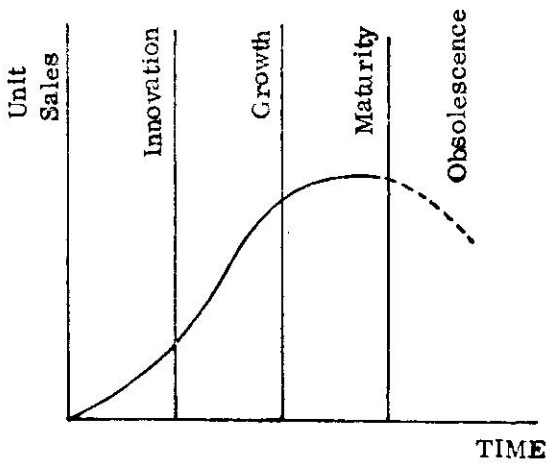


Fig. 1
The Product life cycle

approach, the new slogan being "Drink it Hefty, Hot and Hearty: Take Tea and See".

A lot of money can be wasted in advertising unless the advertisement is drafted properly and incorporates an appropriate theme. Selling is psychological and a need-oriented approach is essential. For example, if we are selling tooth-paste, are we supplying the "need for insurance" against one's own self-neglect, i. e. appealing to "people who cannot brush after every meal"? As against this, is our objective to offer a "benefit of social acceptance" with the advertising theme "Cleans your breath, while it cleans your teeth"? Or are we trying to supply the "need for a medicine" and offering a benefit in the form of "Fewer cavities?" Unless we analyse our marketing strategy in depth in terms of our customer, our marketing efforts are not likely to be sufficiently productive.

Productivity and Product Life Cycle

Productivity of the promotional effort is also related to the position of the product in its life cycle, i.e. whether it is a new product or a mature product or a saturated product. Generally a

product passes through certain stages during its life span, namely, innovation, growth, maturity and obsolescence, as indicated in Figure 1.

The reasoning is that when a new product is introduced, it takes some time before it takes off. Thus at this stage the sales response to the promotional effort is low as potential purchasers have yet to learn about the new product, assess its value to them and be convinced that they should purchase the product. As consumer acceptance is secured, the growth stage is reached and sales increase faster in proportion to the promotional effort. This is followed by the period of maturity and ultimately a saturation phase is reached as more competitors have entered the market. If proper steps are not taken at this stage, the obsolescence stage is likely to follow. Apart from evaluating the obsolescence stage in terms of productivity, the marketing manager and all those concerned with profitability of the operations would do well to ask other relevant questions. For example, in case of the innovation stage or in connection with new products, one must be convinced that the long term sales and profit possibility support the decision to incur the heavy initial expenditure for the promotional effort as the productivity of such effort will be low in this period. In case of mature products, awareness of which are the mature products of the company would enable the organisation to apply appropriate promotional efforts on such products which result in substantial sales response or more productive promotional effort. In case of saturated products, it is well worth asking whether the extra effort to sustain that product is justified in terms of future expectations or whether it is time to eliminate such a marginal product requiring less productive promotional effort.

Productivity vs. Costs

To most managers in India, productivity consciousness seems to be synonymous with the expression "cost consciousness". For example, the typical production-oriented manager may think in terms of reducing costs which might result in restricting the output. Despite availability of resources, he may concentrate more on

minimising costs by saving in materials, avoiding waste, etc. in his desire to secure high profit per unit of sale. Whilst watching over costs and trying to reduce them is an important aspect of productivity and profitability, it can result in overlooking of better opportunities which might be available in a situation but can be secured by increasing costs such as promotional cost and thereby increasing production and perhaps ultimately thereby decreasing the unit production cost of that article. In case of many products, markets are expanding in India and the resources required for production are also available. In such a situation, the price factor becomes an important consideration. In case of a product with a relatively price elastic demand, it may be wiser to fix the price as low as possible, thereby increase the demand and sales and even with a lower margin of profit secure higher profits in the aggregate. Figure 2 indicates the break-even at different prices of a hypothetical product incorporating the estimated demands. D_1 , D_2 , and D_3 represent the total revenue likely to be generated in terms of estimated demand for prices Rs. 100, 80 and 60 respectively. The graph indicates that D_2 generates the best profits as the vertical distance is greatest in case of this price between the respective sales revenue line and the total cost line. Thus productivity or profitability is greatest at price Rs. 80 when compared with either price Rs. 60 or price Rs. 100. This emphasises the importance of the "right price" concept. As the question of demands at various prices were considered in arriving at D_1 , D_2 and D_3 , this method also took into consideration the psychological and other variables involved in a pricing situation.

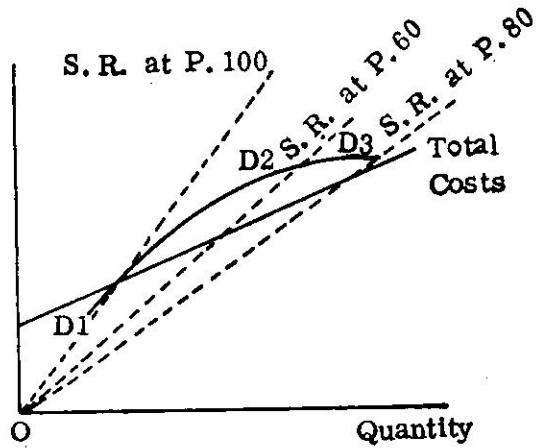


Fig. 2
Break-even at different prices incorporating the estimated demands

$$R = \frac{S - C}{C}$$

where R = the Rate of return,
 S = the estimated Sales of a particular channel,
 and C = the estimated Cost of that channel.
 All other factors being equal, the channel with the higher rate of return would be preferred. In cases where we can presume that both the channels under consideration are capable of producing the same sales, a break-even analysis would indicate the "point of indifference". This is depicted in Figure 3.

Productivity of Distribution Strategy

Let us now shift from Promotional Strategy to the distribution aspect. How many marketing managers in India have really tried to evaluate the productivity or effectiveness of their distribution system? There are methods available, such as the rate of return analysis, the break-even analysis, and comparison against standards. For example, the rate of return can be calculated by dividing the profits in terms of the cost of the particular distribution channel involved, the formula being:

In the graph it will be noticed that the fixed costs are higher in case of one's own sales force and the rate of commission would be lower than when using an outside sales agency. Q is the point of indifference. Such an analysis would indicate that, in terms of costs or productivity, one method is better than the other depending on the level of sales we are visualising. Of course there are other non-quantitative variables which must be borne in mind. For example, the sales force naturally has its advantages. However, the emphasis is not on what technique we use, but whether such an evaluation is done from time to

time to ascertain the productivity of the operations.

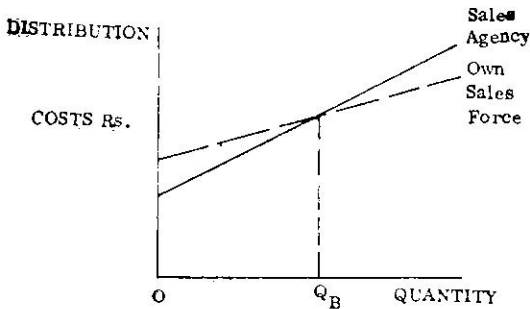


Fig. 3

Break-even Analysis

Conclusion

In this way, each activity forming part of the marketing mix can be analysed in terms of productivity. For this analysis, pertinent questions should be asked. Are we aiming at the right customer segments? Are we wasting marketing effort on relatively unproductive customers or markets? Is our promotional effort and distribution strategy productive? Can we change our packing material to reduce costs without

affecting efficiency? Do we select our marketing personnel on the basis of merit or other extraneous considerations? Can we secure the same sales and profits by lowering marketing costs? Can we secure higher sales and profit at the same marketing costs? Can we secure higher sales and profits proportionately greater than the increase in marketing costs? Can we obtain lower sales with reduction in profits proportionately less than the reduction in our marketing costs? Answers to these and similar questions can result in highlighting areas in which greater productivity can be secured through improvements in our marketing strategy. Such an analysis may result in better selection, training and motivation of our salesmen and sales supervisors. The result could be improved sales promotions and introduction of advertising that sells our products or services. Such a productivity analysis could generate the introduction of new profitable products or the elimination of unprofitable products and customers. The change in distribution strategy highlighted by such an evaluation may suggest the use of more productive distribution channels. There are infinite possibilities. If such a productivity analysis were constantly pursued by our organisations in India, whether they be large or small, our economy would get a contributory boost and the result could well be a higher standard of living for all of us. □

New Products' Success and Failure

What about all those sophisticated procedures we keep hearing about for minimizing new-product failures? They don't seem to be working very well. Or are they? They may be working very well and we're simply looking at the wrong side of the coin, so to speak. For if 60 per cent of new products fail in test market, 40 per cent succeed.

And it may guess that the 40 per cent success rate belongs predominantly to a relatively small group of manufacturers who do indeed have a regimen and science governing the development of new products and new-product marketing planning.

—Donald A. Wells, *Printers' Ink*, Vol. 291 (August 27, 1965).

Interaction Process : Small Group Behaviour

A Case Study

Dr Narendra K Sethi*

This study is divided in the following three sections: Section I (Interaction Process—Small Group Behaviour) introduces the subject of research, significance of the small group entity, and reviews pertinent literature in the field. Section II (Theory of Small Group Behaviour) presents a personal theoretical schemata of a small group in terms of its structure, creation, composition, membership, leadership styles, business, selection of leader, entrance criterion, variables needed for effectiveness, and possible signs of conflict. Section III (Case Study of Small Group Behaviour) illustrates the foregoing concepts by the use of a hypothetical case study drawn from an academic environment.

I—INTERACTION PROCESS — SMALL GROUP BEHAVIOUR

THE work group can be thought of as the smallest unit of any formal social organisation. Despite its small size, however, it is vital to the effectiveness of the entire society. There are probably few organisational problems from which work group structure and dynamics can be excluded from consideration.

The individual's most immediate and meaningful experience of work is obtained through his work group and his work associates. The larger organisation is encumbered by indirection, but membership in the work group contributes directly to the shaping of attitudes and behaviour toward the complete concept of work.

Interaction is the process of mutual influence between both the organization and environmental mix. It is capable of assuming the following three directions :

1. *The Equilibrium Direction* : In this direction, the interaction results in the establishment of a *minimal* level of behaviour, narrowly defined within limits of disturbance.

2. *The Homeostatic Direction* : In this direction, the interaction results in the establishment of a *high* level within ever-present environmental conditions threatening to reduce it.

3. *The Adoptive System Direction* : In this direction, the interaction results in the establishment of a variable level depending upon the environmental variety.

The purpose of this section is to comment upon the rationale of small groups, the need to study their behaviour, the structural differences between small groups and individuals, group norms, small group research and its application in the modern business environment. Existing theories and models of small group behaviour are discussed in this section.

Why Study Small Group Behaviour?

The study of small group behaviour focuses on the most persistent and probably the oldest

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form of social organisation known to man. Civilizations, governments, and institutions are transient but the small group has remained the most persistent form of social organisation. It is said that, "Its survival affirms that small groups satisfy important human needs which no other form of organisation can supply."¹

Although the small group is a tenet of society and persists despite the variety of institutions in the large social structure, it is also true that the effectiveness of large-scale organisation depends, in large measure, on the development of effective small groups. These groups should build their own cohesion and continually resolve internal problems. They must also maintain a positive identification with other groups and with the parent organisation. The fact that small groups satisfy important human needs assures their survival as an organizational form. This does not, however, assure the development of effective groups and consequently effective organisations in the larger societal institutions. It is here that administrators face an important challenge.

Any formal organisation creates, with some degree of consciousness, many small groups. "The system of interlocking and overlapping group structures is the very essence of organisations such as business."² Each group has a function in the effectiveness of the overall organisation. Viewing organisations as a system of group relationships immediately poses important questions for continuity and effectiveness. What are the conditions besides spontaneous tendencies for the development of group cohesion? By what processes are members selected for inclusion in the group? How do groups influence the attitudes and actions of their members? How do groups maintain relationships with other groups? Why do groups sometimes develop internal cohesion but at the cost of antagonistic relationships with other groups and the overall organisation? Is openness supported and valued in the group? Is there a high degree of trust among group members? What are the

different roles of group members? How is conflict within the group resolved?

Many other similar issues could be considered, but this list conveys the nature of the alternative choices that must be made. With our present knowledge, it is impossible to indicate right or wrong answers to these questions, though a high proportion of the literature on groups appears to lean toward openness, cohesiveness and democracy in the group behaviour."³ The best way to answer these questions is to examine the findings being expounded in the descriptive research on the subject.

Group Versus Independent Individuals

Why do people form groups in the first place? Do they contribute or detract from productivity? According to recent research, the answer depends on two considerations: (1) the nature of the problem to be solved and (2) the characteristics of the members of the group.⁴ A few illustrative examples are the following :

1. If the group consists of members with equal skills performing a single task, group interaction can slow production.
2. If one member is more skilled than the others, the group may be more productive than independent individuals because of the guidance of the skilled operator.
3. If the task is so complex that the group members do not recognize that some solutions are more difficult than others, confusion may result. If the skilled operators can demonstrate the correctness of expert solutions, productivity will increase; if not, there will be conflict.
4. If the task is one of reaching a decision or solving a problem, rather than direct production, group effort has advantages as well as limitations. The pooling of ideas of members will

¹W. Warren Haynes and Joseph L. Management: Analysis, Concepts and Cases, Englewood Cliffs, N. J., Prentice-Hall, Inc., 1969, P. 150.

⁴The four summaries of research most directly influencing this discussion are: (1) George C. Hamans, *The Human Group*; (2) Josephine Klein, *The Study of Group*; (3) Herbert Banner, *Group Dynamics: Principles and Applications*; and (4) Harold J Leavitt, *Managerial Psychology*.

¹Abraham Zaleznik and David Moment, *The Dynamics of Inter-personal Behavior*, New York: John Wiley and Sons, 1964, P. 4.

²*Ibid.*

solve problems that might have been difficult. The members will have a sense of participation and may be more willing to carry out the resulting decision. Nevertheless, groups consume time and tend to stress conformity rather than originality.

There are no simple axioms on the superiority of group endeavour. The management problem is the determination of the task at hand for which group endeavour will, in fact, carry benefits exceeding the costs.

Group Norms and Cohesiveness

Small groups are more than structured collections of individuals. To use a favourite expression of sociologists, group members interact with each other. Different patterns of interaction will influence the behaviour of the group. "One of the clearest illustrations of this point, supported by one research study after another, is that groups tend to establish norms (goals, rules of behaviour, concepts of right and wrong) which have an impact on individual attitudes and output."⁶ Whether we like it or not, most members act and decide in terms of the ideas of others in the group. There is a considerable tendency to conform to an estimate of the group average, though this may be offset by a desire to demonstrate skill or to impress supervisors. Individuals may strive for success, but determination of what success is will be heavily influenced by the attitudes of the group.

Members who do not conform to group standards may be classified as idiosyncratic. No doubt, some small groups are more tolerant of eccentrics than others, but the pressure to conform is very intense. The group thus sets the pace for the work; it influences the level of aspiration toward which the individual aims.

Some studies, specifically the work of Haynes, suggest that increased interaction among group members fosters increased friendliness. "Unfortunately, casual observation raises doubts;

Some studies suggest that increased interaction among group members fosters increased friendliness.

this question calls for further research. The converse is more certain. If individuals like each other, then the group will be more cohesive and the groups norms more powerful. It is true that interaction helps clarify misunderstandings that arise from ignorance. In a disturbing situation in which the work is unpleasant or unrewarding, a person may turn on those closest at hand."

Despite the uncertainties concerning these findings, there can be little doubt that group interaction and group norms are of primary importance in determining the outcome of most kinds of activities. Managers may find it valuable to examine the impact that groups have on morale and productivity, provided that they are willing to avoid snap judgments or dogmatic generalisations in evaluating group processes.

Breakdown of Communication

Limitation or breakdown of communication can have strong effects on group and individual behaviour. Without communication, people develop a distorted or biased view of what others are doing, and their mistaken beliefs may result in hostility. When people are split into groups and communication breaks down among these groups, the tendency toward hostility may be stronger. If members of the group imagine a threat from the outside, they join the other members in a defensive compact against the outsiders. Such defensiveness may lead to open conflict or to its opposite, the repression of illfeeling. In either case, the effects on total productivity and individual satisfaction may be negative.

⁶ Haynes, *op.cit.*, p. 154.

Work Environment

How do the various factors in the work environment affect group behaviour? "The two broad aspects of the environment which affect group behaviour are: (a) the physical environment, e. g., plant, equipment, layout, and so on, and (b) the psycho-social environment, e. g., worker needs, reward systems, work group structure, supervisory practices, work group norms, worker roles and attitudes."⁶

Generally speaking, "it has been found that it takes rather drastic changes in physical variables to produce a noticeable and reliable difference in worker behaviour."⁷ Thus recent research efforts dealing with the worker and his work situation have veered away from consideration of the aspects of the physical environment, concentrating instead on the psycho-social environment as a source of potentially useful discoveries regarding the correlates of work group behaviour.

Several publications by Haire⁸ March and Simon,⁹ Stodgill¹⁰, Whyte,¹¹ and Zaleznik¹², have presented theoretical models of organizational behavior which emphasize the importance of the interaction between psychological needs of workers and the existing environmental conditions in determining the work group behaviour. Typically, these models maintain that certain conditions in the environment, e. g., wages are correlates of the behavior of the work group.

One should approach these research findings on small groups with a critical attitude. The

following questions are particularly meaningful in this context:

1. Are the research findings on experimental groups applicable to more complex industrial situations?
2. Are there implicit value judgments involved in some of the small group studies?
3. Have the extreme enthusiasts for group dynamics neglected the very tyranny of the group?
4. Have some writers neglected the creativity of the individual outside of the group?¹³

Significance of Small Group Research for Business

In spite of these criticisms, the progress in the study of small groups remains one of the most impressive developments in the study of human behaviour especially as it concerns administrative management.

If this evaluation of small group research is correct, management has two reasons for interest in it. One reason is to keep up with research developments as they occur. The other reason is to be fully aware of the importance of small groups in current business decisions. Uncertainty about some of the present hypotheses should not blind managers to the value of a view point that is cognizant of groups. Human beings are conditioned by group norms and pressures. The manager who recognizes this fact is more likely to consider probable group and individual reactions in his decisions.

There is little doubt that attention to group norms, to patterns of group leadership, to formal and informal organizations, and to the impact of communication networks can contribute to the effectiveness of management. Managers will have to use careful judgment in separating the relevant generalisations from the irrelevant, the tested from the untested

⁶Readway Parker: "The Psychological Environment and Work Group Behavior," *Personnel Administration*, September 8, 1965, P. 26.

⁷*Ibid.*

⁸Mason Haire, (Ed.) *Modern Organization Theory*, New York: John Wiley and Sons, 1959.

⁹J.G. March and H.A. Simon, *Organization* New York: Wiley and Sons, 1958.

¹⁰R. M. Stodgill, *Individual Behaviour and Group Achievement*. New York: Oxford Press, 1959.

¹¹W.F. Whyte, *Money and Motivation*, New York: Harper and Row, 1955.

¹²A. Zaleznik, et al., *The Motivation, Productivity and Satisfaction of Workers*, Boston, Mass.: Harvard University, 1958.

¹³Haynes, *op. cit.*, pp. 157-158.

ways by a competing company. Thus, a logical starting point would be to take present products and opposite each one state the end use(s) to which the product can be applied and the basic needs that the end use is attempting to satisfy.

Objectives have consequences. Emphasis on one aspect or another of the above will turn the company's activities in different directions.

(b) *Consumption Systems:*

Each product is part of some consumption system. This means that product is but one part of a set of inter-related parts. The totality of a system—which exists to satisfy some basic need—is such that one cannot understand any of the parts without comprehending the aspect of wholeness. It may be helpful to regard a consumption system as a series of steps which embrace one or more products plus certain different actions by the consumer relative to solving a problem. This “solving of a problem” or goal directedness is critical, since a failure to understand the nature of the goal and the standards set by the consumer to determine the expertise with which the goals are accomplished will inevitably result in a misunderstanding of the systems and its operating rationale. Typically, there are a constellation of goals; for example, a housewife likes to prepare meals to show that she is a dutiful housewife, to show her family that she looks after them, loves them, preserves them and so on. Systems vary substantially by social class groups.

It may be useful at this point to think of the consumer as operating a manufacturing process by which some end-product emerges. This would mean, of course, that a variety of systems would be in operation at any one time and that they would have some degree of relationship. It is important for the seller to go far enough in this thinking to relate one consumption system to any wider systems which have an important effect on the operation of the system in which he has an immediate interest. It is important to keep in mind that it is not only a consumer's viewpoint but there are other viewpoints which do interact; for example, the viewpoints of other members of the household, the viewpoint of the purcha-

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After properly understanding the corrective steps required to be taken in a consumption system, the seller can move to examine existing products and measure their efficiency through the eyes of the consumer. This type of detailed examination should provide an opportunity for innovation to suit local consumption systems. Because of the fact that most Indian consumers have consumption systems which are more primitive than corresponding systems in operation in the more industrialised nations, they are less demanding than more affluent consumers. Adjusting to a harsh environment is still the major problem of the bulk of the population and simple products which can be produced in large quantities to sell at a low price is still to have effect than more complicated products, which can only be used by a few with any degree of expertise.

(c) Other Considerations in Setting Objectives:

The notion that no firm can hope to sell to the whole market is significant. While the idea of market segmentation is vitally important, most firms pay little attention to segmenting the market in such a way as to understand how the needs and wants of one segment *versus* another have a profound effect in setting of objectives and choice of strategies.

As a matter of fact, markets lend themselves to segmentation in many ways and probably the most obvious is the geographical location. Also, differing costs are experienced in selling into different areas because of transportation and warehousing. But markets can and must be segmented on the basis of the demand functions. In the more-industrialised economies of the West, many firms segment on the basis of social class. Other bases of classification frequently used—depending on the product—are education of the male head of the family, size of household, presence and age of children, occupation of male head, etc.

It is necessary for a firm to state clearly the segments in order to optimize the use of its resources and make intelligent decisions regarding its product, price, channels, personal selling

and advertising. It must be prepared to accept the fact that different segments require different treatments. Often what is successful strategy regarding one segment is a failure with another. It is, no doubt, true that the same product cannot be sold to two or more segments since acceptance of the product by one may cause reflection by the other.

In determining their objectives, firms must always consider their resources *vis-a-vis* those of their potential competitors in the market. Often attention is paid solely to the financial resources of the firm. In the final analysis, however, resources can only be judged through the eyes of the consumer. Surely, the financial assets of a firm are important but equally important is the firm's "know-how" in the context of knowing what the market wants and how best to satisfy the consumers. A production-oriented unit is not only likely to overlook the importance of market know-how, but to place almost complete reliance on the advice of individuals devoted to the primacy of the internal system with its emphasis on obedience and doing things in the traditional way.

One of the main differences between a developed society and a developing society is that the latter is mainly production-oriented whereas the former is marketing-oriented. We have in the past paid considerable attention to expansion of production; the time has come when we have to pay equal attention to expansion of distribution also.

(d) Plan:

Given precise goals, as well as an understanding of the market conditions, the administrator can then move to the next step in the administrative process, setting forth the plan, organising his resources into a detailed set of actions and co-ordinating them in such a way as to provide a maximum thrust in the direction of his goals. Needless to say, the plan depends upon the objectives and we note the interlocking nature of the steps in the administrative process.

Any plan has necessarily to be concerned with the strategies of product and product line,

pricing, channels of distribution, personalised selling, advertising, etc. Since a decision with regard to any one strategy will affect the other, the problem in planning centres around obtaining the best "mix". The planner must, therefore, assign some value to a given input and in so doing make sure that the same input in another strategy will not yield a higher "return" for the same time period.

It must be ensured that the strategies available to a firm are essentially marketing strategies. All other efforts of the firm will come to naught unless the marketing side of the business is understood and translated into effective action.

For a customer a unique product is the most important strategy. A unique product strategy if properly implemented will no doubt permit all sorts of inefficiencies elsewhere in the firm. It matters little to the customer how operationally efficient a firm is if its product does not suit his needs.

Many Indian firms think that they are producing a product for sale to middlemen. This means that the marketing function is being left to an outside party and the firm becomes dependent upon the integrity and efficiency of the outside firm. As the middlemen who operate in the emerging economies are mere speculators than real marketing institutions, this practice of delegating the function to such parties often lands the firm in disaster. In essence, a producer cannot be deemed to have completed his job until he has made the *right* product available at the *right* time at the *right* place for purchase by the consumer.

As stated earlier, a plan centres around the estimate of pay-offs for various input units. This is by no means an easy task regardless of the amount of experience possessed by the decision-maker. Yet, few Indian businessmen make serious use of marketing research to provide them with information which will help them minimize the risks inherent in making any decision. Marketing research is an essential adjunct of the

administrative mix and it is difficult to perceive how any firm could plan successfully without it.

Organisation

Many Indian organisations would have difficulty in handling effectively the implementation of the administration process steps. The typical organisation would resist it and in so doing would be behaving in a manner similar to any organisation which was "threatened". But this is not to say that the organisation cannot be changed over a period since any organisation must make adjustments to changes in its mission.

This is not to advocate that Indian organisations do what many Western firms did when they embraced the marketing concept. In fact, Indian organisations can change only gradually and not overnight. Implementation of the marketing concept is difficult in the sense that it is a way of thinking which, to be effective, must permeate the entire firm.

Actually a starting point of the development of an organisation is the plan formulated to attain certain objectives. Obviously, a well-designed plan will call for a certain kind of organisation as well as for the organisation to operate in certain direction. Take, for example, a situation where the firm's product strategy call for substantial product innovation. In such a case an R & D (Research & Development) Department would be required to be set up. The work of this Department would be directed, in part, and evaluated by the marketing department which would, in turn, rely upon marketing information generated by the marketing research unit. Further, in the case of a consumer product, emphasis will have to be placed on sales promotion in order to make certain that consumers knew well of the unique features of the product.

At a minimum, the marketing concept would call for Indian firms to have a marketing department which is on par with such other departments as finance and production. □

Productivity in Marketing

Dr Rustom S Davar*

Today when we talk about productivity, we generally think in terms of manufacturing or production, and how costs can be kept down or reduced to make our production activity less costly. However, one rarely talks about productivity in marketing in the Indian context. This is understandable in view of the prevalence of the seller's market in most commodities for a long time which has resulted in a lack of appreciation of the importance of marketing activities. It is only in recent times that the inflationary pressures and the recessionary trends, combined with the greater sophistication of customers, have forced some of our businessmen to become aware of the need for a more professional approach in marketing. Some of our products have already entered the buyers' market and the manufacturers concerned were suddenly faced with the problem of becoming marketing-oriented. Their response was to increase, and in some cases introduce for the first time, their advertising. In view of their uninitiation for so many years in organising marketing activities, the results can be described as amusing if we shut our eyes to the wastage involved through lack of productivity of their efforts.

MARKETING is no doubt challenging and exciting as the solution of marketing problems requires insight, experience and analytical abilities. The marketing manager has to blend a number of elements such as product planning, arranging effective distribution channels, promoting the product effectively, and arriving at the optimum pricing strategy. This he has to do whilst bearing in mind the interdisciplinary horizons in marketing. For optimum marketing, he must be aware of the useful contributions of social scientists such as psychologists, sociologists, anthropologists, economists, mathematicians and statisticians. Is it any wonder that businessmen in India have fought shy of increasing their marketing activities? They have, therefore, often argued with themselves that systematic marketing can be important only in a developed economy such as that of the United States of America. However, if we consider the aspect of productivity as applied to marketing and think in terms of optimising the use of the available resources, the importance of the strategic role which marketing can play in our economy will

become obvious. Let us therefore try to understand more clearly the meanings of the words "productivity" and "marketing".

Productivity and Marketing

The word productivity is generally explained with the help of words such as "inputs", "outputs" and "ratio". Let us look at it in a simple way. What we are really talking about is the securing of maximum results from the minimum of effort. If a company can produce better results from its marketing activities than another which employs the same amount of resources, we would say that the former was more productive or that there was higher productivity in its marketing operations. Therefore marketing management can be defined, from the angle of productivity, as

"the process of ascertaining consumer needs, converting them into products or services, then moving the product or service to the final consumers or users to satisfy such needs and wants of specific customer segment or segments with emphasis on profitability ensuring the optimum use of the resources available to the organisation".

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but they must be concerned with groups, for groups are indeed most persuasive. Managers must always be aware of the principles of group dynamics. These principles explain to the manager both the pro and the con of group interaction.

The principles of group dynamics are as follows:

1. If the group is to be used effectively as a medium of change, those people who are to be changed and those who are to exert influence for change must have a strong sense of belonging to the same group.
2. The more attractive the group is to its members, the greater will be the influence that the group can exert on its members.
3. In attempts to change attitudes, values, /or behaviour, the more relevant these are to the basis of attraction towards the group, the greater will be the influence that the group can exert upon members. If a man joins a union mainly to keep his job and to improve his working conditions, he may be largely uninfluenced by the union's attempts to modify his attitudes towards national and international affairs.
4. The greater the prestige of a group member in the eyes of the other members, the greater the influence he can exert.
5. Efforts to change individuals or sub-parts of a group which, if successful, would have the result of making them deviate from the norm of the group.
6. Strong pressure for change in the group can be established by creating a shared perception by members of the need for change, thus making the source of pressure for change generate from inside the group.
7. Information relating to the need for change, plans for change, and consequences of change must be shared by all influential people in the group.
8. Changes in one part of a group produce strain in other related parts which can be reduced

only by curtailing change or by bringing about readjustments in these related parts¹⁴.

Conclusion

A review of the main points of interest in the study of small group behaviour is as follows: First, "the group is an important instrument for the accomplishment of work."¹⁵ Practitioners and students of organisations, who are especially concerned with efficiency and productivity, will find important conclusions in the study of group behaviour. Second, "the small group can be thought of as a miniature social system."¹⁶ The study of the small group should make possible a deeper understanding of larger scale social systems especially business organisations. Third, "the small group is at the center of the influence process."¹⁷ Anyone interested in the formation of attitudes or decisions made by the individual must understand the effects of group membership. Fourth, "the small group is a setting for learning more about the dynamics of personality and interpersonal relationships."

II—THEORY OF SMALL GROUP BEHAVIOUR

Introduction

In the preceding section of this paper, an effort was made to review existing literature and theoretical constructs on small group behaviour and interaction process. The rationale of group behaviour, the barriers to optimal behavioural development, the determinants of behaviour, and the processes of corrective action were already discussed earlier. With this background information, the author will outline his own theory of small group behaviour, which will be amplified later by a detailed case analysis.

¹⁴Darwin, Cartwright, "Achieving Change in People : Some Applications of Group Dynamics," in Keith Davis and William G Scott (eds.), *Readings in Human Relations*, New York : McGraw-Hill Book Company, Inc., 1959, p. 220.

¹⁵Zalesnik, Moment, *ap. cit.*, p. 13.

¹⁶*Ibid.*

¹⁷*Ibid.*

A theory is relevant only when it is seen in practical observation that can be easily transferred into reality. Furthermore, in the social sciences-oriented business environment, a theory should be current, pragmatic, relevant, and convenient. It may be immensely personal or be totally social, depending upon the set of active circumstances. However, a theory should be based on generally identifiable dimensions or else it may only remain in the realm of hypothesis.

A group is characterized as a group of not over six persons. There is no magic in this number. It is chosen so that the group will not become an unmanageable crowd or limit itself to a narrow two-person interaction. Within these two extremes, the number suggests small group structure, cohesion, unity, balance, and communicative channels. The theory constructed in this scheme recognizes this average number.

Theoretical Schemata

A small group is structured on the basis of the following motivating forces :

1. Economic
2. Social
3. Job-structured
4. Family
5. Religious
6. Communal
7. Ad Hoc to serve a purpose.

The creation of a small group is possible only based on one of the foregoing forces :

A small group can have the following time spans :

1. Permanent
2. Temporary
3. Ad Hoc
4. For a definite date
5. For a definite purpose.

The composition of a small group is determined by the following factors:

1. By the virtue of birth
2. By appointment
3. By election
4. By adoption
5. By convenience of being present.

The membership-relationship patterns in a small group may include the following patterns:

1. Horizontal relations
2. Vertical upwards or vertical downwards
3. Kin relations
4. Circular relations.

The leader in a small group may exercise his leadership in the following ways :

1. Democratic process
2. Autocratic process
3. Cross-fertilization of ideas
4. Rules and regulations
5. Conventions and traditions
6. Management by exception.

The small group may conduct its business in the following ways :

1. Formal meetings
2. Informal get-togethers
3. Written exchange of ideas
4. Telephone communication
5. No meetings—by intuition

A leader may be chosen in a small group in the following ways :

1. By election
2. By appointment
3. By seniority of age, education, or other
4. By birth
5. By statute
6. By convention (like the head of a family).

A small group may have the following entrance criteria for new members :

1. Open to all
2. Closed entry
3. Open to a particular race, religion, job
4. Open to people related by blood or professional ties
5. Open by appointment or election.

The effectiveness of a small group is dependent upon the following major variables and considerations :

1. Degree of interacting among members
2. Degree of understanding
3. Degree of homogeneity
4. Degree of tolerance
5. Degree of purposefulness
6. Degree of time-perception
7. Degree of individual motivation
8. Degree of cognitive feeling in members
9. Degree of cooperation ; and
10. Degree of implied and unimplied leadership.

The group may be formal or informal, structured or unstructured, temporary or permanent, leaderless or with a leader, and it may be direct or indirect. The underlying behaviour of its component members is an over-riding consideration. The behaviour of the small group will reflect basically two patterns :

1. Behaviour of individual group-members
2. Behaviour of the entire group.

In these two aspects of behavioural interaction—individual and group—the conditioning of the following forces is quite important :

1. Cultural profile of members
2. Environment in which the group is functioning
3. Constraint, challenge, or responsibility of group.

These three forces are important in shaping the behavioural patterns of both the individuals and the small group. Of course, it is obvious that due to conflict, the patterns will definitely undergo changes—both temporary and permanent.

The harmony in a small group can be shattered by the following variables :

1. Sudden conflict
2. Death or illness of a member
3. External catastrophe
4. Change in structure and composition of group
5. Change in the mandate given to the group
6. Change in rules, regulations and conventions
7. Overwhelming personality expression by the leader
8. Personal objectives superseding group objectives
9. Environmental disturbances
10. Psychological areas of communication breakdown.

The author believes that some minimal degree of conflict is required for optimal small group effectiveness. If the group is permitted to develop lethargy, complacency, and wasteful ignorance, the group will lose its cohesiveness, unity, and sense of action-oriented participation in the social or external-environmental complex of which the small group is a major part. Conflict should not, however, be allowed to assume severe proportions as this would, in the final analysis, tend to again tamper with group effectiveness. This conflict in small groups should be subtle, strategic, and in tune with the cultural profile and background of individual members of the group.

Conclusion

In conclusion, the theory presented above is the personal view of the author based on the observations of and research on a number of small groups in action. Many variables and

classification schemes suggested above would, in essence, develop a total perspective on small group interaction and resultant behaviour.

III—CASE STUDY OF SMALL GROUP BEHAVIOUR

Case Details

A large metropolitan university in Los Angeles, California, follows democratic procedures in matters pertaining to departmental organisation, educational standards, appointments, promotions, tenure grants, and the awards for sabbaticals. The University desires that each department should elect a committee of four to six persons—depending upon the size of the department—which is to be designated as **FACULTY PERSONNEL COMMITTEE**. The chairman of the department serves also as the ex-officio chairman of this committee. The committee serves for a period of two years paralleling the duration of the chairman's tenure. The committee members are elected from the entire departmental body. The decisions of this committee are final as far as the above listed duties are concerned. In the event of a tie, the matter is left to the Dean for final decision. The committee also recommends salary schedules to the chairman but the recommendations on salary are not binding. On the whole, the committee is quite powerful.

On September 1, 1969 the Department of Cybernetics elected the following six members to the committee:

1. Dr Robert Metz, Professor
2. Dr Charles Deegan, Professor
3. Dr Walter Frank, Associate Professor
4. Dr John Smith, Assistant Professor
5. Mr Abi Bin Ali, Instructor
6. Dr George Theetham — **CHAIRMAN**

The committee had a varied ethical and cultural background. Dr Metz was a Protestant. Dr. Deegan was a Catholic. Dr Frank was a Jew. Dr Smith originally emigrated from England. Mr Ali was an Arabic scholar. Dr Theetham was the second generation of a prominent family of Italian scholars to establish

roots at the University. All of these people were scholars of repute. Their ages varied from 57 (Theetham) to 26 (Ali).

The committee was job-structured and its duration was for a fixed length of time (two years). The composition of this group was determined by open election. The relation among the members was professionally horizontal. The chairman served as the leader of the group. The business of the group was to be conducted by formal meetings. However, on some occasions, the business of the group was transacted on the phone so that precious faculty time could be saved. The group had no open entry.

On November 1, 1969, Dr Decarlo José applied to this committee for promotion from the rank of Assistant Professor to Associate Professor. He supported his request with the submission of two articles and two years of full-time teaching. Dr José had received his Ph.D. from the University of Spain in 1969. His age was 45. Dr José had more enemies on campus than friends because of his professional pride, arrogance, and overall, hostility towards establishment. He also was not quite social. The faculty club was often outraged at his crude behaviour and lack of graciousness. No faculty member had even been invited to his home. He lived about ten miles from campus. The details of his personal life were unknown.

His application was discussed at the November 17th meeting of the committee. The relevant details of the meeting are as follows :

Dr Metz was opposed to the promotion of Dr José because of the latter's hostility toward the entire group and the University.

Dr Deegan pointed out that Dr José lacked time-perception and tolerance. However, he favored the promotion on the grounds of Dr. José's reputation.

Dr Frank considered the matter a fiasco. According to him, José was not on the faculty long enough to deserve any consideration. Matters of personal and professional competence were not relevant.

Dr Smith supported José on all counts and made a dissection of the character of other members of the group in total support of José's claim to promotion.

Mr Ali introduced the cultural dimension in the group's deliberations. He discussed it at length but reserved his decision.

The Chairman remained silent. The meeting had been a heated discussion—sometimes on matters not relevant or even pertinent to the main question. The members deliberated on personal issues, faculty welfare, educational standards, and each other's writings. The atmosphere was mixed. Sometimes, there was geniality and an aura of overall cordiality. At times, it appeared that physical conflict might erupt. The moods of the group members ranged from passionate support to outright bitterness and hostility. It all made sense to the members of the group. The November 17th meeting started sharply at 10:00 AM and adjourned at 1:00 PM. A few moments before the adjournment, Mr Ali proposed to the table the motion regarding Dr José's promotion and invited him for a personal representation and appearance before the group. Due to the proximity of the luncheon hour and the time already spent in fruitless deliberations, the group seemed to unanimously favour the motion. The meeting adjourned until December 15.

Case Analysis

This group meeting was a good commentary on various aspects of small group behaviour, functioning, and overall group structure. This section analyses group behaviour as illustrated in the foregoing case description.

The Faculty Personnel Group was composed of people having professional ties and horizontal job relationships. There was ample interaction at both personal and job levels. The fact that the group reflected a non-profit institutional setting did influence the behaviour patterns and operations of the members. The group was committed to a specific purpose, had a definite time-span, was not self-perpetuating, or permanent in nature. Its members were not openly elected but were elected from within another

bigger group. Hence there was interaction of a group-to-group nature as well.

Group behavior is never limited to group functions and group acceptances alone. Everyone brings to the group the prejudices, beliefs, and attitudes which he has developed in an individual capacity—even before becoming a member of that particular group. (One striking exception would be the *Jury Group*—but then it is governed by equally different sets of rules, regulations, and laws). This was reflected in the views of the five faculty members on this committee. Each member expressed his views and prejudices in connection with the applicant and in almost all instances, these expressed views and prejudices reflected a prior association.

There were communications problems in the group's functioning at this meeting. Not that there was not enough communication but it appears that there was too much. Most groups have this communicational imbalance. In an institutional setting, this might become quite significant as the members are not afraid to be vocal because of the security of their tenured positions and permanent jobs. Furthermore, the articulate group members might exceed the limited objective of the meeting. This indeed happened at this meeting. Rather than limit the entire discussion to the application of Dr José, much extraneous matter and discussion was brought into the meeting. It cannot, however, be said with any degree of authority whether or not the exclusion of this extraneous material would have contributed to the smoother working of the group.

Leadership exercised by the Chairman was minimal. He only participated briefly and left the deliberations to the other members of the group. In "Group Dynamics," the practice of not allowing the leader to lead too much, is generally adhered to in order to fully optimise the communication and cross-fertilisation of ideas without the least bit of pressure. This factor has its own advantages as well as disadvantages. In this particular instance, the Chairman of the department who also served as the head of this FACULTY PERSONNEL COMMITTEE remained aloof. Generally, in academic institutions, the Chairman is not endo-

wed with powers commensurate with those enjoyed by departmental heads of private and public firms. The negation of the profit incentive, results consciousness, and overall control also played important roles in such academic group situations.

The nature of this group cannot be termed as truly homogeneous. Its members are drawn from different ranks in the department, their ethnic origins are different, and their fields of specialisation are also varied. The only fact that integrates the group is the fact that they are all academicians and owe allegiance to one particular departmental unit of the school. However, with the exception of Mr Ali, the other members are of Western origin. The applicant, Dr José, is Spanish. (This curious cultural polyglot of the group also marks a significant point in determining the group's behaviour).

The group has a limited degree of motivation. However, academic institutions are noted for extreme hostility, temper and aggressive expression of views whenever the question of a colleague's promotion comes up. Similar instances are seldom to be observed in a business-oriented group. This approach should be understood in trying to analyse the group's interaction and behaviour as expressed in this particular meeting.

The nature of conflict evident in the functioning of this group is partly personal because of the prejudices of individual group members and partly professional emanating from considerations of jealousy, animosity, and regulatory issues. This conflict is inherent in any given group interaction. If everyone agrees in a given group, it cannot yield an effective decision. Conflict to a certain degree brings out the best in everyone. If conflict were not forthcoming, the group would eventually assume a limited, lethargic, and purposeless position.

Conclusion

In the final analysis, it can be said that this hypothetical case study of a group-interaction process observed in an educational institution represents a variety of positions, issues, and considerations of group behaviour developed in

the earlier sections of this paper. It is not a unique situation but a common occurrence. It represents whatever is best or worse in a group. It shows the advantages and disadvantages of group decisions. In the process of its functioning, the case projects meaningful insight into organizational understanding and dynamics. □

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Role of Incentives in Productivity and Profitability

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In India we are currently witnessing a new environment—an environment of change—a change which has been brought about by a conscious awakening in the masses who look for a fair deal not only for themselves but for their children as well. A great social obligation therefore rests on industries. Fulfilment of this requires a complete transformation in the outlook both on the part of industry and labour. Every problem has, therefore, to be viewed not merely from the point of technical implications or profitability, or wages but more from the standpoint of social good. The subject of incentives in relation to Productivity and Profitability has therefore to be viewed in this wider perspective. In order to have a pragmatic look on the role which incentives play in increasing productivity, it may be worthwhile to determine the scope and application of Productivity and efficiency in relation to Incentives.

PRODUCTIVITY in a general connotation is referred as input-output ratio though in essence it is the process of harnessing the capacity to increase production by ensuring proper and efficient use of all types of resources in employment using them to produce as many goods and services as possible, of the kind and quality most wanted by the consumers, at lower costs. In this context productivity is not merely volume of output, nor a factor of production like land, labour, capital, etc. It is not even a technological or technical contrivance employed in industry. It is basically an instrument which transforms a lagging world of production into a kicking entity. In a more summarised manner **P-R-O-D-U-C-T-I-V-I-T-Y** may be defined as **Planned, Rationalistic, Organisation and Distribution of Constructive and Technical Ingredients-Viable for Intensive Technological Yoke.**

Efficiency

The term “efficiency” in the realm of physical and mechanical sciences refers to the proportion of the “energy input” which is recovered in useful work. Accordingly, a similar ratio of output-input becomes essential if the term “efficiency” is to be applied to human organism as well. In giving it a meaningful interpretation, the term “efficiency” may be referred as “efficient performance” and more accurately as “economical performance”. In doing so, we have not merely to consider the factor of minimum “energy consumption”, as we do when measuring mechanical efficiency, but also give due account to the overall cost of work. To explain this aspect in a concrete measure let me take an example. The buyer of a motor car today is interested not only in its fuel consumption (mechanical efficiency of the engine) but in the cost per mile of operation, including initial expenses, depreciation and repairs along with the fuel. It is in this context that for practical, psychological problems it may not be enough to know the mechanical

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Incentives are measures which stimulate human exertion.

efficiency of the individual alone in a given task. Other elements of cost become much more important through the interpretation of economical operations. However, let me make it very clear that a simplification of this point does not mean that the term "efficiency" has less relevance in its exact 'physical' meaning, viz. ratio between output and input. What is, therefore, to be appreciated is the broader concept of "input" beyond the 'energy' immediately consumed since other elements of cost ultimately involve energy even though it may not be possible to express them all in terms of energy.

Incentives

Incentives are measures which stimulate human exertion. In this context they are as old as the history of mankind, since this process has been a fundamental aspect of human activity. Yet, unlike machines the human beings do not have buttons which could be pressed to accelerate their activity. They are only motivated by a complex of stimulants—economic, social and psychological. For this reason it may be difficult to identify one single stimulant which may be most effective, even though, looking to the present low level of living one might be prompted to suggest that the economic stimulants will be most effective.

Incentives and Efficiency

While an incentive affects the quantitative basis of what an individual does, it may not necessarily raise efficiency at the same time that it raises productivity. In most physical or muscular tasks, it is found that the energy consumption per unit of work is least for a moderate pace

—a brisk walk rather than a run. If the effect of an incentive is to increase the pace of the work beyond this optimal level it may decrease the overall efficiency of the performance. In the long run it may even cause adverse effects. As such, recognising the fact that every task has its optimal level of effort, the problem of motivation cannot hinge merely around those incentives which will raise output. It only represents a part of the activity. In fact what we have to aim at is to find out those incentives which will raise production without unduly decreasing efficiency. For example, fear of severe punishment might raise the level of output but at the same time this fear would waste so much effort that it may not be possible to maintain the output at the new level without serious consequences in the form of ill health, decline of production and so on.

In viewing the problem of incentive in relation to Productivity what is most important to my mind is a prior consideration of the optimum rate of performance which is to be maintained. The application of incentive, therefore, should not merely aim at increasing the rate of production but rather at maintaining the rate of work at a level as near as possible to the optimum level.

Incentives and Productivity

The national commission on labour (vide its recommendation No. 110) emphatically stated that the central aim of all incentive schemes is to raise productivity at the enterprise level. They opined that in this matter the responsibility of employers is primary for it is they who have to seek the necessary response from workers. Since productivity improvements ultimately bring about a benefit to the community, Government as the custodian of the interests of the community will have to share in promoting productivity and, in this process, building up incentives which would help such promotion. The Study Group on Productivity and Incentives which examined this point in details suggested the following:

- (i) The Government must pursue policies which will contribute to the growth of a social, political and economic climate

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in the country conducive to the rapid and continuing growth of production and equitable distribution of the same.

(ii) The objective of increasing productivity must be raised to the level of a high national purpose and the regulation of industrial relations as well as policies in other related fields should be oriented towards this objective. Especially, it must be ensured that the workers get their due share in the benefits of rising productivity and their status in the social and political set-up in the country is paid due attention.

(iii) The Government must take purposeful steps to improve the nutritional standards and living conditions of workers so as to raise their productivity.

(iv) The industrial relations legislation and administration in the country should be so conceived as to promote sound collective bargaining even at the risk of some possible industrial conflicts.

(v) Specialised bodies working in the field of productivity like the National Productivity Council and the Local Productivity Councils, the training institutes in productivity, etc., should be provided the means to extend their activities at the shop floor level.

(vi) Research in all aspects of productivity needs to be promoted and encouraged on the widest possible scale so that approaches and methods best suited to Indian conditions can be developed and made available to industry. The public sector should play a particularly active role in this respect.

(vii) The Government should provide specialised, technically competent, independent and impartial agencies to assist employers and trade unions in handling productivity problems and resolving disputes arising therefrom. X

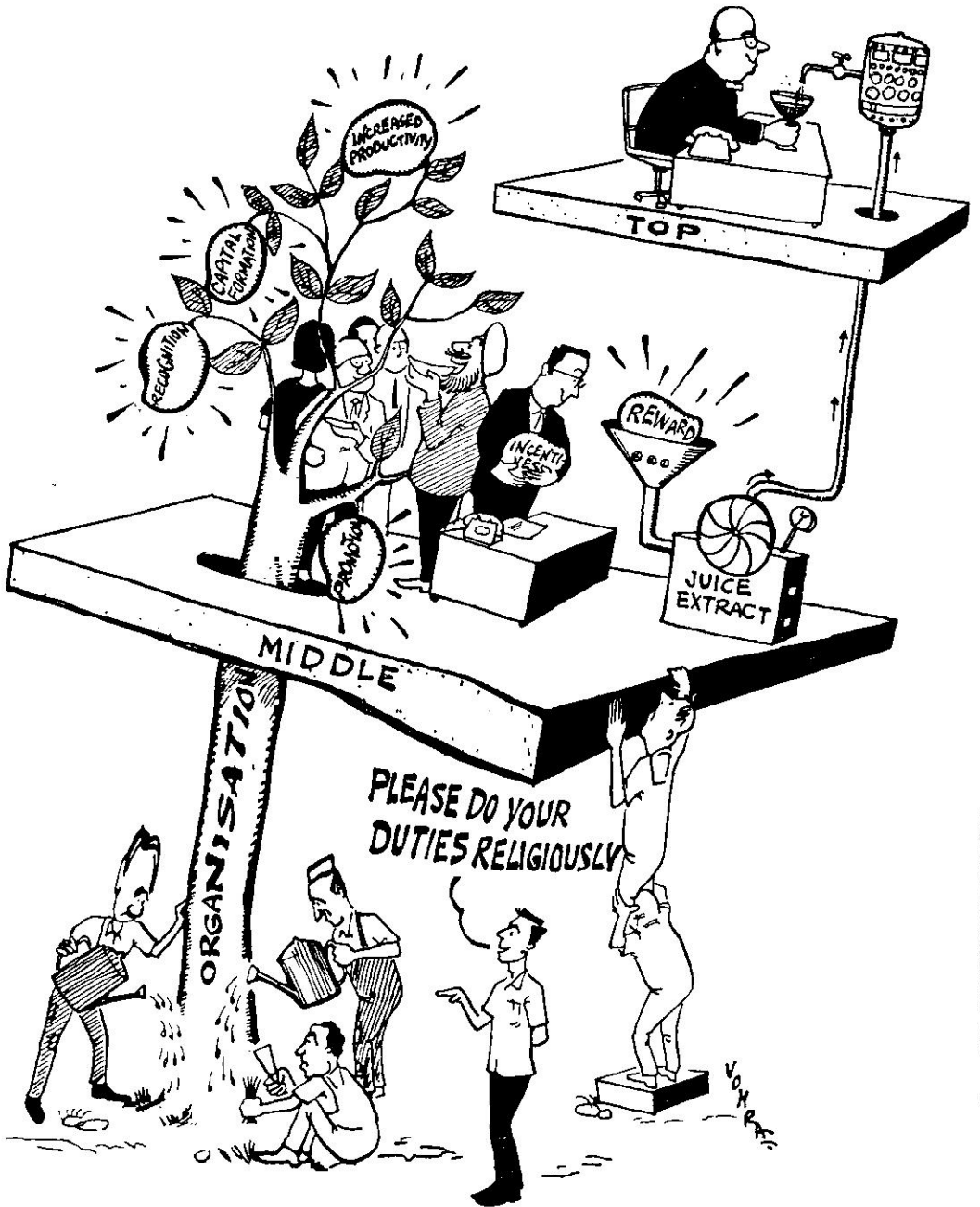
It must be ensured that the workers get their due share in the benefits of rising productivity.

NPC and Incentives

Recognising that a well-designed and properly-installed incentive scheme offers a number of advantages both for industry and labour as it contributes substantially towards increasing productivity; brings about an improvement in the purchasing power and also fulfils the demand for exports, NPC sponsored a Productivity Team on Incentives which visited West Germany, United States and Japan in 1960 and made certain significant recommendations. These were taken up by the NPC as well as LPCs and various professional institutions for application at the enterprise level. Recently, NPC further undertook a survey of Incentives Schemes operating in the States of Andhra Pradesh, Kerala, Mysore and Tamil Nadu. The study included 51 incentive schemes already in operation and their study goes to prove that they have generated among the industries a practical interest in the improvement of efficiency and have also prompted them to take all possible measures to increase industrial output, improve quality and reduce cost through improved organisation and management which is the ultimate goal of productivity.

Another significant revelation that has come to the fore is that there is in evidence a growing awareness on the part of the workers to consider incentive schemes, provided they are satisfied that there would be no possibility of a cut in the rates settled. This apprehension has its own basis because the problem in India is quite different from that obtaining in developed countries inasmuch as the efficiency in c

ROLE OF INCENTIVES



Incentives for increasing productivity and efficiency should extend to all those who work for it and should not be confined to certain levels only.

traditional industries continues to be below normal and, therefore, the first problem is to raise it to 100% normal efficiency.

Incentive Systems—Some Classification

Since the inception of incentive systems, several schemes have been evolved to suit the socio-economic conditions prevailing in several countries. The essential aim of these schemes has been to encourage workers to increase productivity by establishing a direct relationship between output and earnings. They provide standards of performance for various jobs, and savings which result from production over the standards are shared between the employers and workers on a predetermined basis. All of them seek to reward performance.

According to ILO in its report on "Payment by Results" the system of incentives has been classified into four groups according to whether workers earnings vary.

- (1) in the same proportion as output
- (2) proportionately less than output
- (3) proportionately more than output; or
- (4) in proportions which differ at different levels of output.

This classification has been improved by R. Marriot, who undertook a study of research and opinion on incentive payment systems at the instance of Medical Research Council, U.K. and he has attempted to add two more classifications.

I. When long-term 'targets' are explicitly used or are implicit and some form of bonus is paid at intervals ranging from one month to a year, when the target is reached. This basis has been reclassified in two groups.

- (a) Incentive based on a standard derived from past performance in such tangible terms as weight of the product or raw

material or the ratio of wages or labour costs to sales; and

- (b) Profit sharing or co-partnership scheme.

II. When they are not directly related to the amount produced, but have a decisive effect on products in the short or long run which includes:—

- (a) those based on personal assessment of the worker e.g. merit rating, attendance, length of service bonus, and
- (b) those which are supplementary to production, quality bonuses, waste reduction bonuses, etc.

For a broader classification of R. Marriot's findings, incentive schemes could be placed into the following group.

A. *Weekly wage incentives system* (individual or groups)

- (1) In the same proportion as output (straight piece work and standard hour system)
- (2) Proportionately less than output (Hasley, Rowan Barth and Vedaux systems)
- (3) Proportionately more than output (high piece rate and high standard hours system)
- (4) In proportion which differ at different levels of output. (Taylor, Merick, Gantt, Emerson and Accelerating Premium Systems).

B. *Long-Term Collective System*

1. Those based on standard production, cost or sales (Priestma, Russon, Scalon System)

2. Those based on profits (Profit sharing Co-partnership).

C. Systems Not Directly Dependent on Production

1. Those based on personal assessment (Merit-rating attendance—bonuses, length of service bonus)
2. Those supplementary to production (Quality bonuses, waste reduction bonuses).

Payment by Results

The system which has been most in vogue is often used as a synonym for incentives. It has its basis in the earnings of individual workers or groups in relation to their output, provided that it can be measured, by means of individual or group system of payment by results. This system has been advocated by the ILO. A tripartite meeting of experts convened by the ILO further expressed its views as follows:

1. That there is in evidence from a number of industries and countries that payment by results is often associated with relatively high productivity. In cases where payment by results and high productivity are found together it cannot be assumed that high productivity is necessarily a result of incentive wage plan. Further it may be, that both are results of one or more factors, e.g., more efficient and alert management, better labour management relations or better organisation or work.
2. Systems of payment by results are, however, not likely to yield advantage unless certain conditions are fulfilled. The most important of these conditions is that before the introduction of such a system every thing possible should be done to improve and standardise methods of production; secondly, that the system should be fair; thirdly, that it should be reasonably simple; and fourthly, that good relations should prevail between the management and

workers concerned and that the workers involved should have confidence in this scheme.

3. The fairness of any system of payment by results should depend largely upon the accuracy with which it is possible to measure the work content of a job. Where this cannot be done accurately so that piece rates or bonus have to be fixed in an arbitrary manner there is a great danger that the results will be seriously inequitable as between different categories of workers.
4. The system of payment by results should be simple enough to enable the worker to calculate without difficulty what is due to him. It is on this ground that it is sometimes advocated that where payment by results is to be applied there can be a quicker and direct process payment which can be related to output.
5. A reasonable degree of fairness and simplicity is necessary if workers are to have confidence in a system of payment by results.

Essential Safeguards

The following could be considered among the safeguards which seem to be essential to ensure effective functioning of any scheme of payment by results.

1. That there should be a trial period, during which any necessary changes may be agreed upon between management and the workers' representatives before a system is finally applied.
2. That a rate modification should only occur for agreed reasons such as changes in job content, equipment or methods or organisation, the correction of radical errors.
3. That workers should be guaranteed a minimum earning for any period in which output is affected by causes beyond their control.

4. That safety and health of workers should be adequately protected.
5. That quality should be safeguarded.

When any incentive scheme is not well designed and does not meet the objective of increased output, lower cost of production and higher earnings for workers they are a clear pointer to the following:

1. The quality of product may deteriorate unless proper measures are instituted.
2. Introduction of improved methods, better tools and machines etc. may become difficult.
3. Workers may resist such changes for fear that a resetting of their jobs may result in lower earnings.
4. Clerical work may increase due to calculations involved in computing incentive earnings.
5. Workers may overlook safety precautions and may over work for the sake of earning incentive which may affect their health.
6. Standards may have to be properly fixed. Both too tight and too low rates will result in difficulties.
7. If there are wide fluctuations in production, introduction of incentive becomes a difficult task.

Pre-requisites for Incentives

Incentives should not be used to compensate workers against low wages, or towards a rise in economic wage levels. The rate structure should be kept separate from incentives. Incentives will be fair and reasonable only when the industry has established an equitable wage structure based on a systematic job evaluation. Job evaluation should, therefore, precede the introduction of any incentive plan.

Trade Unions and Incentives

Any wage incentive plan will be successful only if it has the acceptance of the workers and their unions. Good labour relations are a pre-requisite to successful operation of an incentive

plan. Workers are likely to resist anything which they do not know or do not understand. It is advisable to take the workers into confidence and explain fully all the benefits and implications of the scheme. In particular they will have to be satisfied about the following apprehensions:

- (i) Working continuously at a high pace is injurious to the health of the worker.
- (ii) Incentives may result ultimately in a reduction of total labour strength.

To overcome these apprehensions incentives based on standards fixed by work measurement techniques, are fair and appropriate since all the factors affecting the job are taken into consideration. Adequate minimum wage will have to be guaranteed. It may also be necessary to give a guarantee that surplus labour if any would be absorbed on other jobs to allay the fear of unemployment. In any case, most of the difficulties can be overcome by providing for the participation of union representatives in the introduction of the incentive scheme. This participation may be in timing of the job, in fixing standards or in setting rates.

Environment: Its Importance

In considering the problem of incentives, the first pre-requisite, therefore, is the atmosphere prevailing in an enterprise. Any scheme imposed on unwilling workers or in an atmosphere of mistrust is destined to fail. Incentives, therefore, cannot be treated as a substitute for good management and an establishment which is suffering from strained labour-management relation must first strive to improve the relations before thinking of applying any scheme of incentive. The British Institute of Management while expressing similar views observed as follows:

“The task of installing a successful incentive scheme is one of the most difficult and complex of management jobs and should be approached with great care and fore-thought. Unless mutual confidence and good relations exist between Management and workers in a concern the chance of full success for a new wage incentive system is very poor. Good relations, if they are absent,

Raising productivity has to be reckoned as a national problem and the level of productivity has to be attained throughout the industrial system.

cannot be created overnight but their establishment must precede the introduction of a new incentive scheme. The introduction of a wage incentive scheme will take time. This fact must be faced and sufficient time allowed to complete the installation with care. A rushed job is bound to lead to later troubles."

Attitude to Work

In all our efforts to increase productivity the most impeding factor is the problem of attitudes. Why is that so? The reason is simple because very few people have the opportunity to work at jobs which completely satisfy them. They could be classed as a fortunate minority and belong to professions of artists, scientists, technologists and sometimes to industrialists and managers and might continue to work even if the material rewards are quite small, because the work provides for the expression of their personalities. Contrary to this the average man working at routine job has to work because it is essential for him in order to support himself and his family. The attitude that he brings to his work largely depends on the attitude of the society in which he lives. If the general attitude is that hard and conscientious work is admirable, then he will tend to work steadily and carefully. If on the other hand, the ideal is represented by an individual who is able to support himself without systematic work, then he will tend to do as little as possible and he may even be slipshod over details and will always be seeking opportunities through short cuts to avoid hard and systematic work. Attitudes to work are, therefore, of major importance to any enterprise since they do bring about a substantial difference to costs of staffing and certainly make a difference in the quality of the products or services.

Economic Motivation

Motivation is created and maintained by a changing cycle of hope and achievement. When the achievement is of economic interest, the motivation is called "economic motivation". Under this group of influences human exertion is stimulated through the hope of economic security and economic improvement. Economic security is a negative influence as it involves a fear of losing something. Fear gives rise to many social and psychological influences which may be shortlived. Economic improvement on the other hand is a positive influence and is more enduring.

Economic motivation is always more intensive, pointed and within effective control when it is related to individual human capabilities and contributions. The underlying principle of economic motivation is, therefore, 'reward' and 'compensation' to individuals or groups of individuals in proportion to their contribution.

Profitability

The aspect of profitability in relation to Productivity and Incentives has also to be viewed in a larger perspective. Profit today is not the sole objective. In fact, in the present economic structure, it is one thing which cannot be pursued whole-heartedly or without limitations. Any statement of profits in the objectives of an enterprise is either conspicuous or it is stated as a corollary to the fulfilment of several other objectives, which are in the nature of manufacture and supply of products, which it is set up to produce; to make adequate quantities of that product available to consumers at stated levels of quality, and at reasonable levels of prices. In the Public Sector, the objective is primarily oriented towards meeting the national and social needs, in the nature of providing service and laying the infra-structure.

Profits, therefore, are of a secondary consideration. And yet, we have to be clear in our minds that whether it is private or public sector, productive operation through economical performance is of greatest importance and if these

have to be accomplished, profitability must become the index of performance. Making profits, is therefore, something in the national interest (unless profits are used for personal and sectional gains) because they will generate capital formation which will bring about greater investment and expand employment opportunities and ultimately reduce inequalities. Incentives thus have a positive contribution in augmenting the profitability for improving the very structure of the industry.

Some Recommendations

Recognising the importance of giving a fillip to Incentive Schemes in every sphere of economy, a few steps will have to be taken at the National plane. This could be as follows:

1. Organising Seminars and Symposia at the National and Regional levels for generating an awareness on the part of Industry and Labour for incorporating Incentives in the larger context of the economic development and benefits to industry, labour and the community.
2. In centres like Bombay, Calcutta, Madras, Ahmedabad, Bangalore and Kanpur where, as a result of concentration of industries, potentiality already exists for adopting Incentive Schemes special technical institutions should be set up to educate workers in background studies, Methods Study, Work-Measurement, Job-Evaluation etc. In West Germany such institutions are run by Labour organizations, but in our country industry and government will have to promote such facilities. In the long run this will be to their advantage.
3. A tripartite body representing Industry, Labour and Government as well as expert bodies should be set up on the same lines as REFA in West Germany. Such organization will be able to dispel doubts in the minds of workers and at the same time safeguard their interests.
4. Effort should be made at the enterprise level for promoting harmonious relations and persuading them to develop a scientific outlook on wage Incentive problems.
5. Establishments which at present have wage Incentive plans for direct workers only, will have to bring indirect workers also into suitable Schemes of Incentives either by linking their incentive earnings with those of direct production workers in some proportion, or in some other suitable manner. In any case it may not be a healthy proposition in the long run to have some workers on Incentives, leaving a large number without incentives.

Conclusion

In the context of our commitment to bring about a rapid industrialisation with a programme of increasing levels of output and productivity for raising the standard of living, there is a great scope for the application of incentive systems. This will not only make useful contribution in tiding over the shortage of foreign exchange which has placed serious limitations on our ability to secure plant and equipment from abroad on scales considered desirable for our rapid development but will also ensure optimum use of plant and capacity already installed which is of paramount importance. A minimum of 20% increase is certainly possible not only in the older industries but also in the newer ones, many of them being key industries.

Raising productivity has, therefore, to be reckoned as a national problem and the level of productivity has to be attained throughout the industrial system. An atmosphere of efficiency has to be created so as to give a certain tone to all our activities. The special point to be emphasized in this connection is motivation. This idea should be present in all our thoughts. We should not only concern ourselves with maximum output or profits or wages but the importance of workers in the whole scheme if we really aim at achieving something substantial in the long run. □

Human Resources Management

An Experiment in Reorganising a Company

R Ratnam*

This is a case study of a private city transport company, which ran into difficulties to the point of facing closure. It brings forth how human relations approach finally led the company to bring about normalcy in its operations.

THIS experiment relates to a private limited company operating a city transport bus fleet and employing about 200 people. The company was established 35 years ago. Its career has been somewhat chequered. During the war years it had run into difficulties. The operations during the post-war years were generally profitable. In the past few years it had been losing heavily, debts had been piling up and the company was facing the threat of closure and the employees faced the threat of losing their jobs.

This was a family-owned company. The directors, due to other pre-occupations, were not able to devote proper attention to the management of the company. It was allowed to run itself and the company had been drifting along to a crisis. There was not much of coordination. There were three unions, constant inter-union rivalry and gross indiscipline. There was considerable amount of thieving in the traffic side. In the workshop, proper work was not being turned out; the workshop employees would sleep during night shift. No proper attention was being given to the maintenance of buses, resulting in frequent breakdowns. Using this as an excuse, the drivers used to bring

the buses back to the shed on the slightest pretext and spend their time playing cards and gambling.

Attempts to sell the company failed and hence a new management was called in to make the best out of the company. The situation was studied. Most of the employees had put in years of service; some had been working for the company for one or two generations. Since they were allowed to drift and since no proper control existed, they had acquired bad habits. Unions had been formed and had gathered strength due to their frustrations, since many of even their minor demands were not met.

Looking about for a philosophy and a policy to be adopted, the new management took to the Human Resources Management philosophy. 95% to 99% of the people are generally good and if there is not proper leadership, the minority leads them into bad ways. So, the management decided to give them proper leadership, 'repair' the human beings wherever possible and effectively avail of their services. It decided to treat the human resources like any other asset, say machinery—if the machines go out of order, we repair them and use them but we do not throw them out immediately. So, the management decided to make an attempt to treat

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Labour-Management Relations

everyone individually and correct their ways. With patience, it hoped to succeed, in its choice of retaining all the workers and giving them an opportunity to mend their ways during a trial period of a few months.

Mr A, representing the new management, met them in small groups of 4 or 5. He established friendly relations with them—asked them their names, where they were living, and got information about their families. They were addressed as ‘appa’ which literally means daddy but could be differentiated in English between using the word ‘you’ instead of ‘thou’ when addressing a second person. Each was asked whether the management should run the company or close it. All of them wanted it to be run. Mr A told them that if it was to be run, they would have to work honestly and sincerely and would have to plug the leakages from their collections (i.e. the conductor’s bag). They promised to work honestly and sincerely.

After 15 days the management arranged a meeting of all the workers at about midnight on a certain day. Both shifts could get together only about that time. Mr A addressed them as friends and posed them the problems that the company faced. The alternatives before the Company were :

- the company’s assets could be handed over to the creditors
- the company can be sold
- or we could run the company

He asked them what would happen to them in each case. To the first question they said all of them would lose their jobs, to the second that 50% of them would lose their jobs and hence they wanted us to run the company so that all the 200 families would be able to make a living. In that case, he told them that they would have to work honestly and sincerely and help the company improve its prospects. At the end of the meeting, Mr A said that he would wait outside. Each one of them was asked to touch his palm and affirm that he would work honestly and sincerely. This acted as a bond.

Mr A gave them a talk in which he said that they were all good and responsible people but due to circumstances have been led to bad ways. He affirmed the management’s faith in them and said: “We reap as we sow. Hence, we have to keep three principles in mind namely: Work Honestly, Earn Well, and Spend Wisely. From this day we would forget the past and go by what you do from that day onwards; none will be dismissed based on past records and performance. Our policy will be one of without

fear or favour." Finally, he ended up by saying: "We are interested in your improving yourselves, improving your families and then improving the company." They were also told that the bus passenger was their ultimate master and he had to be treated courteously; they were playing a key part in solving the transport problems of the public who depended on them to go to hospitals, offices, schools, etc. Theirs was an important and essential public utility service.

This meeting boosted their morale and from that day onwards they showed greater diligence in their work and the performance and earnings of the company improved. The management had posed only problems to them and they made the decisions. Hence, they willingly followed up their decisions with great emphasis on self-discipline.

During nights when maintenance work was being done, Mr A paid surprise visits at odd hours between 1 A.M. and 6 A.M. and whenever he found anyone sleeping, he woke him up. If there were older workers they were told that they should set better example and lead the younger ones along the right path. Younger workers were pointed out how such things would affect the fortunes of the company and their jobs and their prospects. No charge-sheets were issued but names of those who slept were written in chalk on a blackboard. Interpersonal quarrels were settled by making them shake hands and making one buy a cup of coffee for the other. Teamwork was thus ensured.

On the traffic side, the management carried out surprise checks to stop leakages. Great care was, however, taken not to injure their prestige in front of the passengers, by giving the impression that it was a normal check, and not one based on suspicion. Whenever any mistakes were found, it was taken up with the conductor in private and not in front of the public. They were not issued any charge-sheets but were persuaded to adopt better methods. Attempts were made to enforce discipline without punishment. After waiting for 6 months those who were found incorrigible were removed from service after the required enquiry.

When they came with personal problems, sincere attempts were made to help them. School admissions, hospital admissions, problems with police and courts were dealt with. Workers felt free to approach top management with their problems when they found that they could get a friendly and sympathetic hearing.

The Collector was invited to address them and unveil portraits of Mahatma Gandhi and distribute books and booklets on workshop maintenance. The collector was garlanded by one of the oldest workers (a sweeper) and a bouquet was presented to him on behalf of the management.

Two teams of senior Officers from a nearby large public sector organisation were invited to meet the workers in two batches and assess their attitude change and morale. The teams and workers were introduced to each other, and the management representatives left the meeting after telling the workers that they were free to say whatever they felt—bad or good about the new management.

These meetings made them feel that the eyes of important people were focussed on them and hence they wanted that their image should go up in their eyes and changed their behaviour. Their language also improved considerably and group pressures changed the recalcitrant few. Those who had threatened others when their mistakes were found, became leaders willingly taking up the responsibility of checking evil practices and leading the workers along the right path. Cinema shows were arranged and when they saw a London Transport driver observing traffic signs and giving proper signals, they also felt that they should follow the example of the London Bus Driver.

When three drivers were involved in minor accidents, their eyesight was found to be poor on a medical check-up. They were kept on the payroll for 3 months without giving them any serious work. At the end of 3 months, they along with their trade union leaders came to the management and said that they would like to retire. The fact that the company in

spite of financial difficulties kept them on their pay-rolls for 3 months established the abiding interest which the management had in the lives of the workers.

One worker, a cleaner.—was found to be regular in attendance when he was posted as a watchman but as a cleaner he would feign illness and take medical leave. Once when he was found sleeping and the supervisor woke him up, he complained that he had been beaten and came with a bandage near the eye and wanted action to be taken against the Supervisor. Consultation with the ESI doctor proved that the injury was a minor one. Probing his background it was found that all his family (his wife, his father, brother, brother's wife) were all white collar workers (teacher, station master, etc.) whereas as a failed SSLC he was working as a cleaner. He considered the watchman's job as a higher status one and was regular; the cleaner's job was of a lower status one and he was irregular. His father was called in and in his presence, he was shown the example of a fellow who had comparatively a lower education but who had risen to a high position as the owner of a workshop. The worker with higher education had greater chances of improving himself if he made greater efforts to learn and do the work well. His financial problems (paying Rs. 10/- monthly as interest on a loan of Rs. 100/- to a Pathan) were solved by giving an interest-free pay advance. From that day, he became a good worker. Such help to solve the personal problems of a few of others, boosted the image of the management in the eyes of the workers.

Much before Deepavali, bonus negotiations were started. A meeting of all workers was held. The company practice had been to give a minimum of one month bonus, that too after considerable agitations and strikes. The workers had asked for 2 months bonus though they did not expect even half a month bonus. When the management offered one month's bonus in spite

of financial difficulties, the worker representatives wanted it to be increased to signify the advent of a new management. After consultations, it was agreed to give ½-month additional bonus but the workers were told that they would have to earn the money themselves by improving collections. Actually, the collection went up significantly and they earned much more than that. The company in its history had never paid bonus so smoothly.

The morale of the workers was very high. When somebody pointed to a notice "Engine overhauled, limit speed to 25 miles", the driver said they had to follow it strictly because the bus and the company were THEIRS. They had identified their fortunes with that of the company.

The workers had now found dignity. They had active participation in the decisions about the working of the company. They showed a remarkable change, shedding their bad habits of the past and worked with unity and with a great sense of mission and participation.

The company soon turned the corner, broke even during the rest of the eight months of the financial year and made a profit during the next year. It is running now successfully at a profit with many new buses added to its fleet. The workers have since merged their Unions to form a single Union.

This experiment by its success proves that human material can be shaped successfully by proper management. The same workers had converted a losing concern into a profitable one and boosted up the image of the company as also their own in the eyes of the public. More often, the difference between success and failure is the difference between good and bad management. To quote Napoleon: "There are no good or bad soldiers; there are only good or bad officers." Perhaps this can also refer to workers and management. □

Variable Loads and Manpower Planning

GD Sardana*

There is hardly any industry which does not face variable loads some time or the other. Such variable loads may be both random, as well as regular. It throws to the planners and managers the problem of optimum and economic manpower planning to meet such variable loads. In this article, the author attempts to analyse the problem of economic manpower planning and suggests ways to achieve an optimum solution.

VARIABLE loads are not an uncommon feature in an industry. Some of these arise because of the inherent nature of the jobs such as servicing, maintenance or carrying out emergency work because of some public utility involved in it. Yet others can be witnessed in normal production function, where these arise because of peak loads to be met at certain intervals of time.

The occurrence of variable loads in both the cases can be random or regular. One is, therefore, often faced with the problem of optimum and economic man-power planning to cater to such variable loads. Obvious alternative solutions which can be resorted to, can be:

- (a) Recruit for a minimum load, so as to keep all the hands engaged and compensate for the extra loads through overtime as and when the needs arise.
- (b) Offload the extra load beyond certain level through sub-contracting.
- (c) Keep enough high man-power and let it remain idle in case of low loads. This may be necessary when adequate sub-

contracting facilities may not be available.

Yet, none of the above alternatives may yield the optimum economic man-power planning. In this article an attempt is made to analyse the problem of economic man-power planning and suggest ways to achieve an optimum solution. Two cases are discussed. *First*, when it is possible to complete the workload over and above estimated optimum workload level, through sub-contracting. *Second* case does not take into account facilities of sub-contracting and overtime. It interprets the case as a regular Markov Process.

First Case

The following assumptions are necessary:
1. Existence of effective system of measuring and recording the work content of the jobs to be performed.

2. Easy availability of facilities of sub-contracting the job and information on the costs of such sub-contracting. Let, the cost of performing job with the Company's own resources at the Company's Works, = Rs. A/Unit time, the cost of performing the same job through sub-contracting, = Rs. B/Unit time

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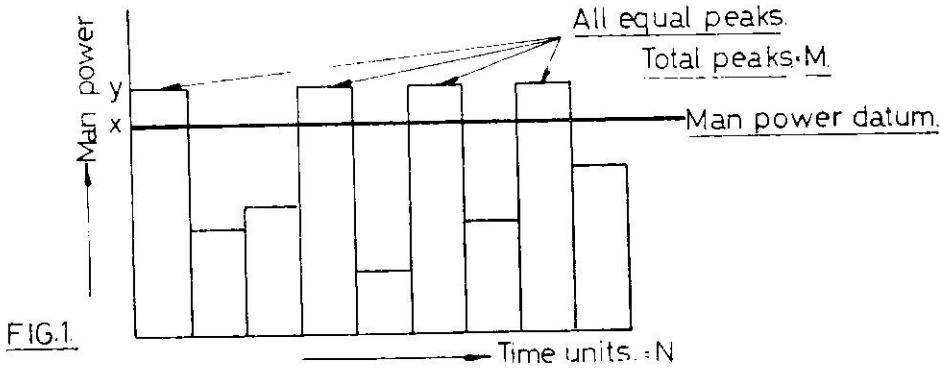


FIG.1.

Therefore, Ratio of IN-Making to sub-contracting

$$= \frac{A}{B} = R$$

Existing man-power

$$= X$$

Man-power required for peak loads

$$= Y$$

Total No. of time units, under analysis

$$= N$$

No. of peaks in N at level X

$$= M$$

Therefore, frequency of peaks

$$= \frac{M}{N} = S$$

Total cost of doing the job

$$= C$$

(a) *Sub-case I*

Assume all peak loads as equals (See Fig. 1) Therefore, Y is constant.

Total Cost $C = X \times N + XA + (Y - X) \times M \times B$.

In this expression, only X is variable.

To determine least costs we shall differentiate C with respect to X.

$$\frac{dc}{dx} = NA - MB$$

equating R. H. S. to zero,

$$NA = MB$$

$$\text{or } \frac{A}{B} = \frac{M}{N} \text{ i. e. } R = S$$

Or, in other words for the least costs, the economic man-power should be so chosen which creates S, the frequency of peaks, as equal to R, the ratio of IN—making to sub-contracting.

(b) *Sub-case II*

Consider now, that all peak loads are unequal (See Fig. 2)

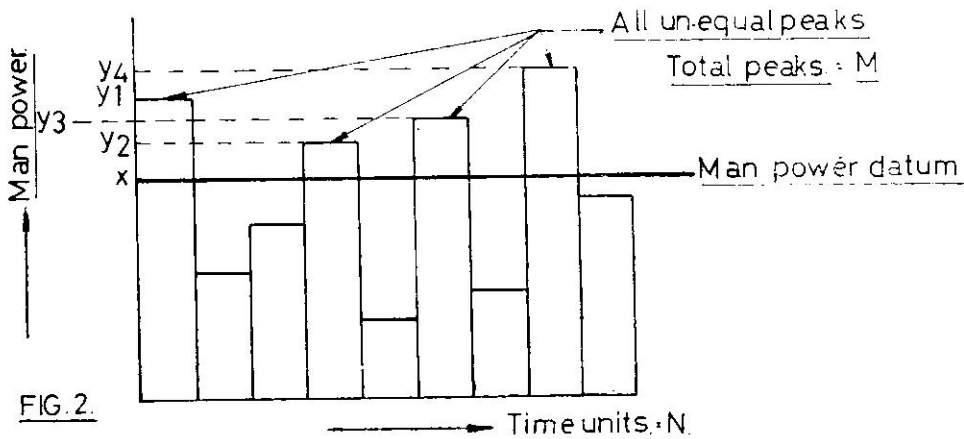


FIG.2.

Let, peak loads be denoted as

$$Y_1, Y_2, Y_3, \dots, Y_m$$

the total number of peaks (M) and hence the frequency of peaks $M/N=S$ remaining unchanged.

$$\therefore \text{total cost } C = X \times N \times A \dagger [(Y_1 - X) B \dagger (Y_2 - X) B \dagger (Y_3 - X) B \dagger \dots (Y_m - X) B]$$

$$C = X \times N \times A \dagger B (Y_1 + Y_2 + Y_3 + \dots + Y_m) - BM \times X$$

$$\frac{dc}{dx} = NA - BM$$

equating, $NA - BM = 0$; $\frac{A}{B} = \frac{M}{N}$ or $R = S$

which is the same as seen in sub-case I. Or, in other words the frequency and not the volume of variable loads determines the economic man-power planning.

The total work content, that is the sum of work content in thoughts and peaks remaining constant, it would be interesting to see how the varying ratio of A/B or R shall change X , economic man-power datum.

(i) If $R > S$

As the costs are minimum only when S equals R , our endeavour should be to increase S . This is possible when we move the datum X to a new position so as to create more peaks, till the new S equals R .

Creation of more peaks means bringing down existing level of X . or in other words when $R > S$, lesser man-power is required and more sub-contracting is needed.

(ii) If $R < S$

The situation is reverse here. The existing man-power datum shall have to be moved up so that less of peaks are created to decrease S in order to make it equal to R . That is, more man-power would be needed and less of jobs should be sub-contracted.

Steps in Manpower Planning

The exercise of determining economic man-power planning would, therefore, consist of the following steps:

1. Draw a chart (Ref. Fig. 2) of the work content spread over a period. Determination

and plotting of exact magnitudes of work content is not necessary. But the relation between the troughs and the peaks should be realistic.

2. Determine the ratio R i. e. ratio of IN making to sub-contracting.

3. Draw a datum line in such a way that the peaks and the troughs are divided to provide $S (=M/N)$ equal to R . The datum line so drawn determines the economic man-power requirement.

Second Case

Another way of determining the optimum economic man-power is to treat occurrence of variable loads as a sequence conforming to a Markov chain.* Markov chain presupposes that the result of a current sequence shall be dependant upon a preceding sequence. In other words, the occurrence of variable loads is a system which passes through different states at various intervals of times, the states being the varying amounts of workloads.

Consider a workshop consisting of a number of identical work-centers passing through discrete points of time designated as $t=0, 1, 2, \dots$ and claiming variable work loads X_1, X_2, \dots, X_n .

The probability of a work center being at a variable load X_i at point t is $P_i(t)$

The transition probability for the transition of state X_i at t to X_j at $(t+1)$ is P_{ij} (which is constant). Also, the sum of all probabilities extended over a space for all states is unity, or

$$\sum_i P_i(t) = 1, \text{ for } i=1, 2, \dots, n$$

And also the $\sum_{i=1}^{\infty} P_{ij} = 1$

According to Markov process, the probability of the state at time $(t+1)$ is given by $P(t+1) = TP(t)$ where $P(t)$ is vector of state probabilities at time t and T is Matrix of transition probabilities.

$P(0), P(1), P(2), \dots$ are state probabilities at time $t = 0, 1, 2, \dots$ so that, if we know $P(0)$

**Concepts in Management Science* : Donald J. Clough, Prentice Hall Inc.

and T, we can easily calculate P(1) P(2) etc. These values when plotted shall reach a stationary stage indicating an average of such variable loads which can be utilized to calculate the man-power requirement.

A Practical Example :

Consider a company having an installation of 300 machine tools. This Company has recently installed a preventive maintenance scheme. This scheme calls for:

- (a) Inspection of every machine tool every month in accordance with the check-lists with a view to determining whether a machine tool requires overhaul as a preventive maintenance measure.
- (b) Complete overhauling of a machine tool as determined under (a) above. The interval between two overhauls is not to exceed 6 months.

It is required to determine optimum economic man-power of the maintenance fitters. We will first find out the number of overhauls arising in a month.

The problem can be viewed this way. Suppose at time $t=0$, all the machines stand overhauled and we start with a clean slate. At the end of **first month**, all the machines will have been inspected with some of them say 'X' found to require overhaul.

At the end of second month, some of the remaining i.e. $300-X$ as well as some of X

will require overhaul; so on and so forth, so that at the end of sixth month, we shall have the rest of the machines (un-overhauled in the previous 5 months) and a part each of the machines overhauled at the end of first, second third, fourth and the fifth months, requiring overhauling.

The whole process can be considered equivalent to a discrete Markov Process. The different states of machines at different intervals can be enunciated as follows:

State (s)	Condition
0	Overhauled
1	End of first month
2	End of 2nd month
3	End of 3rd month
4	End of 4th month
5	End of 5th month

There will not be any 6th state, because at the end of 6th month, it would have been again overhauled, thus reaching state 0. We notify the state, in general as n , so that,

a machine makes a transition from n to $n+1$ when it goes to next month without overhaul, and makes a transition from n to 0 when it is overhauled.

Value of n varies from $n=0, 1, 2, 3,$

To simplify, assume that the probability of overhauling follows a known pattern as under:

Month K	Probability of overhaul at the end of month (K)	Conditional probability of overhaul at end of month K
1	0.10	0.1/ 1.00
2	0.12	0.15/ .90
3	0.18	0.18/ .78
4	0.25	0.25/0.60
5	0.20	0.20/0.35
6	0.15	0.15/0.15
	1.00	

(sum of probabilities should equal unity)

MANPOWER PLANNING

A table for Transition probabilities (T) is drawn as under :

Transition Probabilities (T)

		FROM STATE					
		0	1	2	3	4	5
To STATE	0	0.1000	0.1667	0.2308	0.4166	0.5714	1.0000
	1	0.9000	0	0	0	0	0
	2	0	0.8333	0	0	0	0
	3	0	0	0.7692	0	0	0
	4	0	0	0	0.5834	0	0
	5	0	0	0	0	0.4285	0

$$\text{Now } P(0) = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

(i. e., all the machines stand positively overhauled at state 0 ; as such probability is unity)

Probability vectors, therefore, at end of first, second months etc. i.e. t=1,2... are as follows:

$$P(1) = T.P(0)$$

$$P(2) = T.P(1)$$

$$P(t+1) = TP(t)$$

Calculating,

$$P(1) = \begin{bmatrix} 0.1 & 0.1667 & 0.2308 & 0.4166 & 0.5714 & 1.000 \\ 0.9 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.8333 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.7692 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.5834 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.4285 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 0.100 \\ 0.900 \\ 0.000 \\ 0.000 \\ 0.000 \\ 0.000 \end{bmatrix}$$

$$P(2) = \text{ditto} \begin{bmatrix} 0.100 \\ 0.900 \\ 0.000 \\ 0.000 \\ 0.000 \\ 0.000 \end{bmatrix} = \begin{bmatrix} 0.160 \\ 0.090 \\ 0.750 \\ 0.000 \\ 0.000 \\ 0.000 \end{bmatrix}$$

$$\begin{aligned} P(3) &= \text{---} \\ P(5) &= \text{---} \\ P(12) &= T.P(11) \end{aligned}$$

The results are tabulated as under:

P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
0.100	0.160	0.205	0.304	0.304	0.312	0.229	0.256	0.270	0.285	0.273	0.265
0.900	0.090	0.144	0.183	0.274	0.274	0.280	0.206	0.230	0.243	0.257	0.246
0.000	0.750	0.074	0.120	0.152	0.228	0.228	0.233	0.170	0.190	0.195	0.2145
0.000	0.000	0.577	0.057	0.092	0.117	0.174	0.175	0.178	0.133	0.152	0.151
0.000	0.000	0.000	0.336	0.034	0.054	0.067	0.102	0.110	0.102	0.078	0.089
0.000	0.000	0.000	0.000	0.144	0.015	0.023	0.028	0.042	0.047	0.044	0.035

The first elements in the vectors $P(t)(t=1,2)$ are the probabilities of the machine asking for an overhaul.

need of an overhaul are as in the Table on page 436:

As we have a total of 300 machines, the corresponding number of machines being in

If plotted graphically, it will be observed that overhaul shall even out at the rate of 80 numbers per month approximately. (See Fig. 3).

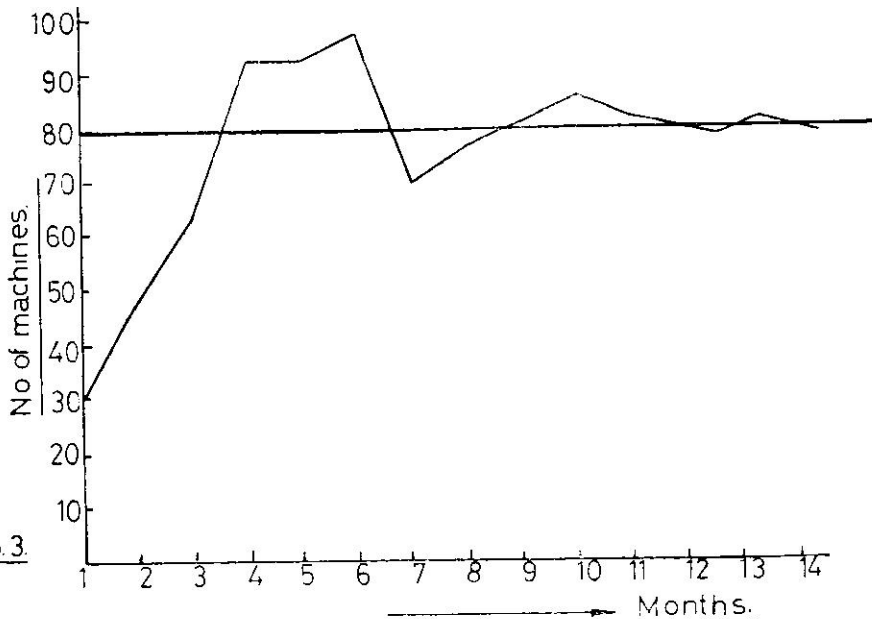


FIG. 3.

MANPOWER PLANNING

<i>Month</i>	<i>Probability</i>	<i>No. of machines in need of overhaul at the end of month</i>
1	0.100	
2	0.16	$0.100 \times 300 = 30$
3	0.205	$0.160 \times 300 = 48$
4	0.304	$0.205 \times 300 = 62$
5	0.304	$0.304 \times 300 = 91$
6	0.312	$0.304 \times 300 = 91$
7	0.229	$0.312 \times 300 = 94$
8	0.256	$0.229 \times 300 = 69$
9	0.270	$0.256 \times 300 = 76$
10	0.285	$0.270 \times 300 = 81$
11	0.273	$0.285 \times 300 = 86$
12	0.265	$0.273 \times 300 = 82$
		$0.265 \times 300 = 80$

We assume that an average overhaul requires 24 skilled and 24 unskilled man-hours (It is assumed that while doing an overhaul, a crew of one skilled and one unskilled fitter works on the job.)

Therefore, total man-hours (skilled, unskilled each) required for 80 overhauls shall be:

$$80 \times 24 = 1920 \text{ hrs.}$$

Further, assuming a 48-hour week and only

one shift in operation,

$$\text{Available hours of work/month/fitter} = 4 \times 48 = 192$$

Therefore optimum economic man-power would be

$1920/192 = 10$ skilled and unskilled each. This solution, as could have been seen, is entirely based upon the correctness of estimating the transition probabilities. In this particular case a regular Markov Chain has been assumed.

It is an era of great opportunities for raising decisively the level of productivity. But the opportunities will not be realised unless the re-equipment of our minds, to meet the problems and seize the opportunities of the new era, matches the scope and scale of the drive to re-equip our factories. We must see to it that when we junk the old machinery, outmoded concepts, prejudices and fears go with it and are not left lying around like scrap on the shopfloor to obstruct the progress of the new age.

—JAMES CRAWFORD

Programme for Reliability Creation in Management

Brig SS Apte*

With the growing complexities of modern weapon systems and industrial plant, the problem of reliability has become serious. Western countries have successfully tackled this problem, but the recognition of reliability as an engineering discipline has not yet come to this country. Sporadic attempts mostly by operations research workers, have been made to analyse small problems mathematically and these have been published from time to time in journals on Operations Research. Few of these seem to have had any practical application for want of a thorough understanding at various levels either of the problem or of the solution.

This paper discusses the present status of reliability engineering in India and the possible directions it ought to take. The need for an organised and integrated approach to reliability engineering with support and direction from the highest level is emphasised.

THE second half of the 20th century has brought about a proliferation of new products, exhibiting new characteristics (or old characteristics so radically more demanding, that solutions must be new); complex weapon and industrial systems; shorter developmental cycles; growth of sub-contracting; new and usually more severe environments; new levels of precision; miniaturization, and other advances in technology.

These changes have contributed to the increased extent to which human beings stake their lives, health, and convenience on man-made products. The changes have also affected remarkably the relation of purchase price to the cost of keeping the product in service during its life span. To cope with the increased occurrence of malfunctions or failures of the products in service, the new science of reliability engineering came into being.

Facts About Reliability

Reliability engineering is that technology concerned with prediction, control, measurement and continuous reduction of equipment failure rates. The reliability creation builds reliability in, and reliability control and assurance involves surveillance (use of authorised techniques and evaluation of results).

Reliability is not the same thing as quality: Two circuits with identical performance and quality of components can be different in reliability, i.e. the chance of continuing in service without malfunction for a given duration. Reliability is a design feature. It places more emphasis on the activities of the design area, and on operation in the field.

Reliability does not necessarily mean failure-free operation: Failure-free operation is important in one-shot devices like missiles and in-flight, non-repairable systems like aircraft. More than one failure or malfunction is accep-

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table in repairable systems like vehicles. Indeed this may be cheaper than "failure-free operation" because it enables use of standard quality components. High reliability is very expensive on component cost and R&D costs. Thus, there is a distinct and measurable cost trade-off between reliability, maintainability and operational availability.

Reliability is quantifiable: Since the occurrence of a failure cannot be predicted with certainty, the entire science of mathematical statistics can be called upon—indeed it is necessary—to solve reliability problems. It has almost evolved as a new branch of O.R. The mathematical theories have helped develop test plans, assessments and design synthesis. Once quantified, reliability becomes a design parameter just as any other (weight, tensile strength, etc).

Reliability is essentially an engineering discipline: The same quality and quantity of material may be used to make a tower or a pyramid but one is more stable to shocks than the other. So it is for the reliability of different designs, to achieve any given quality level. Its improvement requires a detailed study of failure modes and stress analysis.

Reliability improvement is a continued engineering process: It involves enormous amount of data collection (from operating equipment/components) and its analysis. The feedback of information goes from user, the repairer, the manufacturer (quality control), right up to the designer. These are under different organisations and, in any case, their immediate priorities being different, conflicts invariably arise. Unless there is a moving force to get over these, reliability improvement actions do not even begin.

Setting and Allocation of Overhaul Reliability Goals

In order that the designer sets about producing an adequate design, the user must specify his reliability requirements. Demanding 100% reliability only shows ignorance about reliability science. Merely specifying the requirement

as 'high reliability' can get no more reliability than can specifying 'high quality' get high quality. The duration of the period for failure-free operation for which a given level of reliability is required, must be specified, as also the environment in which the product is to operate. Unless this is done, the designer cannot even select his basic design.

Twenty-five years ago, this problem did not exist. There was very little choice of basic designs and, in any case, safety factors—and hence weight—were generous. The user got what was available. The situation today is quite different. There are myriads of materials, processes and designs to choose from and the choice seriously affects reliability, and the reliability levels required are themselves extremely demanding.

It is true that users do show preference for one manufacturer over other on account of the durability of his products (besides other factors) but there is no quantitative comparison available either to the user or, for that matter, even to the manufacturer and the designer. It is unlikely that the consumer (other than an organised consumer such as defence, railways, posts and telegraphs etc.) would be able to define the requirements in quantitative terms. Since the requirement of these departments are themselves large, varied and critical, they may well take the lead in this area. In respect of consumer goods such as electrical and other domestic appliances, the manufacturers themselves should evolve quantitative measures of reliability.

Reliability Apportionment and Reliability Prediction

The reliability of a system is dependent on reliability of its sub-systems. The interactions of sub-systems and component reliabilities are, however, quite complex. These can only be estimated mathematically. The incremental cost for reliability improvement is not the same for each component or sub-system. For the greatest pay-off, the system reliability can be suitably "budgeted" amongst the sub-systems,

components etc. This is known as *Reliability Apportionment*.

Reliability prediction is the process of estimating quantitatively the probability that a product will perform its mission without malfunction (or with not more than a specified number of malfunctions, in the case of repairable systems) for a specified period, in a given environment. Insurance Companies predict the chances of human mortality from data on specific individuals, genetic or community mortality rates, long-range trends, new perils, etc. and using actuarial analysis. In a similar manner, data on failure rates, environments, test results on components, combined with alternative product designs with the use of statistical techniques enables prediction of reliability. These techniques are highly mathematical. Besides reliability prediction, they indicate weak design area, which is useful to engineers for defect prevention.

Reliability apportionment and prediction lean heavily on mathematical techniques but they also involve association of R & D and important financial decisions.

Design Review

Design review is a mechanism for complete review of a proposed design to assure that the design can be fabricated at the lowest cost and yet perform successfully. Design review is not new but in the past it has been done rather informally with little pre-planning and follow up. A formal design review programme would usually be necessary for high reliability or complex products. The review team consists of the best available technical experts. The review includes not only of reliability but also producibility and maintainability and other pertinent parameters. It is generally made against design criteria and check-lists of good and bad practices. All potential problems uncovered by the design review are documented and responsibility is assigned to individuals for further investigation. In fact, design review is the first engineering step in reliability improvement—a process which is *continued* throughout the life of the product.

Reliability engineering is the technology concerned with prediction, control, measurement and continuous reduction of equipment failure rates.

Critical Components Programme

The engineering breakthrough in the process of reliability development came from an observation akin to that found in many other managerial areas, i.e., there are a few vital components which contribute to the bulk of failures in any product system—be it electrical, hydraulic, electro-mechanical or electronic. The critical components programme identifies these vital few so that maximum corrective action can be taken to minimise their failures or, if that is not possible, to provide for alternative or standby units.

Enormous amount of failure data of electronic components has been catalogued in various handbooks. Relatively little published failure data is available, even in Western countries, on mechanical components.

A formal list of critical components defining their critical features is prepared and plans to determine or improve their reliability are made. These include programmes for evaluating components highlighting failure causes requiring preventive actions by the designer, or special handling procedures during manufacture or usage of the component.

An important preventive technique which studies the cause and effect of failure before a design is finalised is that of failure-mode and failure-effect analysis. The analysis of failures by itself is not a new process. Engineers have

done this for centuries but statistical techniques such as regression analysis and analysis of variance have now enabled engineers to assess the dominant modes of failures in a probabilistic sense. This is a new approach to failure studies which is peculiar to reliability science. More sophisticated test instruments, non-destructive testing and field observations have added to the engineers' tool kit.

The critical component programme depends on field studies, design engineering and to some extent use of mathematical techniques.

Reliability Testing

Reliability testing today stands at the same level where statistical quality control was 20 years ago. The reliability test plans are quite different from those for statistical quality control. Whereas statistical quality control aims at identifying process deviations or, in the case of acceptance sampling, percentage defectives, the reliability test plans determine the probability of *continued* service for a given period. The determination of reliability test plans is a highly mathematical process; but once determined, they can be applied in the production shops.

The other two elements of reliability testing are: definition of the performance requirements and testing under specified environmental conditions. Accelerated life testing is often used for long-life components in order to terminate the tests rapidly. Reliability testing overlaps with conventional engineering testing of a new design and, therefore, the two must be planned concurrently.

Improving Design Reliability

When a product is being tested under field conditions, data begins to accumulate on failures, and design weaknesses in terms of symptoms. Their identification and diagnosis, and tracing them to their likely causes, is greatly added by the tools for quantifying reliability and reliability prediction mentioned earlier.

The persons who use these techniques are the "reliability engineers", a breed of men different

from the design engineer. The design engineer and the reliability engineer question the function of the unreliable part with a view to eliminating it entirely, if the function is found to be unnecessary; they also determine whether "availability" would be more meaningful than "reliability"; if so, whether a strong maintenance programme will achieve the required availability and hence ease the reliability problem. They review the selection of parts from suppliers who are relatively new and unapproved. Use of standard parts whose reliability has been proved by actual field usage are preferred; conservative replacement times, reviewing the need for "burn-in" to eliminate early failures, de-rating, reviewing the operating environment, redundancy etc. are other techniques used for reliability improvements. Some of these actions can be done by the designer himself. Others require maintenance consideration.

Failure Reporting and Corrective Action System

Failure mode analysis and identification of critical components start with well-documented failure data, e.g., frequency of failure, conditions and usage at which failed, proficiency of the operator, environments etc. In terms of the physical effort required, the failure reporting system is probably one of the most extensive system in any major reliability programme. Warranty claims and other failure reporting systems currently in use in India are quite inadequate, since such data represent a very small fraction of the totality of failures. In a major reliability programme, the failure data will have to be organised as is done in the Armed Forces, and will almost certainly require computer processing. This analysis requires an excellent knowledge of handling of the product by the user and, also the various techniques of data collection. Standard mathematical techniques are employed for analysis. Statistical techniques are particularly useful for the analysis of a great deal of data which is "censored" (incomplete).

The corrective action is essentially a coordinating process, since it may lie in several areas within the organisation, and also because it is often not easy to decide who should take it.

The responsibility for various actions has to be specific and direction should come from a high managerial level in the organisation. The corrective action itself may lie either in the design area, training of operators, replacement and stocking of spare parts, training of the repair technicians within the user organisation, re-designing of tools, changes in preventive maintenance practices etc.

Organisation for Reliability

Very high levels of reliability have been attained in Western countries not only for their space programmes but also for domestic products. It is important to note that they have not been attained merely by demanding them quantitatively in the user specifications alone, nor by the engineering advances by themselves; neither by sophisticated mathematical theory alone nor by the improvement in quality levels by itself.

The reliability creation has been successful because all these have been integrated in the programmes—formal, recognised, funded and organised with full authority and adequate direction from top management.

The essential features of a typical reliability programme are as under :

1. The reliability programme starts in the conceptual phase of the product and continues throughout design, development, production, testing, field evaluation and service use. Naturally, it must cover all organisational units that affect the reliability in service.
2. Adequate funds—to be determined at the proposal phase—must be earmarked for the programme.
3. The execution of the programme is both a technical and a managerial task. The latter integrates and controls the technical efforts and makes available the necessary means.
4. The plan should be a formal, written plan which specifies responsibilities, procedures, schedules and budgets.

*Reliability must be 'managed'
i.e., directives must be issued,
authority delegated, resources
found and progress coordinated.*

5. The programme must include controls which detect and report to the management its progress as well as deviations.
6. The overall integration and evaluation of the reliability programme must be performed by an organisation independent of those taking the detailed steps necessary to achieve the required reliability.

The basic fact to be remembered is that reliability must be 'managed' i.e., directives must be issued, authority delegated, resources found and progress coordinated. Unless this is done, the programme will wander under the influence of conflicting priorities of the participants, without achieving anything.

The Present Status

In India, hardly any reliability programme as defined above, exists. A few quality-conscious organisations are making attempts to improve their products on traditional lines but miss out the many essential actions required in reliability creation and improvement. Reliability is still treated as a highly mathematical subject—in fact, very few engineers have taken to study or practice "reliability engineering" of which mathematics is only a tool. Even the mathematical papers published on this subject in various Indian journals are mostly minor extensions of already-published material on different ways of solving the same problem.

These erudite papers have not much practical application — either because they solve some imaginary problems or because the engineers

who should use their solutions do not understand the terse mathematical results and hence cannot apply them in practice. This points out to the great need for bringing these minds together. The modern-day engineer's curriculum must include some study of mathematical techniques of reliability engineering; also, the mathematicians must be associated right at the design stages so that they can work on worthwhile, real-life problems.

Within the technical field, studies such as failure mode analysis, field data collection and analysis should be undertaken by the R&D organisations of the industry. Development of competence in this field is the immediate need of the day.

Reliability Engineering in USA

At this stage it would be useful to study how the problem was tackled in USA, since there are lessons to be learnt from the history of reliability engineering in that country.

The first survey of the general problems of electronic reliability was carried out in 1951 by an *Ad hoc* Group on Reliability of Electronic Equipment in the R&D Board. Following this the RAND Corporation published a 'Status Report' on the same subject. These reports highlighted the following problem areas : (a) Tubes, (b) Components, (c) Systems, (d) Personnel and (e) Organisation.

The Reports also brought out the following:

- (a) That electronic reliability is a womb-to-tomb problem in a complex weapon system ;
- (b) That there are seven factors which determine overall military & economic worth of a weapon system viz., Performance Capability; Reliability; accuracy; vulnerability; maintainability (ease of maintenance) and procurability. Only a system approach will help realise the best combination of these.

- (c) That it was necessary to organise and direct the technical effort and activities through scientific planning and control. Reliability Control involves: determination of reliability requirements; data collection on component & system failures and its analysis; improvement; and surveillance.

The year 1952 saw the formation of a very important study Group—The Advisory Group on Reliability of Electronic Equipment — now remembered as the famous AGREE. The Group consisted of Service Officers, defence scientists, eminent men from the Universities, industry and the engineering profession. It had 15 members, four consultants and 28 observers. The Group submitted its report, after working for 5 years, in 1957 and is considered to be the foundation of Reliability Engineering in the USA. Several specialised studies notably by ARINC Research Corpn. (a subsidiary of Aeronautical Radio Inc.) and TEMPO (Technical Military and Planning Operation) of General Electric, followed and soon Reliability became an established engineering discipline.

Proposed Action Plan

In India, we are now somewhat at the stage at which AGREE was formed. Considering the success of AGREE, it seems most prudent to follow a similar procedure in this country, no doubt taking advantage of the enormous know-how now available from published literature, DOD publications on test plans, etc.

The AGREE had formed themselves into nine task groups to undertake the following tasks allotted to it :

- (a) Develop minimum acceptability figures for reliability of the various types of military electronic equipment.
- (b) Develop basic requirements for test to meet the minimum levels of reliability.

- (c) Develop basic requirements for tests on pilot production and on production models to meet the minimum reliability levels.
- (d) Investigate and recommend methods of specifying development procedure to ensure that equipment designs will have the inherent reliability required.
- (e) Establish criteria and methods for specifying the reliability of component parts in terms of failure rate as functions of time and environment.
- (f) Study present procurement and contract practices and regulations to determine their compatibility with reliability.
- (g) Investigate present practices of packaging and transportation and recommend improvements of enhanced reliability.
- (h) Investigate the effects of storage of electronic equipment upon the reliability and recommend improvements.
- (j) Review present methods and procedures to ensure that the reliability of equipment in Services is kept upto the inherent design level.
- on the lines of AGREE. To start with, the Study Group could carry out a survey of the present "State of Art" actually practised in the country. They should study the literature, articles, research papers, etc. available in India and abroad on the subject of technical, mathematical, managerial and organisational aspects of reliability. The Study Group should then list out, in consultation with the designers, manufacturers and users the range and type of problems, drawing also upon the published literature referred to earlier. They should initiate studies on the reliability of selected important products in the field of electronics, automotive, machine tools, etc. through collection of full data. The Study Group should then recommend methods of reliability improvement in the following fields.
- (a) Organisation for reliability creation, control and surveillance;
- (b) Training in reliability engineering to consumers, manufacturers and designers.
- (c) Requirements of funds for the above;
- (d) Requirement and availability of technical personnel in the various fields such as manufacturing technology, materials engineering, quality control and mathematical analysis.
- (e) Type of management directives required for reliability creation.

Each of the task group consisted of 15 to 20 members. The recommendations of the AGREE Report were largely followed up and the concept of programme management developed.

Keeping the above facts in view, the author suggests the following steps to be taken for the development of reliability engineering in India. *Firstly*, a high level Study Group consisting of a number of full-time members should be set up

Such a Study Group should be able to formulate their initial proposals in about one year after their formation. Their very formation and contact with industry, users, designers, etc., is bound to create an increased tempo of work in this area. Firm long-range planning can be done, organisations set up, funds allotted and training conducted thereafter. □

A Concrete-Plastics combination has been developed by two U.S. government agencies. "Concrete polymer" is made in much the same way as radiation-processed wood plastics. The material has four times the tensile strength, compressive strength, resistance to abrasion, and cavitation of concrete. Water permeability is negligible. Weight boost is less than 7 percent.

—International Management

Quality Control in Industrial Products

DM Patel*

During the past two decades, industry has seen an extremely pronounced growth of competition in product quality. This competition has been reflected in the cost structures of most of the industries. Product quality is rapidly becoming the most significant factor in customer decisions. This is true whether the purchaser is a housewife, a large industrial corporation or a military procurement agency. A natural result of these circumstances has been for many factories to place a premium upon the establishment and maintenance of a good quality reputation. Today, fighting to produce truly trouble-free products is one of the major ways an organisation has to build its sales volume. Product quality has become such a sensitive hinge point for successful business that no industry can afford to neglect it in this competitive world.

A MANUFACTURER is in the business to sell his products to the customers and not to himself. He must, therefore, judge the quality needed by his customers and arrange to build this level of quality into his product. Marketing forecasts predict that customer demands for higher and higher quality will be amplified by intense competition in the period ahead. The consumer exercises his free choice to buy what gives him best satisfaction. Hence, he is the final judge of what will be or will not be produced. Manufacturers compete each other to supply best of what he wants at the lowest price.

In the present time, to maintain quality reliability is a problem of utmost importance. Once the interest of a few technical men, quality control is now the primary concern of a growing number of managers, engineers and statisticians. Now, the goal of competitive industry is to manufacture a product into which quality is designed, built and maintained at the most economical costs which also allow for full consumer satisfaction.

In the phrase "quality control" the word quality does not have the popular meaning of

"best" in any absolute sense. To industry it means best for certain customer conditions.

The important customer conditions are (1) the actual end use and (2) the selling price of the product. In turn, these two conditions are reflected in five additional conditions namely: (1) the specifications of dimensions and of operating characteristics, (2) the life and reliability objectives, (3) manufacturing and engineering cost, (4) the production conditions under which the article is manufactured, and (5) the field installation and maintenance objectives.

Quality in industrial products can be defined as the composite product characteristics of engineering and manufacture that determine the degree to which the product in use will meet the expectations of the customer. In short, quality is not perfection. It is the amount of imperfection we are willing to allow and able to tolerate.

Concept of Total Quality

The quality of a product extends over its entire life span. It commences with the initial idea of the product and continues right upto the time the product has served its useful life and is scrapped. The quality of a product visualised in

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this manner from "cradle to grave" or "womb to tomb" is termed as total quality.

For real consumer satisfaction, reliability or good performance over a predictable period of time is important. Many firms are now using written guarantee to show their faith in reliability of a product. This kind of confidence can only be accomplished through a deep, well-planned, organisation-wide quality control programme. At one time, this only meant screening the final product before it left the factory. Now a days, more and more programmes are spreading the quality control function over the whole manufacturing process. A watchful eye is kept on the product from raw material to finished items. Quality control is now recognised as a new and important industrial management function.

Total quality control is an effective system for integrating the quality-development, quality-maintenance and quality-improvement efforts of the various groups in an organisation so as to enable production and service at the most economical levels which allow for full customer satisfaction.

The quality control function includes the inspection but it goes much further. It is based on the concept that the making of unaccepted parts or products can largely be prevented. Statistical analysis of inspection data commonly called statistical quality control is a valuable aid in accomplishing this objective. A lessening of scrap, rework, complaints, and so on is a source of cost reduction. We may then say that the function of quality control is to coordinate the quality control efforts in the manufacturing organisation in such a fashion as to carry on production at the most economical levels that will yield full customer satisfaction.

Stages in Quality Control

There are generally four stages in quality control. These steps break down as follows:

1. *Setting standards:*

Determining the required cost-quality performance—quality and reliability—quality standards for the product.

2. *Appraising conformance:*

Comparing the conformance of the manufactured product to these standards.

3. *Acting when necessary:*

Taking action when deviation exceeds the natural variation limit.

4. *Planning for improvement:*

Developing a continuing effort to improve the cost, performance, and reliability standards.

Jobs of Quality Control

The broad concept of total quality control encompasses the complete industrial cycle. The jobs of quality control gear right in with the production and service process. The jobs fall into four natural classifications.

1. New-design control
2. Incoming-material control
3. Product control
4. Special process studies.

1. *New-Design Control:*

The first job of quality control is new design control. It includes quality control efforts on a new product while its marketing characteristics are being selected; while design parameters are being established, and proved by prototype test and while the quality standards are being specified. Both product and process designs are carefully reviewed. Qualified engineers collaborate with scientists and researchers and attempt to predict weak areas before starting formal production in order to improve maintainability and to eliminate threats to product reliability. In the case of mass production, new-design control ends when pilot runs have given proof of satisfactory production performance, and with job shop production the routine ends as work is being started on production of the component parts.

2. *Incoming Material Control :*

The second job of quality control is 'incoming material control'. When production is set in motion, strict control of raw materials and

purchased components is ensured. Procurement officers select their source of materials carefully and constantly inspect samples of it to maintain quality.

There are two phases in incoming-material control.

1. Control on materials and parts received from outside sources.

2. Control on material and parts processed by other plants of the company or other divisions of the plants.

Specifications and standards are established as criteria for acceptance of raw materials, parts and components. A number of quality-control techniques are applied to provide acceptance at most economical levels. These techniques include vendor quality evaluation; certification to material, parts and components by the vendors; acceptance sampling techniques, and laboratory tests.

3. *Product Control*

When the design has been released for production, tools have been procured, and materials, parts, and components have been received, product control (the third job of quality control) comes into play. It involves the control of products at the source of production so that deviation from quality specifications can be corrected before defective products are manufactured. It not only involves the materials and parts but also control of the processes that contribute the quality characteristics during the manufacturing operation.

4. *Special Process Studies:*

The fourth job of quality control is special process studies. It is concerned with scientific analysis of the problems which occurred and were detected during the manufacturing process. Elimination or control of causes of defective products results in product and process improvement, not only in improving quality characteristics, but also in reducing cost.

What Factors Play Decisive Role in Quality Control?

The factors affecting product quality may be divided into two major groups:

- (a) Technological, that is machines, materials, and processes.
- (b) The human, that is operators, foremen, and other company personnel. Of these two factors, the human is of greater importance by far.

As far as technological factors are concerned, it is often difficult to trace a quality problem back to a single cause. The failure of an instrument assembly to pass a final preshipment inspection may be due to earlier acceptance of faulty materials, to improper machining or processing of certain component parts, to faulty assembly jigs, or to any of a dozen other possibilities.

When these technological conditions have been traced, it is equally difficult to pin down the human factors. The faulty machining of a part may be due to carelessness of the machine operator, to incorrect instruction by the foreman, to defective methods set up by the job planner, or to a poor design by the engineer. Blaming a foreman, operator, or engineer on a superficial basis may have little bearing on the true problem.

Effective human relations is basic to quality control. A major feature of this activity is its positive effect in building up operator responsibility for and interest in product quality. After all, it is the human hands which perform the important operations affecting product quality. It is of utmost importance to successful quality-control work that these hands be guided in a skilled, conscientious, and quality-minded fashion.

Importance of Quality

Unless all the members of the industrial team have the right attitude toward quality, little will be accomplished despite excellent inspection facilities and a complete quality control programme. The quality control programme is incomplete without quality-mindedness.

Quality Mindedness in Upper Management:

Unless top management shows a perpetual interest in quality by word and deed, there will not be serious effort for quality in the shop.

Management must be sold quality control first. The importance of quality as far as management is concerned is in that it helps build a good reputation in the competitive market. Management must offer more than lip service to quality. It must give sincere attention to quality reports and quality audits.

Quality-Mindedness at Supervisory Level:

Management relies on the supervisor or foreman to extend company policies into the shop and to the personnel under the foreman's supervision. Here "actions speak louder than words" holds true. The foreman must be interested in seeing that his section produces a quality job. He must go round to the persons under him and discuss the quality of their work, compliment them when it is good and suggest improvement when it is sub-standard. He must shut down the operation that is turning out defective products—even in the face of tight production schedules. He should regard the inspector as a helper in matters pertaining to quality and not as an impediment.

Quality-Mindedness at Operator Level:

Unless the individual operators are convinced that it is in their interest to produce quality work the quality control programme will not achieve much success. The operator has to have the correct attitude. When he does, he regains pride in workmanship and takes the rightful share of his responsibility for quality.

How to Promote Quality-Mindedness?

An occasional promotional drive for quality is a useful device for letting the men in the shop know what management's attitude on quality is. Even a modest promotion can effectively use the following devices:

1. Short write-ups in plant paper
2. Cartoons in plant paper
3. Posters displayed in work area—
 - a. General
 - b. How to do it better

c. Why do it better.

4. Quality slogans:

- a. Quality is everybody's job
- b. Quality must be built into the product and not inspected into product
- c. Quality you can trust

5. Increased suggestions awards.

Role of Management in Quality Control Programme

The reputation for quality is not a thing of chance, but it is the direct result of internal policies of a company. There must be a sincere desire by the management to have an effective quality control programme. Participation must be so evident as to leave no doubt in the minds of the subordinates about the attitude of management. A quality control programme must have complete support of top management. With lukewarm management support, no amount of selling to the rest of the organisation can be genuinely effective. Management must recognise at the outset that the quality control programme is not a temporary cost reduction project. Only when the inefficiencies represented by the cost reduction are out of the way, can the quality-control programme take over its long-range role of the management control over quality. Management must determine the policy that will be followed when there is apparent conflict between quality-control and production. Quality must never be subjugated to production and in this policy, the quality-control department must have the complete support of top management.

Quality Control Through Team Work

For effective quality control, regular and systematic consultation between the operating, engineering and quality control personnel is essential. Careful examination of all control charts, inspection reports and consumer complaints and making quick decisions is most effective means of controlling quality. This management concept is illustrated in Fig 1.

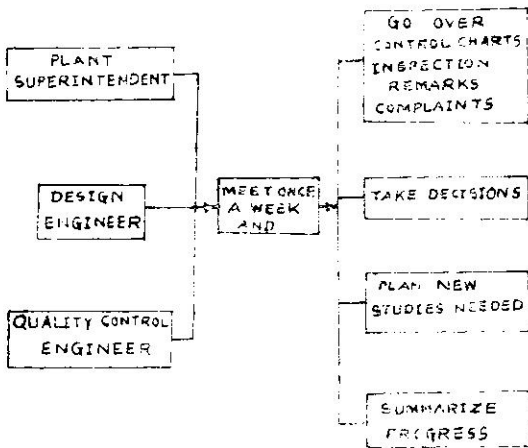


Fig. 1.

product quality and the satisfaction of the ultimate user of the product. The quality control department should be interested in the product right from the inception of the engineering model. This interest should sustain through preliminary tests on the product, production of the product packing for shipment, and field performance. Based on experience gained during manufacturing, as well as from field performance the quality control department should make recommendation for improvement and cost reduction. This philosophy is best illustrated in the quality-control chain shown in Fig. 2.

Benefits of Quality Control

The benefits that accrue to both producers and consumers from quality control are:

- | | | |
|---------------------------|----------|----------------------------|
| 1. Lower Unit Cost | } Due to | a. Fewer defects |
| 2. Better Quality | | b. Fewer operators |
| 3. Better Employee Morale | | c. Fewer inspectors |
| 4. Higher productivity | | d. Less scrap |
| | | e. Less inspection rejects |
| | | f. Less machine-breakdown |
| | | g. Fewer complaints |
| | | h. Higher efficiency |
| | | i. Fewer interruption |
| | | j. Better design |
| | | k. Improved specifications |

Quality Control Chain

The quality control supervisor should adopt the philosophy that the quality control department is interested in all factors of design, manufacturing, and selling which have a bearing on the

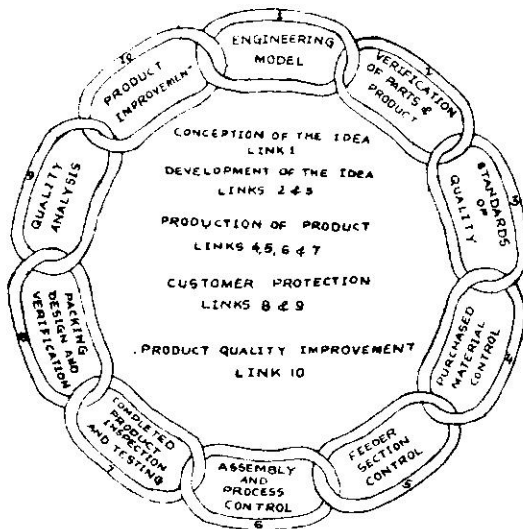


Fig. 2.

Both producers and consumers reap these advantages.

Quality control is a powerful tool to increase the profitability of business. Total-quality control programme should be allowed to develop gradually within a given company. It is often found wise to select one or two problem areas to achieve successful results in attacking them, and to allow the quality-control programme to grow step by step in this fashion. □

Production Planning Problems in Steel Forgings Industry in India: A Process Analysis Study

VVN Somayajulu*

In this paper, the author attempts to study the production units in the steel forgings industry—with its characteristic feature of continuous multidimensional products on the lines of 'Studies in Process Analysis'. The study deals with broadly (1) general technical features of the steel forgings in relation to castings and (2) of the forging production units or firms under investigation, coupled with a few production problems of this jobbing type industry.

THE forging process may be defined¹ as the plastic deformation of metals or alloys into predetermined size or shape generally at elevated temperatures, by a compressive force exerted by a hammer, press or upsetting machine. Parts or members produced in such a manner are called forgings. The forging process produces a wide range of products, each of which is identified by continuous product dimensions or characteristics of the products. Thus, there is no limit in enlisting the products of forging process because of continuous variation in the physical quantities of product dimensions. Because of the continuous variability in the physical values of products

dimensions, the cost structures of the firms and of the industry are also likely to be fluctuating as a continuous phenomenon. This problem of continuity and product multidimensionality² gets amplified as it is a jobbing type or customer-oriented industry.

While the technological forging process is a continuous phenomenon, the economic studies based on inter-industry analysis require the discrete and finite processes and products as basic information. The intermediate stages of production, as intermediate technological processes in a firm or a production unit, do not specify the final products, so as to meet customers specifications. Besides, not all production units have similar intermediate technological processes. The derivation of economic processes with unique input-output combination or a combination of such activities, cannot directly be linked with the technological intermediate processes of the

*Economist, NCAER, New Delhi. This Study was carried out at Gokhale Institute of Politics and Economics, Poona, as a part of Ph.D. thesis, "Process Analysis of steel forgings industry in India with special reference to problems of continuity and multidimensionality for sector specification in the inter-industry framework". The author is grateful to all firms and companies collaborated in this study. He is grateful to Prof. P.N. Mathur for his close guidance. This is dedicated to the everlasting memory of the Author's wife, Susila, lost just after the survey.

¹W. Steeds: *Engineering Materials, Machine Tools and Processes*, Longmans, 3rd ed. 1957, ch. 5, Forging, p. 120,

²See, for details on Multidimensionality problems, Mathilda Holzaman, "Problems of classification and aggregation", in *Studies in the Structure of American Economy — Theoretical and empirical explorations in input output analysis* (ed.) Leonief, WW and others, New York Oxford University Press, 1953, pp.343-344.

industry. For this, attempts are made to specify the product groups with respect to the homogeneity of product dimensions and to derive the distinct average prices and dissimilar input structures of a set of aggregated product groups.³ The distinct economic processes of the product groups, disintegrated from a continuous forgings sector, are to serve as discrete and finite sectors in the disaggregative commoditywise input-output tables and/or as activities in the linear programming models.

While the input-output analysis assumes that only one method is used for producing each group of commodities, the linear programming analysis assumes that there may be more than one way of producing a given commodity because of inputs substitution. Approximating these assumptions to reality for sector specification depends both on the nature of production in the plants and on the way in which those units are aggregated into sectors.⁴ In this context, Leontief⁵ observes, "As soon as the economist abandons grossly aggregative formulations, he will find in engineering data a promising and accessible source of direct empirical information on the input-output structure of the individual industries." Various uses of such engineering analysis and process results are suggested:⁶ (i) as a basis for classification and aggregation, (ii) as a supplement to other methods of calculating input coefficients, (iii) in testing and modifying the underlying assumptions of fixed propor-

tions among inputs and outputs. Carter,⁶ in this connection, distinguished three fundamental problems; (1) the problem of dividing the economy into technologically-homogeneous industries (classification problem), (2) the problem of selecting technically significant attributes or input and output dimensions in each industry and (3) the choice of appropriate types of functions in which the input and output variables are to be related in each industry. Mathilda Holzman⁷ observed that the input structures for multidimensional products must be obtained from engineering production functions of the products.

In the light of those basic ideas and works, this paper attempts to investigate the production units of a continuous multidimensional products of steel forgings industry study⁸ on the lines of "Studies in Process Analysis"⁹ and deals with broadly (1) General technical features of the steel forgings in relation to castings and (2) of the forging production units or firms under investigation, coupled with a few production planning problems of this jobbing type industry.

General Technical Features¹⁰ of Steel Forgings Compared to Castings

The stages of manufacturing the forgings are

³See Chapters IV to VII in unpublished Ph.D. thesis of Somayajulu, VVN., Op.Cit., See (1) Somayajulu, VVN., "Input and capital structures as parameters of instantaneous production functions of firms and technological processes in steel forgings industry in India", *Artha Vijnanana*. Vol. 12 No.4. Dec 1970. pp. 574-593. (2) Somayajulu, VVN., "Product specification in steel forgings industry for sector specification in process analysis studies," accepted for publication in *Econometric annual of Indian Economic Journal*, Vol. XVIII, 1970 issue. (3) Somayajulu, VVN., "Average prices for multidimensional products of steel forgings in India", Accepted for publication in *Indian Journal of Economics*.

⁴Chenery, HB, and Clark PG, *Inter Industry Economics*, pp. 33-42, New York, John Wiley and Sons Inc., London 1959.

⁵Leontief, WW., Introduction", *Studies in Structure of American Economy*—(ed.) Leontief and others, op. cit. p. 14.

⁶Carter, Anne, P: "The technological structure of cotton textile industry" in Leontief and others (ed) op.cit p. 361. ⁷Mathilda Holzman, "Problems of classification and aggregation in input-output analysis", in *Studies in the Structure of American Economy*" (ed.) WW Leontief and others, op.cit, p.359.

⁸Somayajulu, VVN., unpublished Ph.D. thesis, op. cit. ⁹Manne, AS., and Markowitz, HM. (ed.), *Studies in Process Analysis, economywide production capabilities*, Cowles Foundation for Research in Economics at Yale University, Monograph 18, 1961, John Wiley and sons, Inc., New York, London.

¹⁰For the technical features of steel forgings industry the following selected books are consulted to facilitate the field investigation of the firms. The other sources of information are referred to, at the appropriate places. For details, refer the originals.

- (1) *Forging Practice* by GKamen Shchikov and others, translated from Russian by L Zelikov, Peace Publishers, Moscow.
- (2) Rusinoff, *Forging and Forming Metals*, DB Taraporevala and Co. Pvt., Ltd., Bombay 1967.
- (3) *Tool Engineering Handbook*, II edition, Sec. 54
- (4) Jenson, John, E, *Forging Industry Handbook* (ed.), Director of Marketing and Technical Services, Forging Industry Association, Cleveland, Ohio, 1966. The Ann Arbor Press, Inc., Ann Arbor, Michigan.

represented in the sequence of operations or processes of a typical, commercial and full-fledged forge production unit. Similar to the forgings, there are castings manufactured in foundries catering to the requirements of many engineering industries. Castings are made by pouring molten metal into moulds and allowing it to solidify. Though the two, forging and casting processes, are technologically different in respect of manufacturing operations, the nomenclature of them may overlap because of the similarity in their shapes.

Inherent Advantages of Forgings Compared to Castings

The main distinction between forgings and castings is of relevance here. Forging process aligns fibre like metallic grains in continuous and unbroken lines, utilizing the inherent properties of the metal. This controlled grain flow, characteristic to forgings alone, provides inherent advantages of forging process. The mechanical properties of forgings are likely to provide some economic advantages to the user, by saving the material, energy, and by increasing the strength and longevity of the service life of the users' products. The inherent advantages of forgings in comparison to castings are:

- (1) Greater strength
- (2) Reduction in weight of finished part
- (3) Ability to withstand unpredictable loads
- (4) Minimum of machine finish required
- (5) Saving in material
- (6) Elimination of internal defects

Technical Substitution of Castings

Parts like connecting rods, camshafts and crankshafts which were previously forged are now being substituted by casting process as the components of automobiles industry in America.¹¹

¹¹"Technical Evaluation of the Forging Industry" Report of a study by the Illinois Institute of Technological Research Institute, Chicago, Illinois, sponsored by the Committee of Hot rolled and Cold finished Bar Producers, American Iron and Steel Institute, 633, Third Avenue, New York, 10017.

This is because the foundries in America have developed production techniques to reduce the cost of production of castings, which are able to meet the minimum service requirements of the automobiles. The scrappage rate of old automobiles, keeping pace with the new models and mass production every year, is so high that they get satisfied with the minimum service life of the castings as automobile components. The automotive industry adopted this sort of technical substitution, but still, it is the second major consumer of steel forgings in America (22.6% of the total sales of steel forgings).¹² The first major consumer of steel forgings in U.S.A. is Aerospacecraft industry (31.7% of the total sales of steel forgings), because of heavier strengths and less weight of steel forgings. Aerospacecraft industry has not developed in India. The cost of production of quality castings is too high to replace forgings in India. The markets for forgings and castings and their processes are distinctly different, for any given specifications of the requirements of users in engineering industries. The internal demand for automobiles in India is so high that the longevity of the expected service life of the automobile is always preferred. Thus, on both the counts of technological reasons and from the users' demand point of view, any possible substitution as in America, is not in India.

Types of Forgings

There are broadly two types of forgings: (A) open forgings, and (B) die forgings. These are further classified according to the method of fabrication in four general groups. They are (I) Open or free or smith forgings and (II) Die forgings (i) Drop forgings by drop hammers, (ii) Press forgings by Presses, and (iii) Machine or upset forgings by upsetters.

Within each of these types, there are a wide range of forgings identified by the continuous product dimensions or the characteristics of the forgings. The quantitative and qualitative features of the products are because of the wide

¹²See, for more details Jenson, John E. *Forging Industry Handbook*, op. cit. See also Appendix to this Chapter III of thesis for Ph.D., Somayajulu, VVN, op, cit,

range of the technical processes and of materials used for forging purposes. The hundreds of grades of materials and the flexibility in the processes, bring out the wide range of numerous forgings with their variations in the quantitative and qualitative features.

Salient Feature of Forge Production Units Under Investigation

Nature of Investigation

There are about 48 production units in the industry, of which only 19 readily agreed to supply the information to the study.

All these forge units can be broadly classified into two distinct groups: (1) die forging units, (2) open or free forging units. There is a third group of repair and maintenance type forge units, which may be open or die forge units, but the purpose of these third group units is distinguished mainly as they produce repair parts and maintenance replacements of the equipments. The main distinction between open and free forging units is that the former produce open or free forgings without the use of impression dies, while the latter essentially need impression dies, preparation facilities and the closed die forging hammers, presses and upsetters in forge shop.

Preliminary details of the 19 forging units

From Table 1, it is seen that the gestation period between the year of establishment and the year of production is 3 to 6 years. It is normally 3 years. The accounting periods of the firms are divergent.

Out of 19 units, 11 belong to West Bengal with nearly 5000 tons of production,¹³ 3 to Mahara-

shtra with nearly 6000 tons of production,¹⁴ 2 to Madras with nearly 2000 tons of production, and the rest of the units producing nearly 1000 tons of production. Thus, nearly 14000 tons of production is covered,¹⁵ which may serve as nearly 20 to 25 % of the coverage of total tonnage production in the industry in India. Out of 19 units only 5 are independent units, while the rest are captive units in heavy engineering plants, steel plants, mining machinery and ship building plants.

Die forging Units and Their Salient Features

The nature of the products and the processes of the plants producing wheels sets and sleepers are slightly different from those of all other die forgings units, but their basic process of production is forging, conforming to the definition of forging process. For historical and some organisational reasons, they have become part and parcel of steel plants.

WHEEL SETS PLANT AS A FORGING PLANT: It supplies wheel sets, wheels, axles, and wheel tyres to railways. It consists of heavy forging press, rolling, wheel and axle machining, forging hammers and manipulators and assembly department, capable of producing an annual tonnage of 57,000 tons of 45,000 finished wheel sets. It includes the axles of 20 tonne roll bearing type and 16 tonne plain bearing type. About 30,000 sets have to be manufactured for broad gauge and the balance of 15,000 sets for metre gauge wagons.

The weight of each wheel set for the broad gauge is 3.7 tonnes and for metre gauge is 0.63 tonnes. The manufacture of 45,000 wheel sets requires annually 75,000 tonnes of wheel

¹³. 5000 tons in West Bengal is exclusive of that of units (See the asterisk in the table), producing wheel sets and sleepers for railways. Their production statistics are shown under "341-1 Iron and Steel" in Annual Survey of Industries (ASI) reports. There are 53 items of products and byproducts of 341-1 Iron and Steel, listed in the said reports, while these two are out of 53. The percentage of wheel sets' gross output to the gross output of 341-1 is 1.5% and that of sleepers is 2.03%. Similarly the inputs' details for 341-1 are as many as 54 listed, while for wheel sets and sleepers are as less as 15 or 16 that can be listed. From these view points these two products can be distinguished from 341-1 (ASIC).

¹⁴. The 6000 tons in Maharashtra is inclusive of a relatively large unit whose production figures are not given in the table as its production started in 1966-67 but not by 1964-65.

¹⁵. The 14,000 tons is an approximate figure for the difficulties of estimation of exact figures, because the units' (ASIC) production is shown under 341-1, as well as under 341-3. It is difficult to specify the coverage, while the total tonnage production in the industry as a whole in India is itself an approximate figure because of similar difficulties of estimation.

TABLE 1

Details of forging units under investigation (Period of inquiry : April 1967 to March 1968)

Sl. No.	Code name of the Unit	Year of establishment	First year of production	Accounting period	Production in 1964-65 (In tonnes per annum)	Capacity in 1964-65	Nature of the Unit
1	2	3	4	5	6	7	8
I. Die Forging Units							
1.	A	1917	1920	January to December	1920	1920	Captive unit
2.	B	1950	1953-54	April to March	948	2400	Independent commercial forge unit
3.	C	1950	1953-54	July to June	1800	1800	--do--
4.	F	1958	1961-62	April to March	+	+	Captive unit
5.	E	1960	1963-64	April to March	+	+	--do--
6. & 7.	G and H	1960	1963	January to December	1000	1000	G is independent & H is a captive unit
8.	D	1963	1966-67	July to June	No production as it started in 1966-67		Independent commercial forge unit
9. & 10.	X and Y	(During III Five Year Plan, but exact years not available)		April to March	1916	4500	Independent and captive units
II. Open or Free Forging Units							
11.	M	1952	1955-56	April to March	360	360	Captive unit
12.	L	1959	1964-65	April to March	No production as trials are going on.		Captive unit
13. & 14.	J and K	1960	1966-67	April to March	No production as it started in 1966-67		Captive units
III. Repair and Maintenance Type Forge Shops (All are open forging units)							
15 to 19.	N, P, Q, R, & S	1957-58	1960-61	April to March	1500	1500	Captive units

Source : From the firms' data collected on investigation.

+ The production statistics are shown under Iron and Steel rather than under forgings in official statistics. See footnote 13.

X and Y firms were not personally contacted, but their balance sheets data are utilized.

TABLE 2

The piece weights of wheel sets at different stages of operation*

Sl. No.	Capacity of piece and description	Block weight M. T.	Forging wheel weight M. T.	Finishing wheel weight M. T.	Bloom weight M. T.	Forging axle weight M. T.	Finished axle weight M. T.	Assembled wheel set weight M. T.
1.	20 ton wheel set Broad Gauge (BG)	0.60	0.55	0.48	0.55	0.54	0.41	1.37
2.	11 ton wheel set (BG)	0.61	0.56	0.48	0.54	0.53	0.40	1.36
3.	10 ton wheel set (BG)	0.32	0.29	0.235	0.25	0.24	0.16	0.63
4.	12 ton wheel set (MG)	0.32	0.29	0.235	0.30	0.29	0.198	0.668
5.	915 mm wheels	0.51	0.46	—	—	—	—	—

*Source of these data is the firm itself.

TABLE 3

Production Compositions in 1965 and 1966 of a Die Forging Firm

Sl. No.	Description	1965 Production				1966 Production			
		M tons	%	Value in '000 Rs.	%	M tons	%	Value in '000 Rs.	%
1.	Automobile parts	305	40.13	770	34.53	450	40.18	1435	40.42
2.	Diesel engine parts	155	20.39	410	18.39	275	24.55	630	17.75
3.	Forged flanges	85	11.18	350	15.70	90	8.04	560	15.77
4.	General forgings	10	1.32	25	1.12	80	7.14	280	7.89
5.	Jigs, fixtures, etc.	10	1.32	40	1.79	7	0.63	25	0.70
6.	Press tools	5	0.66	20	0.90	3	0.27	10	0.28
7.	Dies and punches	15	1.97	165	7.40	30	2.68	340	9.58
8.	Hand tools	10	1.32	30	1.35	—	—	—	—
9.	Other products	165	21.71	420	18.82	185	16.51	270	7.61
	Total	760	100.00	2230	100.00	1120	100.00	3550	100.00

Source: The firm itself provided the data.

Notes: The major increase in production from 1965 to 1966 is in the case of general forgings and automobile parts followed by diesel engine parts, as observed from Table 3.

ingots and 23,500 tonnes of axle blooms, both being supplied by the steel plants.

SLEEPER PLANT AS A FORGING PLANT: It supplies sleepers to Railways. The materials for sleepers are the sleeper bars rolled in the continuous Billet mill of steel plants. Each bar for a Broad gauge sleeper weighs 171 lbs.

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Carbon Steel				
1. Wagons and Coaches	208,617	96.94	654.965	70.99
2. Cranes	3,951	1.84	186.400	20.20
3. Others	2,628.5	1.22	81.239	8.81
Total	215,196.5	100.00	922.604	100.00
Alloy Steel				
1. Wagons and Coaches	1	0.00	0.060	0.00
2. Cranes	110	3.83	7.066	26.55
3. Others	2,768	96.17	19.601	73.45
Total	2,879	100.00	26.727	100.00
Total				
1. Wagons and Coaches	208,618	95.66	655.025	69.00
2. Cranes	4,061	1.86	193.466	20.38
3. Others	5,396.5	2.18	100.840	10.62
Total	218,075.5	100.00	949.331	100.00

Source : From the firm's data.

Notes : The composition of carbon and alloy steels for the three types of products is in a reversing order as obvious from Table 4.

The I stage of this project is expected to reach the capacity of 14,000 tons per year by 1967-68, the II stage to reach the capacity of 27,700 tons per year by 1971, the III/1 stage to reach the capacity of 33,000 tons per year by 1973 and III/2 stage to reach the capacity of 46,000 tons per year by 1975, when the 6,000 ton press will also be working on one shift basis. The I and II stages together are to manufacture a piece weight of 500 kg, III/1 stage is expected to establish the medium heavy forge shop for the manufacture of rough forgings of a rough piece weight upto 30

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	One firm						Another firm			
	Value in Rs.	Percentage	Value in Rs.	Percentage	Value in Rs.	Percentage	Value in Rs.	Percentage	Value in Rs.	Percentage
1. Coke oven	4177	2.73	18347	3.23	63436	12.47	141492	4.75	9120	0.58
2. Blast furnace	25746	16.82	38702	6.80	55771	10.96	137984	4.63	216461	13.84
3. Steel melting	20803	13.59	181779	31.96	141639	27.83	619865	20.83	399884	25.55
4. Blooming Mill	21669	14.16	25103	4.41	20310	3.99	219867	7.39	114842	7.34
5. Billet Mill	17568	11.48	27529	4.84	20722	4.07	56395	1.89	17378	1.11
6. Sleeper Plant	5804	3.79	13337	2.34	17684	3.48				
7. Section Mill	159	0.10	23026	4.05	16173	3.18				
8. Foundry and Pattern shop	257	0.17	24853	4.37	27004	5.31	141931	4.77	84180	5.38
9. Sinter plant							55005	1.85	32025	2.05
10. Rail & Structural Mill							74785	2.51	140788	9.00
11. Rolling Mill			9375	1.65	17195	3.38	18653	0.63	3169	0.20
12. Refractory material plant			17902	3.15	16102	3.16	60803	2.04	30242	1.93
13. Scrap and salvage and slag							9070	0.30	3069	0.20
14. Wheel and Axle Mill			33826	5.95	34297	6.74				
15. Merchant Mill			11694	2.06	17699	3.48	215494	7.25	114963	7.35
16. Steel straightening shop			5103	0.90			4982	0.17	3279	0.21
17. Machine shop			4260	0.75			5191	0.17	5165	0.33
18. Tool Room			9052	1.59						
19. Civil Engg. Dept.			3928	0.69			257	0.00	4105	0.26
20. Power and blooming	1168	0.76	3117	0.55	5244	1.03			147845	9.45
21. Oxygen plant			276	0.05	369	0.07				
22. Water supply and Pump House	270	0.18	1925	0.34	3633	0.71	2956	0.13	4219	0.27
23. Communications					341	0.07	17587	0.59		
24. Rail transport	11180	7.30	13533	2.38	14527	2.85	18551	0.62	4619	0.30
25. Auto transport			60	0.01	554	0.11				
26. Central Laboratory	1756	1.15			1469	0.29				
27. Instrumentation & Elec. Tech. Lab.			19935	3.50	20076	3.95	27809	0.93	6343	0.41
28. Wire and Rod Mill							1010	0.03		
29. Gas facilities							397	0.01	2974	0.19
30. Plant Central Garage	8764	5.73	1529	0.27	2186	0.43				
31. Crane Dept.	12233	7.99	986	0.17						
32. Others	21496	14.05	79624	13.99	12443	2.44	1146470	38.51	219903	14.05
TOTAL	153050	100.00	568801	100.00	508879	100.00	2977554	100.00	1564573	100.00

Source : From the firm itself.

Notes : The major share goes to steel melting, Blast furnace and Blooming mill in general. The divergences between the firms and over years in respect of the shares of production by the shops are not much spectacular.

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TABLE 5

Production Composition of Another Die Forging Firm
in 1966 July-67 June

S. No.	Using Industry	Ton-nage	%	Value in lakhs of Rupees	%
1.	Oil engines	1650	75.00	99.29	73.23
2.	Motor vehicles	425	19.32	28.67	21.14
3.	Scooters and motor cycles	80	3.64	4.90	3.61
4.	Locomotives	30	1.36	1.90	1.40
5.	Tractors, pumps, other agricultural Me and others	15	0.68	0.84	0.62
Total		2200	100.00	135.60	100.00

Source : From the firm itself

tons and III/2 stage to establish a heavy forge shop for the manufacture of a rough piece weight upto 100 tons.

Another open forging firm's products are centrifugal pumps, conveyors, mine ventilators, winders, coal cutter, friction pumps, gear boxes, etc., serving the requirements of heavy engineering equipment units, mining machinery, steel plants and railways' locomotive engines. It consists of all facilities of equipment, producing 1,800 tons in 1966-67.

Captive Repairs and Maintenance Type Open Forge Shops

A Repairs and Maintenance type forge shop serves the different shops of all steel plants, distributing nearly 95% of its production. The balance of 5% is to cater to heavy machine tools, heavy electricals, etc.

A Few Production Planning Problems in Jobbing Type Industry

The following production planning problems highlight wide range of products and materials

TABLE 6

Estimated Production of an Open Forge Shop in
Different Quality Steels

Type of steel	Forging		
	For process ingots/tons	For finish	
		Ingots/ tons	Finish tons
1. High speed steel	2950	550	350
2. Carbon tool steel	250	—	—
3. Alloy steels and die steels	3800	400	250
4. Die blocks	—	800	500
5. Construction steels	500	2250	1500
6. Stainless steels	500	—	—
Total	8000	4000	2600

Source : Booklet of the firm

with flexibility in the use of equipments, which are the useful information for the studies relating to substitution possibilities, optimisation problems, disaggregative input-output tables, at the economy and/or industry level and also for production planning at the firm level.

Utilized Capacities and Bottlenecks on Processes

As steel forgings industry is a jobbing type intermediate product industry depending upon the fluctuating specifications of the customers, it is more likely that unutilised capacities on some and bottlenecks on other processes will result in. Planning the jobs on equipments becomes difficult because of imbalance in capital structure. The very definitions of optimum capacity, optimum production pattern, measure of imbalance in capital structure and of unutilised capacity,¹⁶ become untenable when market

¹⁶. See Mathur, PN, Valavade, SP, and Kirloskar, MV, 'Optimum capacity and imbalance of capital structure: the case of Machine Manufacturing Industries', published in *Economic Analysis in Input Output Framework*. See also Kirloskar, MV, *Techno-Economic Study of Electrical Machinery Industry*, unpublished thesis.

TABLE 7

Light forge shop production in tonnage per year according to piece weight ranges and forging capacities of an open forging firm

Piece weight ranges in kg.	3 ton hammer	2 ton hammer	1.6 ton hammer	1.0 ton hammer	0.63 ton hammer	0.40 ton hammer	0.25 ton hammer	0.16 ton hammer	25 mt die forging hammer	1.6 ton die forging hammer	500 ton forging machine	800 ton forging machine	160 ton forging press	100 ton forging press	Total forging
Upto 1 kg.	—	—	—	—	—	—	100	200	—	—	—	—	12	35	347
1—4 kg.	—	—	—	—	—	—	300	64	—	460	5	—	50	—	879
4—10 kg.	—	—	—	—	—	700	150	—	10	400	100	50	—	—	1410
10—25 kg.	—	—	—	—	956	92	—	—	66	20	95	80	—	—	1309
25—50 kg.	—	—	850	28	100	—	—	—	400	—	20	200	—	—	1598
50—100 kg.	—	310	500	500	—	—	—	—	842	—	—	—	—	—	2152
100—250 kg.	250	800	1200	—	—	—	—	—	200	—	—	—	—	—	2450
250—500 kg.	2500	—	—	—	—	—	—	—	—	—	—	—	—	—	2500
TOTAL	2750	1110	2550	528	1056	792	550	264	1518	880	220	330	62	35	12645

Source : Project report of the firm.

Notes : The possible ranges of flexibility in the use of capital equipment to attain the piece weight ranges is so close as they are depicted in Table 7. This implies the specialization of equipment for certain piece weight ranges.

TABLE 8

Annual Production According to Piece Weight Ranges and Forging Capacities of a Captive Repairs and Maintenance Type Open Forge Shop on Two Shifts Basis

Piece weight of forging in Kg.	Hammer capacities					Total (in tons)
	3 Ton	2 Ton	1 Ton	0.4 Ton (2 nos.)	Press	
300 — 1000	800	—	—	—	—	800
100 — 300	500	700	—	—	—	1200
50 — 100	—	300	200	—	—	500
25 — 50	—	—	200	—	—	200
10 — 25	—	—	100	100	—	200
Upto 10	—	—	—	300	—	300
Total	1300	1000	500	400	—	3200
Balls and other non-standard products	—	—	—	—	350	350

Source : From the firm itself

Notes : The same findings from Table 7 are also seen from Table 8

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constraints of jobbing type products are numerous and uncertain.

In the analysis of a firm's detailed time requirements and available hours data, it is found that the upsetter requires 6863 hours whereas 4800 hours are available. The blacksmith hammer requires 5632 hours compared to 4800 hours available. The two straightening presses require 10922 hours compared to 9600 hours available, and the 7 hammers taken together require more or less the all available hours. Similarly, one may find that the die shop activities are becoming bottlenecks within the die shop for the preparation of dies and their despatch to the forge shop.

While the linear programming (L.P.) methods for the study of unutilised capacities and allied problems are suggested for a finite number of activities or processes, the application of linear programming method for an illimitable list of products in a jobbing type industry is still on an experimental level. The only way is to group the maximum possible number of products into finite and unique process-product groups or activities with respect to the homogeneity of product dimensions, (as done in the author's broader study) and to make use of those finite processes or activities for the programming problem.

Efficiency Factors

The term 'efficiency' is defined by comparing the actual performance with respect to a standard norm. Norms are generally fixed based on time motion studies of a standard technology with respect to know-how, equipment and skills. The standard technology may be the best available technology at a point of time which may not be accessible to each forging unit. Norms adopted by a particular firm may not be the same with others' norms if they adopt different technology.

A firm has classified the die preparation jobs and found the percentage efficiencies, by considering the ratio of estimated or expected hours to actual hours, for the preparation of both top and bottom dies during March 1967-June 1967.

The averages of 4 months together for three categories of jobs are given below.

	<i>New Sinking(%)</i>	<i>Re-sinking(%)</i>
Medium jobs	107.94	72.19
Easy jobs	84.76	70.49
Difficult jobs	66.82	120.30

Similarly, in Forge shop, the averages of 3 months (February 1967 to April 1967) are given as—Medium jobs 71.58%, Easy jobs 97.21% and Difficult jobs 54.60%.

In the Forge shop of another firm, the efficiency factors of operators (Hammermen) during the winter and summer seasons, on a job x, are relatively better on piece-rated jobs compared to daily-rated jobs.

	<i>Operators (Hammermen)</i>		
	A	B	C
Daily-rated jobs			
Winter	80%	60%	65%
Summer	75%	55%	60%
Piece-rated jobs			
Winter	92 to 95%	75%	75%
Summer	85%	70%	70%

In another firm, Billet shear has 35%, cold saw 90%, Long lathe 57%, Milling Machine 70%, Shaping Machine 60%, Planing Machine 52% as efficiency factors on an average.

Average Yields and Inefficiency Factors on Materials and Products

Index of average yield is expressed as a percentage of piece weight or net weight to the gross weight of the material. The difference between gross and net weight of a piece of forging is the scrap, flash and other wastages. The weight of the latter to the net weight gives the inefficiency

BOOK REVIEWS

INDUSTRIAL DEVELOPMENT : by NR Kulkarni, Published by The National Book Trust, India, July, 1971, Pages 300, Price Rs. 7.25.

The National Book Trust of India has been bringing out a number of useful publications in the series "India—the Land and People". The present volume dealing with the Industrial Development is a part of that series.

Mr Kulkarni, a Senior Research Officer in the Planning Commission has traced the development of Indian industry right from the closing years of the last century to the beginning of the Fourth Plan (1969). The narrative concentrates on specific groups of industries such as the plantation industries, textile and jute industry, and metallurgical industry including iron and steel. The infrastructure for industrial development laid in the last years of the 19th century forms the content of one chapter. Subsequently, the narrative is taken through the War years and the turbulent period of the twenties. The stresses and strains of Partition have been well described while the last chapters deal with the era of planned industrialisation which began two decades ago. The closing chapter gives a critical appraisal of the industrial growth during this period.

There are, however, some omissions in this record of industrial development of the

country. Curiously, no mention is made of the industrial Development and Regulation Act (1951) which has been the basis for the system of licensing that has been an important feature of the industrial scene in the last 20 years. The Industrial Policy Resolution of 1956 which is still valid even today has also received little notice. Adequate mention has not been made of the patterns of industrial administration that have grown both at the Central and the State level in the last 15 to 20 years. The growth of the Public Sector enterprises in the States have also been not covered fully.

But, perhaps, these are matters of details in a book which has to conform to the format of the series and has necessarily to compress a great deal of information in less than 300 pages. Judged by these constraints the author has done extremely well in providing a mass of statistical information on the growth of Indian industry in the last hundred years. The book will be of great interest to all those concerned with the development of Indian industry and, considering its low price, can be used extensively at the collegiate level for students who have to study the subject.

The get-up of the book is pleasing, though marred by avoidable printing errors. A number of tables and charts as well as an index are provided at the end of the book. A bibliography on the subject would have enhanced the utility of the book to those whose curiosity

will be undoubtedly aroused by this well-written absorbing narrative. The National Book Trust and the author deserve to be complimented on an excellent addition to their series meant to project different facts of India.

—DR RAM K VEPA

Product grew at a rate twice that of the United States and made the economic miracle possible.

The author devotes a long and critical chapter to the future of the economic miracle in that country. He lists out the possible arguments for bringing out an economic slowdown or even a turn down, such as growing shortage of labour force, pressing requirements in the context of building national infrastructure, the likelihood of having to spend greater sums of money in the national budget for defence purposes, difficulties in the balance of external trade, trend towards an easier life, the rebellion against the established system of values and priorities, growing complexity of managerial difficulties in large-sized firms and so on. The author proves, however, that the impact of such pull backs will not be imminent on the economic growth of the society. He lays out certain positive qualitative and quantitative reasons for a continuous trend of economic growth such as high saving and investment rates (about twice those of the U.S.A.), superior education and training, ready availability of 'risk capital'; competitive technological abilities, high morale and commitment to the cause of economic growth, top class management of the economy, and prospects of foreign trade. The balance sheet of negative and positive forces emerging in the Japanese economy would thus show that the future of the economic miracle in the country should indeed be bright.

The problem of a growing economic power is then its attaining entrance into the political sphere. "It is probably as impossible to seek to become one of the top three economic powers of the world, much less number one, without eventually being entangled in international political problems as it is to become an Olympic swimming champion without getting wet." Thus given the fact that the Japanese economy is poised for a continuous uptrend in economic well-being in the years to come, it is but reasonable to admit of its potential involvement in international politics. This is so because no industrial economy can continue to grow in its economic stature without collaboration with the other economies of the world and such

THE EMERGING JAPANESE SUPER STATE by Herman Kahn; Published by Andre Deutch, 105 Great Russel Street, London WC1, Pages : 274: Price £ 2.95.

'That in the next decade or two, Japan almost inevitably will achieve giant economic, technological and financial stature, that it will become financially and politically powerful in international affairs, and that eventually it is likely to strive to become a military super power as well, is the essence of the latest book by Herman Kahn, the pioneer of futurology and the inventor of the term 'think-tank'. His reasoning is based on scientific analysis of the Japanese society in various walks of life and on projections of her future *vis-a-vis* other leading powers of the world. If Japan is now in the vanguard of world economic progress, it is mainly due to her strong domestic industrial base and a minimum of international political involvement. But she cannot be contented with mere economic accomplishments; she will have to shift over emphasis to military achievements and may even become the cynosure among world powers eventually.

Having reviewed the historical and economic stages of the Land of Rising Sun in the opening chapter, the author presents before the reader the national characteristics, attitudes, beliefs, and social norms of Japan and identifies Japanese exclusiveness in the world stage today. Their devotion to work and adaptability to the new trend of civilization while retaining intact their identity has indeed helped the Japanese to bring up their economy from a virtual state of disaster at the time of World War II to what it is today. With Government and industry resolved to work together, Japan's Gross National

collaboration will necessarily have political undertones and overtones. If it is a fact that Japan will emerge on the world economic horizon as a major luminary, it will also be a fact that it will carry the world politics with it, to become a super state in its real sense.

The Japanese challenge then will be how its society can keep up its identity as it does now despite political pressures? Will Japan build nuclear forces? And what will be the shape of its relations with the present political powers of the world including the U.S.A., U.S.S.R. and China? These are some of the questions which the futurist Kahn answers in an admirable fashion.

In reference to the prospective Japanese relationships with India he predicts that Japan will play a greater role in furnishing useful economic and technological assistance than either the Soviets or the Americans. The author feels that in the immediate future Japanese might make a major impact on India by generally setting up fertilizer plants or light industries. "One can even imagine some eventual kind of joint Indian-Japanese nuclear force to which the Australians, Indonesians, South Koreans and others might contribute. . . . This may fulfil some important sub-objective of control and European and world stability."

—VDN RAO

of their physical formation and make-up and also the factors that play important role in influencing crop production. The first 7 chapters of the book relate to physical properties of the soils with emphasis on soil survey and classification. The next 4 chapters deal with soil fertility and fertiliser problems. The remaining 5 chapters are devoted to problems of soil conservation, soil and water use, reclamation of saline alkali soils, drainage and other soil management aspects.

No doubt, the authors have tried to touch upon many of the important problems, but it would be appreciated that it is impossible to do more than just introduce such a vast subject of soil, water and crop management. The book is mostly an introduction to the subject but the authors have attempted a professional treatment of the subject of soil surveys and classification with a view to acquainting the readers with the concept of a three-dimensional body. Vast as the subject of soil and water management and crop production is, it is physically impossible to give an exhaustive treatment in these few pages to any of the aspects than what the authors have attempted. They have made an attempt to give a number of examples from practical local experience and have also included certain aspects of production of high-yielding varieties. The book may be found useful in arousing interest of sub-professional and the farmers in various intricate problems of soil and crop management.

—DR JS KANWAR

SOIL AND CROP PRODUCTIVITY by SV Govinda Rajan and HG Gopala Rao, Published by: Asia Publishing House, Bombay Pages 313. Price Rs. 30.

SOCIAL SCIENCES AND PLANNING IN INDIA Edited by Dr Radhakamal Mukerjee, Published by Asia Publishing House, Bombay. Pages 208. Price Rs. 28.

The main purpose of the authors in writing the book on Soil and Crop Productivity seems to be to provide information for the use of workers in agriculture extension, vocational agriculture and farmers. Thus, it is written more from the point of view of a layman and a sub-professional farmer. The authors have clearly and simply made an attempt to make it clear that the study of properties of soils—both in respect

The almost universal quest for progress in the present times, is in essence a revolution which has no precedent in history. Perhaps, it is fired by rising aspirations for economic, social and political progress based as it is upon the optimistic conviction that man, in this century, can move forward by leaps instead of steps. Today the slogan with every country is 'development'—a term which connotes various meanings.

For instance, in some countries it means industrialisation while in others it symbolises the achievement of independence, politically and economically. In not a few of them it encompasses opportunity for education, the construction of a huge dam, the building of skyscrapers, steel mills, television networks and so on. To the social scientist everywhere it means the total transformation of the society for the maximum good of the maximum number.

No wonder then that the sociologists and political scientists tend to think of development as the process of modernisation while concentrating attention primarily on the transformation of social and political institutions. On the other hand, economists tend to equate modernisation and development with economic growth. As peripatetic observers, however, all stand convinced that the world-wide aspirations for development are much more than a mere desire for economic progress. When the economist analyses development exclusively within a framework of economic criteria, he tends to ignore the limits set by the other goals of the society. And if he takes everything into consideration, he falls into a quagmire of confusion.

It was a dilemma of this type that was sought to be discussed and thrashed out by the social scientists, economists, politicians and administrators at a Seminar held on 'Social Sciences and Planning in India' in 1965 at Lucknow. The present book under review contains papers presented by the participants at the Seminar. The 26 papers covered by the book have been grouped under two broad heads. The first part deals with social theory in the context of planning and the second part with the applied side of planning for communication development. However, the two parts are not really mutually exclusive.

No one will dispute with Radhakamal Mukerjee when he refers to planning as a consciously designed advance towards a new social and economic order. Pointing out the deficiency of 'social investments' in our planning process, he makes a plea that all social sciences should provide targets of social goals and optima to be

implemented together in order that progress may take place in the desired directions. For example, education at all levels, the technical know-how in all sectors of life, limitation of family size, austerity, economy and spirit of sacrifice among upper income groups and social equalisation are all to be regarded as essential goals in planning as industrialisation itself would be.

Professor Mukerjee finds that Indian planning has not given serious attention to institutional changes. Only the proper type of institutions in different sectors of economy can condition people to new egalitarian values and virtues and not pious appeal to generosity and nobility of character. For instance, the simultaneous establishment of a minimum floor or level of income and standard of living for all people, and a ceiling for all income requires a good deal of institutional readjustment. Without such considerations, development must inherit imbalances and disharmonies causing social maladjustment and confusion. Besides, according to him, the gravest lacuna of the present economic planning in this country is that it does not cater to the needs of about one-fifth of the Indian rural population, represented by the landless class and holders of undersized holdings who also belong to the underprivileged castes. One way of bringing about institutional reorientation is by the establishment of technical workshops throughout the country for the cultivation and dissemination of applied science and technology. The upshot of Radhakamal's thesis is that economic planning has to be consistent with the totality of goals and values of social progress that must be democratic and universal enough to arouse the social and political idealism of the people. As such, emphasis on true manpower planning or human resource development in the widest context has to be given top priority.

In his paper on conditions of planned development, Prof. Baljit Singh stresses upon the need for improving human capital. He refers to the progress made by the United States where education and advance of knowledge have been more important factors in the prosperity of that country than mere capital that contributed less than 20 per cent to its rate of growth. In con-

trast, educational development accounted for 23 per cent of the growth rate of its aggregate national product and 42 per cent of the growth rate in product per person employed. Taking the two together, their contribution comes to more than two-fifths of the growth rate between 1929-57 which is more than that of any other single factor including the increase in labour force. By 'advance of knowledge' is not meant academic knowledge, rather the application of changing technology, new production functions that help deliver the goods. Another contributor Dr VB Singh examines the process of planning as a tool for bringing about socio-economic changes by widening the net of the public sector. The remaining contributors have dealt with particular aspects of social changes in the context of Indian planning.

The consensus at the Seminar seems to have been that economics alone could not deal with the entire range of factors and trends involved in the total process of social and cultural transformation. The Indian plan and policy should accordingly work in close association with the total knowledge in the realm of the social sciences. Particularly in the agricultural sector lack of adult education, inequality in incomes, caste and class antagonism, absence of unison of public opinion, etc., are the major impediments to planned progress. There being no alternative to a systematic social planning, the participants pleaded for administrative reforms along with a tripod-liason of the policy-maker, administrator and the social scientist.

It is, however, difficult to agree with the view expressed and endorsed at the Seminar that civil servants are not competent to implement social welfare schemes. I, for one, do not find any reason why our administrators, given appropriate training and insight, should fail in the task of administering social schemes. No doubt, guidance from social scientists is useful and if the policy and programmes are competently framed by our economists and social scientists, the civil service would certainly be in a position to deliver the goods.

In sum, the grand cybernetics of social sciences have been abundantly exposed as the main

vitals of planning machinery. A good insight can be had from the various papers on the basic ills with which the planned socio-economic development of the country suffers today, viz., the lack of appreciation of the values and ideals culminating in social maladjustments and inconsistencies on various fronts.

—NAVIN CHANDRA JOSHI

OUR SOCIETY: CONFLICT & COHESION
by Lokaranjan Das Gupta, Published by Indian Associated Publishing Company (P) Ltd., 93 Mahatma Gandhi Road, Calcutta-7, Pages 64. Price Rs. 7.

The world at large is undergoing a transformation of great significance. Not only the much discussed and hotly debated concept of 'generation gap' but also the 'intellectual vacuum' and lack of genuine concern for the humanity appear to be important factors contributing to the present state of bankruptcy and brinkmanship among the leaders of certain Governments in the world. When thousands and thousands of innocent men, women and children are slaughtered, whether it is in Viet Nam, Cuba, or nearer home, in Bangla Desh, in the name of protecting certain undefined cause, barring a "mad philosopher" here or a virulent Professor there, there does not appear to be any systematic and calculated attempt by intellectuals on a wider scale to understand and present a blue-print for action.

It is really unfortunate that the concept of patriotism has now tended to border on narrow parochialism. In this process has been lost consideration for humanity and fellow feeling. A man brutally murdered in Bangla Desh is no less important than a person subjected to the same treatment in the United States or in the Soviet Union. The lack of such a wider perspective has been instrumental in one way or the other for great wars or conflicts in the history of nations. Perhaps there is an inverse correlation

between scientific advancement and rational thinking.'

If this is the situation in the world as a whole, the position is no better in India. In India intellectuals do not just play their role in the social change that is taking place in the country and its long-term impact on the nation. Since independence nobody can contest the fact that there is a distinct awakening among the people. The great expectations which were raised in the wake of the attainment of freedom remain to be fulfilled. At the same time a limited number of persons are seen to be the beneficiaries of economic planning and industrial development. The spectrum of change and what Nurkse called 'demonstration effect' act and interact. The cumulative result is frustration and discontentment all round. It is the duty of the intellectual to understand and interpret these phenomena, without leaving them to the politicians alone. In fact, it is the former who should properly guide the latter in taking corrective measures, whether or not the politicians listen to reason and administer medicine in the manner desired. Unfortunately, in India except a few dedicated social scientists, many of them have joined the band wagon of politicians, and in the process they are neither intellectually honest nor politically competent.

Without casting aspersions on anybody, the intellectuals in this country may be grouped broadly under three categories: (i) Those who sit in the ivory tower and are generally indifferent to what is happening around them; (ii) those who play to the gallery and belong to one political group or the other; and (iii) those who are preoccupied themselves in the politics of the campus. Small wonder except paper reports and a few well-reasoned articles by columnists of the national Dailies, no attempt has been made to understand what is happening in West Bengal and present an objective appraisal of its wider implications on this sub-continent, for that matter, on the world at large.

Mr Das Gupta has therefore done a signal service to put down his random thoughts, and reflections in the book under review. His main

thesis seems to be that "there must be greater awareness of the pervasive character of the change that is sweeping the foundations of West Bengal and India. It may be too short-sighted to miss or neglect the all-India base of West Bengal developments." The under-currents are common. Are we really aware of this? What do we do with such awareness? Mr Das Gupta has sought to analyse these questions and in his own way arrives at certain tentative conclusions.

As the author himself admits, the analysis is in certain places value-biased and confused. Yet it is presented as candidly as possible with an admixture of arrogance and humility. Mr Das Gupta should be congratulated for his frankness, and at times if his analysis tends to read like opinions and *obiter dicta* statements, one is inclined to feel that it is because of his concern for the society at large and his intellectual honesty to put down what he feels about it.

The publication should evoke further discussion among the intellectuals in the country on whom Mr Das Gupta, rightly too, puts a heavy responsibility in the process of social transformation that is under way.

—KSV MENON

LECTURES ON COMPANY LAW: by **SM Shah**, Published by **N M Tripathi Pvt. Ltd.** **Bombay, 16th Ed. (1971).** Pages: 461+i—cccliii, Price Rs. 24.

Company Law in recent years has become a subject-matter of interest not only for lawyers but also for informed public. All over the world there is a controversy between the "preservationists" and "reformers" as one observer has aptly described. In a way both the sides in the controversy favour change. While the reformers want to change the very basis of Company Law, making it more concerned with the relationship of the corporate body with the social environments in which it operates, its responsibility or accountability to a host of interests other than shareholders like the consu-

mers, the workers and the community at large, and the manner in which this relationship is to be reflected in the legal framework, the former also want a great deal of "tidying up" of the present Company Law with regard to such things as the powers and positions of shareholders or of the chief executives. Underlying the need for this change is a growing recognition that the character of Company Law itself is undergoing a vast change. From having been a narrow legal instrument for ascertaining the rights of the shareholders and creditors, it has become today a fundamental instrument of public social and economic policy.

In India, in recent years, we have perhaps gone much ahead of the rest of the world in emphasising this new role of Company Law. In its working in India today Company Law impinges on the development of the country's economy and that explains why not only lawyers, but legislators, businessmen and public officials are taking such deep interest in Company Law.

The latest edition of Mr S M Shah's lectures on Company Law, by no means unfamiliar to students of Company Law will be generally welcome. The one point which has earned for Mr Shah the name of a reputed author on Company Law is his approach which combines, on the one hand the teaching points for the beginner, and on the other the elaborate references to established judicial precedents. The very fact that his book has now seen through the sixteenth edition is a tribute to his handling of the subject and his lucidity of expression in a rather complex field like Company Law. Putting the bare Act separately from the lectures which carry the necessary references to the appropriate sections introduces the advantage of a commentary while eliminating the disadvantage of interrupting the train of thoughts necessary for a systematic treatment of specific topics on Company Law. Elaborate references to all important English and Indian decisions reported till the end of 1970 and the necessary references at appropriate places to important points of difference between the two Statutes add value to this new edition.

In this present edition, another improvement which has enhanced the value of Mr Shah's book is the provision of distinctive sub-titles in

various topics covered by the lectures. Besides, a well-prepared index at the end of the book brings this publication upto international standard. There is no doubt that this new edition will find a place in the shelf of everyone seriously interested in the study of Company Law. Unfortunately this book like any other Indian books written on Company Law does not contain any discussion on the new role which Company Law is expected to serve as an important instrument of Government's social and economic policy. It is hoped that Mr Shah will remove this lacuna in the next edition.

—NK SEN GUPTA

MANAGEMENT ACCOUNTANT by Asim Kumar Sengupta, Published by Academic Publishers, Calcutta-9. Pages 494. Price Rs. 30.

Management Accountancy is comparatively a new subject and as such it is yet to define its domain, scope and role rigidly. This is reflected in variance of coverage given in the books published on the subject. But one point has crystallised that the Management Accountant's job is to advice top management and this entails him understanding of business problems, analyse them, present and interpret relevant data in a way that decision-making becomes an easier task.

Mr Asim Kumar Sengupta, himself a practising Management Accountant, has presented different aspects of Management Accounting and the background facts for decision-making in a lucid way. Proper emphasis has been given on practical illustrations. Exposition of certain topics, Fixation of Profitable Sales Mix, in particular, is brilliant.

A detailed discussion on Inter-Firm comparison, with a fully worked-out example, and an elaborate discussion on capital budgeting would have been more helpful. A chapter on Corporate Planning could also perhaps have been incorporated in the book.

Written in Indian background with illustrations taken from Indian Industries adds to the value of the book. The book will be immensely

useful to the Managers, Accountants and the students of Management Accountancy.

—NC CHAKRAVORTY

PERSPECTIVE MANAGEMENT by Prof. Varanasy K Murty, Published by: Lalvani Publishing House, Bombay. Pages 287.

The present book 'Perspective Management' by Professor Murty is an attempt at developing a conceptual framework of management in terms of Planning, performance and development. The book has been written in three parts; Parts 1 and 2 discuss the management functions in terms of planning and performance. The planning process in part 1 is discussed in terms of strategy formulations, programme budgeting and resource budgeting. Part 2 deals with the economic performance, management information system and organisation structure. Part 3 deals with the skill needed by the Manager and how such skills could be developed. The whole process of management development is examined in great detail and both exposition and analyses are good.

Thus, the whole book covers a wide range of subjects starting from the strategy planning to the philosophy of Management. Professor Murty has tried to elaborate the subjects by illustrations and charts. The charts on management perspective business systems, management information system etc., find a place in the book. Detailed discussions with case illustrations has been also given, wherever necessary.

Analyses of the chapters will show that an attempt has been made by the author to discuss the subject of management perspective in great depth and the various suggestions given by the author have been supported by the charts. The chapters given in the book are basically intended for Post-Graduate students in Management Studies. Therefore, they are too academic in

nature and too complicated for lay manager without formal education to understand. The principles of management are one thing and to see how these can be put into practice by managers, who are having no formal education, is something else. In so far as practicability of the suggestions is concerned, the book suffers. On the other hand, the author has made an excellent exposition of the management subjects.

The present book is another landmark in the management literature, and can be of particular interest to Universities and those interested in management education. Although it suffers from practicability, the book may be found useful by academicians and research students on management studies. The exposition, the analyses of the subjects covered, the get-up, are excellent.

—DR. NAU NIHAL SINGH

PRODUCTION ENGINEERING Published by Asian Productivity Organisation, Tokyo. Pages 148.

"Production Engineering" is a training manual published by Asian Productivity Organisation as a guide to trainers in Production Engineering. The book is organised into two parts: (1) Production Engineering Course by Benjamin W Niebel and (2) Mechanical Engineering Training Manual by Maurice S Gjesdehl. The book was prepared as course outlines for the annual Production Level Engineers Training (PLET) course conducted by Asian Productivity Organisation.

The authors of the book are eminent professors of the Pennsylvania State University, who were on the faculty of the PLET course. The authors are well-known authorities in Production Engineering. In fact, the books "Designing for Production" and "Motion and Time Study" by Professor Niebel have been considered as advanced readings in Production Engineering. The book on Designing for Production is a must for every Production Engineer.

In the part one of the present book Professor Niebel tries to discuss the 'Production Engineer-

ing' as a Product Cost Improvement system and unfolds one by one the proven techniques in aid of cost improvement. The contents include: product cost improvement; competitive cost comparison; standardisation; materials analysis techniques; utilising supplies; manufacturing planning; manufacturing systems analysis; motion analysis; engineering budget standards; physical review of facilities; and productivity improvement. The chapter on Manufacturing Planning is the most elaborate one and is of good interest to Methods Engineers. The other chapters are mainly outlines of lectures.

In the second part of the book Prof Gjesdhel mainly discusses the importance and methodology of developing creative ability in engineers. It covers the subjects like creative methodology, development of engineering skills, and case studies on the application of proven techniques in the field of design and production. At the end of each chapter some exercises are given to be worked out by the participants of the training programme.

The book is prepared as a guide to train the practising Production Engineers to improve their abilities. It is taken as granted that the people who will make use of the book already know the basic technology of production; hence in this book the authors mainly deal with such topics which will integrate engineering with management so that it will help the Production Engineers to apply technology more fruitfully.

The book will be of considerable help not only to trainers but also for practising production engineers in organising and planning production and improving productivity.

—MM JACOB

NATURAL JUSTICE IN DOMESTIC ENQUIRIES by PK Sen, Published by Navaman Prakashan, Madar Gate, Aligarh. Pages 363. Price Rs. 25.

If one wants to see how a subject with highly legal background could be made interesting,

then he may go through this publication on domestic enquiry. The author knows it well that although personnel officers or labour officers should be interested in going through such a publication, it is difficult to sustain their interest unless the book contains adequate case material. The very first chapter, which refers to a number of history-making cases on natural justice and domestic enquiry, cites the example as to how Rama banished his innocent wife Sita on mere hearsay or rumour and thereby denied her the natural justice.

The author feels that the concept of natural justice is as old as the world itself but with the change in the social, political and economic condition, this concept has also changed from time to time. However, he maintains that with all these changes in interpretation of natural justice, the most fundamental point one has to examine is as to how a standard of fair dealing could be maintained at all costs if we are to maintain civilised human values.

Emphasising the necessity of natural justice, the author says: "The conception of 'Natural Justice', as we know today, like man himself, is a product of evaluation. But there is a difference. While the species, homo sapiens as we know him today, can never revert to the Neanderthal type, it is possible for the social and political system in any country to revert to barbarism. That has been the lesson of the twentieth century. When we make our choice, it should be with our eyes open and our wits alert."

After introducing the subject, the author discusses the question of summary termination of service. Citing a number of cases against summary termination of service, he raises a fundamental question regarding conscience. "That employer must have his conscience clear that the action contemplated is just and fair and that malafide intention such as victimisation, unfair discrimination or other unfair labour practice cannot be proved against him."

It has been rightly pointed out that dismissal or removal from service without benefit of enquiry or chargesheet easily lends itself to suspicions of malafide intention or violation of the

principles of natural justice. The author, therefore, advises the Personnel Manager to help his employer with his honest opinion for maintaining better employer-employee relations.

The author deals with all aspects of domestic enquiry, viz., summary of termination of service, preliminary enquiry, chargesheet, ex-parte proceedings, bias in inquiry, discrimination, representation, evidence, findings, punishment, appeal etc. and cites examples or cases either from some court or tribunal or from the industry itself. The problems regarding flaws in investigation or limitations of the system have also been explained through these cases. What impresses most is that the author refers to cases supporting two different opinions which proves that he has a very thorough grasp of the case material. Unfortunately, however, this mastery over the case law makes the reader feel that it is a book dealing more with the cases and examples with very little material both regarding principles of Natural Justice in Domestic Enquiry and also author's own comments on the various points raised in the book. The details of the case material and the findings of the courts or tribunals are often so lengthy that sometimes the reader forgets the linking points of the subject matter. In fact, the interpretations and commentaries of author are too brief and therefore the reader is left to make up his mind on the findings or observations of the case material itself. An expert of the subject like Mr PK Sen could have done greater justice to his readers if he would have elaborated the principles involved in natural justice through domestic enquiries and his own opinions along with those of other experts.

Probably, the author does not want to elaborate these points as he observes in the preface, "Those who have to conduct cases before industrial and other tribunals must also know the finer points of procedure, the likely catches, have sound knowledge of case law and some ready material for reference. It is hoped that the present volume will be of some service to them in these matters." But how can one appreciate those finer points of case law and other complicated matters unless he is well conversant with the principles of domestic enquiries? In fact, the

author will do a great service by adding a separate chapter dealing with principles and the origin of the domestic enquiry procedures when the second edition of the book is published.

Excepting the only limitation as mentioned above, the book is a valuable contribution in the field of Industrial Relations and Personnel Management and will prove to be of great assistance to the members of the legal profession, Industrial Relations Officers, Labour Welfare Officers and also to Trade Union officials.

Keeping in view the price of the book (Rs. 25/-), the get-up and printing is not very satisfactory. Such a standard book should have received greater attention and care in production and printing by the publishers and the printers.

—DP UPADHYAY

INDIAN FOLK ARTS AND CRAFTS by Jasleen Dhamija, Published by National Book Trust, India. Pages 115. Price Rs. 7.25.

The book is a window on the Indian skill and creative arts, and beautifully presents an outline of the richness of India's folk art and craft tradition. It spotlights many aspects of the folk arts and crafts, their legends and myths which are little known.

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The book will go a long way in creating an awareness amongst our people of our cultural heritage and tradition as exhibited in our folk arts and stylized crafts. It will also attract a good many foreign buyers who are anxious to buy our handicrafts for their home market and thus boost our much-needed foreign exchange earnings.

—HARKIRAT SINGH

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Quarterly Journal of National Productivity Council

Productivity is published quarterly by the National Productivity Council of India.

Editorial & Business Offices : 38 Golf Links
New Delhi-3 (Telephone : 619102)

Subscription :

(including postage by Surface Mail)

India : Rs. 12
U.K. : Sh. 20
U.S.A. : \$ 5

Communications : Change of address correspondence regarding subscription service, or subscription order to Superintendent, Business Management, 38 Golf Links, New Delhi-3. Change of address notices should be sent promptly, indicating old as well as new address.

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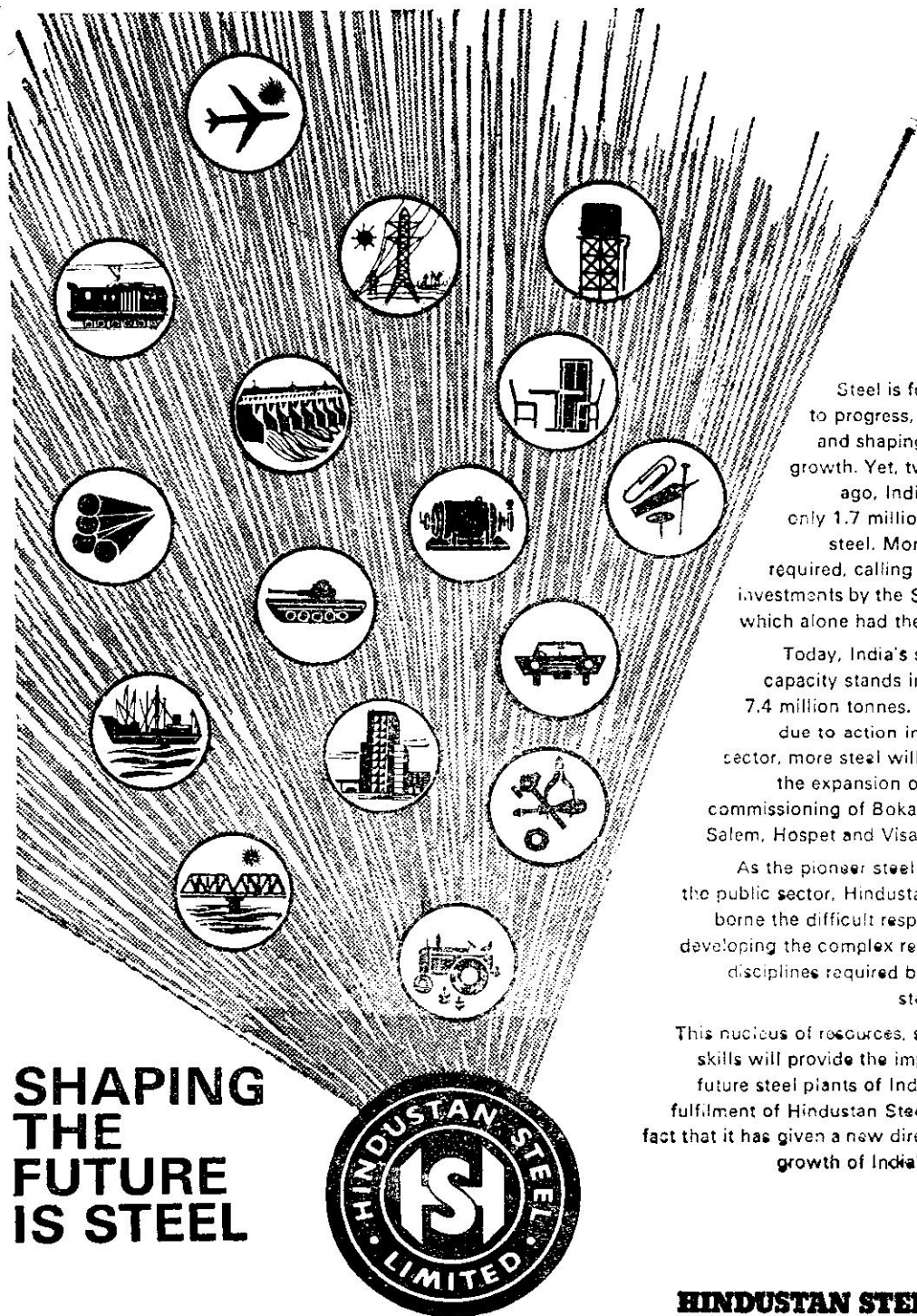
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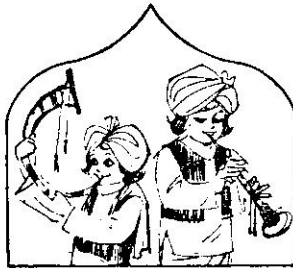
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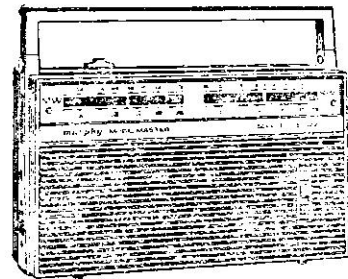
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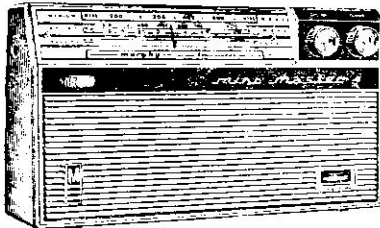
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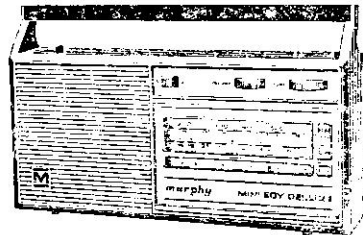


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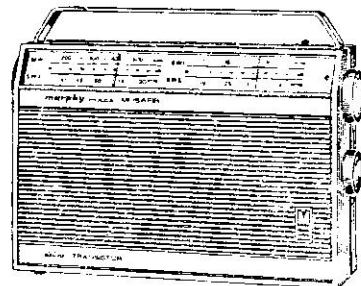


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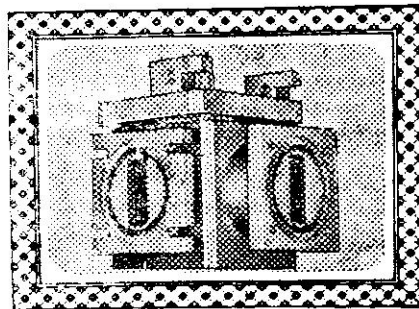
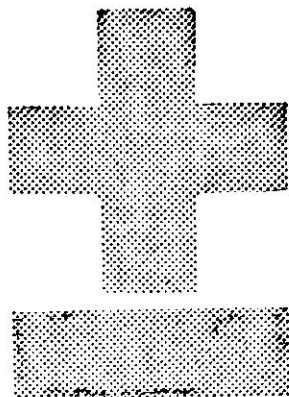
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Statement about ownership and other particulars about Newspaper PRODUCTIVITY to be published in the first issue every year after last day of February.

FORM IV
(as per Rule 8)

- | | |
|--|---|
| 1. Place of Publication | <i>New Delhi (38 Golf Links)</i> |
| 2. Periodicity of its publication | <i>Quarterly</i> |
| 3. Printer's Name | <i>V. S. Chopra</i> |
| (Whether Citizen of India?) | <i>Yes</i> |
| Address | <i>38 Golf Links, New Delhi-3</i> |
| 4. Publisher's Name | <i>V. S. Chopra</i> |
| (Whether citizen of India?) | <i>Yes</i> |
| Address | <i>38 Golf Links, New Delhi-3</i> |
| 5. Editor's Name | <i>V. S. Chopra</i> |
| (Whether Citizen of India?) | <i>Yes</i> |
| Address | <i>38 Golf Links, New Delhi-3</i> |
| 6. Name and addresses of individuals who own the newspaper and partners or shareholders holding more than one per cent of the total capital. | <i>National Productivity Council
38 Golf Links, New Delhi-3</i> |

I, *V. S. Chopra*, hereby declare that the particulars given above are true to the best of my knowledge and belief.

Sd/- VS Chopra
Signature of Publisher

Date: *1st March, 1972*

PRODUCTIVITY

Quarterly Journal of National Productivity Council

Productivity is published quarterly by the National Productivity Council of India.

Editorial & Business Offices : 38 Golf Links New Delhi-3 (Telephone : 619102)

Subscription :

(including postage by Surface Mail)

India : Rs. 20

Foreign : \$ 10

Communications : Change of address, correspondence regarding subscription service, or subscription order to Superintendent, Business Management, 38 Golf Links, New Delhi-3. Change of address notices should be sent promptly, indicating old as well as new address.

Articles for Publication : The Editor invites well-written contributions by way of articles and suggestions for improvement of productivity in

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