The Eternal Flowline of Productivity

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Eternal flow of productivity primarily arises from self-awareness and nature of man as described in the Gita.

Productivity is largely a function of human factor. Management literature embodies several techniques to optimally utilise this factor. Participative management forms a major technique to mobilise human efforts towards productivity. Other measures, as visualised by the author, relate to creativity, reward, reduction of constraints, training, learning environment, group thinking and value system. The manager applies these measures in four areas : conceptual, decision making, operative and service. Finally, the vital factor responsible for eternal flow of productivity involves the concept of self-awareness and nature of man as embodied in the Gita.

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The declaration of the year 1982 as "The Year of Productivity", by Government of India at this juncture of Industrial era, has been the most momentous, when the country is spending very large amounts of money to produce more and more of national wealth.

When large amount of money is invested, it is very natural of any investor to expect high rate of return, which could not be obtained without proper productivity, direction and control of the efforts in its totality and individuality. Such concerted efforts for the productivity are required in each organisation either public or private sector, or Government, and at each level from the lowest administrative unit to the highest.

The major thrust of production of national wealth comes from the Industrial sector. Here it is important that each individual, at either level of the enterprise from worker to the chairman of the Board of Directors, has to function as a united team towards achievement of prosperity of the country through higher productivity.

Understanding Productivity

The concept of productivity has been examined lucidly by John F. Kennedy in these sentences :

> "Manpower is the basic resource. It is the indispensable means of converting other resources to mankinds' use and benefit. How well we develop and employ human skills is fundamental in

deciding how much we will accomplish as a nation".

It is notable in this 'quote' that human factor is mainly responsible for proper utilisation of all the other factors which contribute towards productivity. 'Productivity' is a measure of how well resources are utilised to achieve organisational objectives. Productivity in simpler words means increased production per unit of input.

The mechanics of raising productivity does not merely relate to techniques but is necessarily a matter of proper motivation of *human factor*. Productivity is largely a function of attitude of labour, management and unions. The human relations, behavioural and social approaches have significantly amended the management thinking during the last two decades. There was a swing in pendulum from one extreme of technological imposition where machines assume superiority to the other extreme of behavioural approach where the importance of human factor was rightly emphasised.

Today, many aspects are involved in the task of measurement of productivity which is a quite difficult task because of the complex situations of equating output and input under a common scale. The following are major facets of productivity :

productivity of capital;
machine productivity;
efficient use of raw materials;
use of better and improved technology;
productivity of scarce resources, e.g.;
power (energy), fuel, water, etc.;
managerial productivity;
organisation development.

Professional Excellence Through Productivity Techniques

The different ways of improving productivity along with their attendant systems and techniques known to management science are as follows :

management control;
personnel management;
method study;
value engineering;
materials management;
production planning and control;
preventive maintenance;
financial management control;
maintenance management;
PERT/CPM;
linear programming;
training & development;

It has been experienced that improvement in productivity can be achieved by effective managerial leadership, organisation structure and systems. Decision making ability also plays a key role in improving productivity. Further, productivity is markedly affected by workers' willingness to work efficiently. Finding out how to influence that increased effort choice would yield more productivity per labour-rupee. If we could find out what encourages harder effort, we could design or redesign jobs to incorporate such features and make those jobs more satisfying. Finally, performance is said to depend on two factors, motivation and ability. High motivation but low level of ability yields low performance; high ability but low motivation yields low performance. We can screen out people with low levels of job-related abilities. In addition, we can also train those with low abilities to improve their skills. But motivation is difficult to assess, measure or determine; motivation is less open to objective control but plays an important part in creating performance and hence productivity.

The main issues in the process of

productivity improvement include the following :

quality of management, quality of leadership and their attitudes towards their workforce.

motivation of workers, and attainment of full co-operation of workers in the drive for higher productivity.

quality of labour, his willingness in the application of his knowledge and skill and adaptability to given task.

Improvement in productivity can thus be obtained mainly through people for the prosperity of people.

Productivity – A People's Domain

The changing nature of the workforce is exerting a profound and continuing impact on managerial applications and strategies. We know that management techniques are predicated on a model of the nature of individual. As individuals in our post-industrial society continue to evolve and manifest new characteristics, needs and motivations, new managerial applications will continually evolve in response. Tried-and-true management tools will accordingly become obsolete and ineffective.

Productivity Through Participation

Granted that infusion of sophisticated technology has increased labour productivity besides machine productivity, but such increases have been the result of collective bargaining with people.

It has now become a common practice to incorporate productivity clause in the proposals in the management's charter of demands during the wage negotiations with union. The issues and problems of productivity of labour are resolved in these bilateral negotiations between union and management. In this process, inevitably, the management has to incur certain monetary costs in the form of benefits to workers to secure an increase in productivity. This is even sometimes termed as *Sharing the gains of productivity*.

Productivity bargaining can also occur irrespective of the general agreement with union on plant basis and can be entered into with individual departments when method or technology is changed or in the process of modernisation and expansion of certain departments.

The effectiveness of "Productivity bargaining in an industrial unit lies on relative strengths and skills of the bargaining parties". Development of negotiating skills, therefore, forms a vital factor for all managers.

Productivity Bargaining has thus acquired enduring status in most of the industries and is perhaps treated as the most desirable situation in the present industrial relations climate. The following factors are thus, responsible for the attainment of an effective productivity bargaining plan :

1. Dedicated firm commitment of the management to productivity improvement.

2. Clear concept, scheme of measuring productivity and linking productivity with payments.

3. Management's preparedness to share gains of productivity.

4. Management must be willing to incorporate the necessary improvements in working conditions.

5. Line management's alertness and preparedness to exercise its supervisory authority judiciously and firmly.

6. Creating a productivity bargaining situation at different levels, i.e.,

   (i) on shop-floor-between worker and supervisor.

(ii) at production management level-union committee and line management.

(iii) at plant level-union and management.

7. Executive and supervisory training programmes in the company or outside imparting necessary behavioural and other managerial skills required for effective productivity management.

In the words of V. V. Giri, an eminent leader in Indian labour movement, the desirability of collective bargaining can be summarised as follows :

"Internal settlement is a tonic, whereas compulsion from outside is a bitter medicine to be taken only in emergencies. Voluntary negotiations, conciliation and arbitration, i.e., collective bargaining is far more superior and therefore, desirable than compulsory conciliation and adjudication".

What Else Stimulates Productivity

In addition to participation, I visualise, there are several other factors conducive to productivity in a growing economy. These factors include creativity, reward, constraints, training, learning environment, group thinking and values.

1. Creativity

The process of organisational change requires an organisational planning where the top managers have to be careful in analysing the linkages in the group which are source of stresses and conflicts. Unless conflicts are not there, there is no scope for creativity. Hence, the linkages are the sources of creativity There must be a planned emphasis on different links to provide congruence of individual and organisational goals.

2. Reward

There must be an optimal response so that results of productivity by an individual or an organisation are perceived. The system of response should have a reward system, which can be operated with ease and judiciously.

The recent introduction of awards of productivity at national level and at state level of Rajasthan by National Productivity Council is an addition to the total system, where rise in productivity, in a measure, will become an instrument for rewarding the individual and organisational efforts.

3. Reduction of Constraints

There are always administrative constraints for innovation to happen in any organisation. Similarly, there exist other constraints including cultural, habit-oriented and traditional among superiors and subordinates of the organisation. Therefore, a self-correcting mechanism should be formed by the top management to minimise these constraints.

4. Training

A desire for learning should be inculcated in each person as well as proper training programmes should be organised on need basis. External training helps sometimes, but real training lies in one's own experience, which should be supported with job rotation, job enrichment and certain in-company training programmes. In-company training is more beneficial as it relates to the company itself. The training theme should relate to human skills along with professional skills in suitable ratio as per layer of the manpower under such exposure. The aim of training is to create a learning environment. The real skill is the skill of actions, i.e., the skill of implementing the decisions. All training should aim at this goal. It is this skill, which is instrumental for increase in productivity.

5. Learning Environment

An important and integral system in the Industrial setting is a body of unions or associations. As far as demand is con-

cerned, it is not disputed because there must be somebody who advocates the needs of the people. But they should also support the objectives of the organisation so that the industrial growth via individual productivity which is highly proportional to the discipline is also achieved. Thus, they should inhibit any activity causing production losses like stoppage of work, strikes, etc., because it is anti-social.

6. Group Thinking

The business organisations require a group thinking, where industrial leaders have to provide homogeniety in thinking, designing, operating and controlling the system of organisational and individual communications.

The group thinking process helps to stop external environment's pressures which may act as barriers for productivity. From people at top unto the shop-floor supervisor, the people should be imaginative to promote the group thinking.

7. Values

The productivity is the resultant of integrated and coordinated activities. Each activity must be charged with a high team spirit. High team spirit and performance goals call for a display of certain personality traits among individuals.

Sincerity, honesty, thoughtfulness and devotion are pre-requisites of any productive system. At the time of provocations or upsets in industrial relations, it is only the sense of duty and devotion that will help in controlling the situation and in easily tiding over the difficulties.

All persons engaged in industry are expected to act as human beings to show normal courtesy and respect while dealing with their superiors, colleagues and subordinates in the discharge of their respective duties. They should not only display tolerance and ability to listen to others patiently but should also inculcate this spirit among those who work with them. Every officer should, as far as possible, meet the needs of his subordinates for recognition, development and job satisfaction.

Truthfulness is an unavoidable trait in a good officer. He should, by his own example and action, bring out in his subordinates and people around him the habit of speaking truth and admitting mistakes, if any. Truthfulness always pays : *Satyameva Jayate.* Admitting mistakes helps the individual to improve one's own image.

People should observe regularity and punctuality assiduously. If one is not punctual, his work will remain in arrears and may result in colossal loss to the unit which provides him the means of his living. It, indeed, sets bad example to others, if superior officers are not punctual. This is in my opinion, the greatest barrier to productivity.

Identifying Key areas for action

After discussing the concepts of productivity as known in the Management Science today, and my certain random thoughts, I feel that there are four key areas in the managerial behaviour-action syndrome.

1. Conceptual area
2. Decision making area
3. Operative area
4. Service area

Any individual in the business of production of wealth either in private business, industrial business, or at home, functions, in the above four areas, all at a time; let us examine each area of action-behaviour.

1. Conceptual area

Behind any activity there are ideas. These ideas can be converted into action only when a person goes into process of self-awareness with a unity ratio of his levels of aspiration and capacity to achieve the same. He possesses a trouble free mind

and a healthy body, where he can over-come stresses of system while discharging his duties and responsibilities at the cost of comfort. He possesses an autonomous mind without prejudice and illusions. He has candid communications with courtesy and respect. He allows people around him to do mistakes and excuses them, when it is accepted by the doer and the mistake was a part of his job for organisational objective. On the top of all, he possesses thorough specialised knowledge of trade, discipline and keeps them up-to-date with learning throughout life.

2. Decision making area

He attacks any problem with strong determination to meet the challenge with cool disposition and internal strength of conceptual area with knowledge of skills in technology and human behaviour. He weighs the probable solutions keeping his own emotions and sentiments away, and pre-judges the overall effect of a probable action with respect to productivity of all components of system. He acts with full patience and absolute sense of "timings" of the action, which holds the key of the productivity. The decision making involves an attitude of developing the systems and the people, and a consideration of pursuing growth through 'Innovation'.

3. Operative area

There is a consistent and judicious use of resources for maximum production without interruption. There is a proper maintenance and development of resources of business. Targets are met, which are continuously thrown upwards commensurate to the demands of the society. The creation of money is engineered for further growth of organisation and nation. Growth is shared with the exchequer, consumer and the employees. One should remember that he has to serve the society as an humble servant.

4. Service area

There are many multiple functions for business, how soever insignificant, which contribute to overall productivity. These functions range from conceptual decision making to operative areas. The service area has its own importance in raising the productivity.

The Gita's Message for Productivity

The demands of modern business are met through productivity in the above areas from one individual himself. Each group should produce more than the arithemetical total of individual productivity.

The Gita in its totality tells us that the contribution for productivity in all the above areas is directly proportional to *self-awareness*. The self (ATMAN) has three parts; body, mind and intellect; where body perceives, mind feels, intellect thinks and contemplates in order to face the reality. That means a person should not react with mind emotionally but think, contemplate an act as per reality through his intellect which is defined as power to discriminate. The intellect is *Viveka*.

The Gita also says that there are two types of men. One aggressive, and the other passive. Both passive and aggressive have two parts, aggressive goodness and aggressive badness; passive goodness and passive badness i. e. there are four types of men.

The passive bad man functions as per fancies of his mind without intervention of his intellect. The passive bad man is one who is involved in doing wrong, immoral activities but does not intend to be so. Passive good man is involved in a way of life, which happens to be moral and benevolent. Such unintelligent benevolence at times proves detrimental to community and himself.

The aggressive bad man is one who intends to be bad. He wilfully and viciously manipulates and manouvres without scruples satisfying his ego and egocentric desires.

The aggressive good person is one

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Measuring Total Factor Productivity

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How total factor productivity and efficiency measures can be obtained for industrial sector.

Total factor productivity approach can be mathematically derived from production function. The measure of total factor productivity was suggested by Kendrick. Jani and Jaiswal modified this measure in 1976 and also suggested an efficiency measure for industrial sector in India. In this paper, the authors have attempted to further modify these measures keeping in purview the available data for organised industrial sector in India. The new measures suggested by them are tested empirically by using Annual Survey of Industries results (Census Sector) for Gujarat State which forms one of the Industrially advanced state in India.

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Defining Productivity Measures

Productivity is defined as the ratio of 'output' of wealth produced and the 'input' of resources used up in the process. Of course, the concept of productivity mainly depends upon the purpose of investigation and the input factor in purview Generally, labour and capital are the major inputs in any industrial sector. But labour can further be classified as skilled labour and unskilled labour. Likewise capital can further be classified as investment after fixed assets, expenditure after raw material, value of fuel consumed, etc. Obviously, with the help of partial factor productivity, the effect of single input factor on output can be studied, but while utilizing this measure of productivity a priory hypothesis that the effect of other factors remains constant is left untested. In practice, this hypothesis does not stand, because in any industrial sector, labour and capital are closely related with each other; hence, change in one factor will explicitly affect the later one. The value of elasticity of substitution can give fair idea as to what extent it is meaningful to deal with single factor of input.

The another better alternative of measuring productivity is to work with total factor productivity. Efficiency of any industry gives an idea about the capacity to generate profit in that industry. When we use this measure along vertical line, one can find which industry contributes reasonable share in regional income. If we study this measure along horizontal line, the trend of a particular industry towards profit making can be visualised, and it can be reasonbably predicted whether it is fruitful to invest more money in a particular industry or not.

Kendrick [1] has given the formula for total factor productivity. Jani and Jaiswal [4] have modified this formula, on the ground that denominator of Kendrick's measure is very near to partial factor productivity (capital productivity). In the present paper, an attempt has been made to modifly the measure given by Jani and Jaiswal. While giving the modification of the total factor productivity measure, we have considered all the possible bifurcation of capital, leaving labour as a composite input factor, as the data on skilled and unskilled labour are not available in ASI. However, data on labour according to sex of worker is available in ASI, but we do not consider this type of bifurcation of labour as meaningful, while studying productivity. Moreover data on labour according to sex of workers is not available after ASI—1970. An analysis on the basis of the values arrived at by using the formula developed in the present paper is done for Gujarat State using cross section and time series data.

The Methodology used

For the sake of ready references and convenience, the brief review of methodology used in this paper is presented. The formula of total factor productivity (hereafter it will be referred to as TFP) given by Jani and Jaiswal is

$$(TFP)_{jt} = \frac{V^d_{jt}}{W_{jo}N_{jt} + R_{jo}F_{jt}} \qquad ...(1)$$

where j stands for ith industry and t stands for t^{th} year i. e. $(TFP)_{jt}$ denotes the total factor productivity of jth industry for the t^{th} year.

V^d_{jt} = Value added deflated by the whole sale price index number.

$W_{jo} = \frac{S_{jo}}{N_{jo}}$ (Base year wage rate)

$R_{jo} = \frac{V_{jo} - S_{jo}}{F_{jo}}$ Base year return per rupee of fixed capital

V_{jt} = Value added

S_{jt} = Wages and salaries

N_{jt} = Number of workers

F_{jt} = Fixed capital

They have mentioned that the measures of relative total factor productivity (further this term will be denoted as RTFP) is

$$(RTFP)_{jt} = \frac{(TFP)_{jt}}{(TFP)_{at}} \qquad ...(2)$$

where $(TFP)_{at}$ denotes the total factor productivity of all industries in the region.

Again if $(RTFP)_{jt} = 1$, it suggests that j^{th} industry is normal or standard with respect to TFP. We make the following points on this measure.

(a) If we substitute t=0 in (1) i.e. if we consider TFP for the base year, then TFP of j^{th} industry will be as follows.

$$(TFP)_{jo} = \frac{V^d_{jo}}{\frac{S_{jo}}{N_{jo}} \cdot N_{jo} + \frac{V_{jo} - S_{jo}}{F_{jo}} \cdot F_{jo}}$$

Hence, $(TFP)_{jo} = 1 \qquad (\because V^d_{jo} = V_{jo})$

(b) So far as capital as input factor is considered, the present formula involves the investment after fixed assets like land, building, plant and machinery, transport equipments, tools and other fixed assets, but it does not involve expenditure after raw material and fuels which are basic inputs in any industrial sector.

(c) As proved in (a), we can also show that,

$(RTFP)_{jo} = 1$ for all j

This reveals that every industry in the base year is normal one, this assumption needs some more clarification on the part of industrial structure of the concerned industry for the base year. Thus, there is a case for improving this formula, as it does not give much meaningful conclusions at t=0. We propose the following formula of TFP viz.

$$(TFP)_{jt} = \frac{V^d_{jt}}{P^{(1)}_{jo} M_{jt}} \left\{ \frac{\sum_{1+i=2}^{4} p^{(1)}_j V_{jo}}{p^{(1)}_{jo} M_{jt}} \right\}^{-1} \qquad ...(3)$$

where $p_{jo}^{(1)} = \frac{S_{jo}}{M_{jo}}$ = Base year wage rate.

$p_{jt}^{(2)} = \frac{R_{jt}^d}{V_{jt}^d}$ and $\left[p_{jt}^{(2)} \right]^{-1}$ is raw material productivity.

$p_{jt}^{(3)} = \frac{f_{jt}^d}{V_{jt}^d}$ and $\left[p_{jt}^{3} \right]^{-1}$ is fuel productivity

$p_{jt}^{(4)} = \frac{F_{jt}^d}{V_{jt}^d}$ and $\left[p_{jt}^{4} \right]^{-1}$ is fixed capital productivity

R_{jt} is the expenditure after raw material, f_{jt} is value of Fuel consumed in production process and M_{jt} is number of man-hours utilised in production. Subscript d stands for deflated values. Whole sale price index numbers for various inputs and output are the price deflators. The rest of the notations and subscripts are already defined earlier.

This measure of $(TFP)_{jt}$ has following characteristics.

(1) At t=0 i. e. for the base year

$$(TFP)_{jo} = \frac{V_{jo}}{S_{jo} + R_{jo} + f_{jo} + F_{jo}} \quad ...(4)$$

So, (4) is identical with standard concept of TFP i. e. it reveals the standard form: output/ all inputs.

(2) It emphasises on all the possible bifurcation of capital also.

Needless to say that it is not necessary to presume that every industry is standard or normal in the base year.

Further, Jani and Jaiswal have given the formula of efficiency (E) of jth industry for time t as

$$(E)_{jt} = \sqrt{(LP)_{jt} \cdot (CP)_{jt}} \quad ...(5)$$

where $(LP)_{jt} = \frac{V_{jt}}{S_{jt}}$ = Labour productivity ...(6—a)

$(CP)_{jt} = \frac{V_{jt}}{C_{jt}}$ Capital productivity ...(6—b)

Using (6—a) and (6—b) for (5) we get

$$(E)_{jt} = \frac{V_{jt}}{\sqrt{S_{jt} \cdot C_{jt}}} \quad ...(7)$$

Where C_{jt} denotes productivity capital

We make tne following comments on the use of this measure.

(a) Formula given by (7) reveals that it includes productive capital in denominator. According to the Annual Survey of Industries, productive capital comprises of fixed capital and working capital. Working capital can be again divided into physical working capital and the resultant effect of amount payable and amount receivable. Many times it does happen that amount payable is greater than amount receivable. Consequently, working capital comes out to be negative. In the industry which does not require much investment after fixed assets, productive capital comes out to be negative, which should not be in fact so. Hence, denominator of (7) can not be treated further mathematically in such situation. Moreover, the negative value of capital is not theoritically justified by Economics.

(b) The measure given by Jani and Jaiswal involves the total effect of capital and labour. There is a case of generalization of this measnre, which may include all input factors in the denominator for which data are available.

(c) The efficiency measure given by Jani and Jaiswal gives equal importance to labour and capital. Suppose, we intend to study the efficiency of various industries using cross section data, it may not give sound picture of the Industrial economy because the importance of labour and capital varies from industry to industry.

Keeping in purview the above fact, we propose measures of efficiency of type 1 and type 2,

viz. $E_{jt}^{(1)}$ and $E_{jt}^{(2)}$, respectively, as follows

$$E_{jt}^{(1)} = N\sqrt{(LP)^{W_1} \cdot (CP)^{W_2}}$$

where $N = W_1 + W_2$

$LP = \frac{V_{jt}}{S_{jt}}$ = labour productivity

and $CP = \frac{V_{jt}}{I_{jt}}$ = Capital productivity

$W_1 = \frac{S_{jt}}{S_{jo}}$ Weight based on the change in labour

$W_2 = \frac{I_{jt}}{I_{jo}}$ = Weight based on the change in the capital

$$E_{jt}^{(2)} = N\sqrt{\prod_{i=1}^{4} [P_{jt}^{(i)}]^{W_i}}$$

where $\sum_{i=1}^{4} W_i = N$

and $P_{jt}^{(1)} = \frac{V_{jt}^d}{S_{jt}^d}$ = Labour productivity

$P_{jt}^{(2)} = \frac{V_{jt}^d}{R_{jt}^d}$ Raw material productivity

$p_{jt}^{(3)} = \frac{V_{jt}^d}{f_{jt}^d}$ = Fuel productivity

$p_{jt}^{(4)} = \frac{V_{jt}^d}{F_{jt}^d}$ = Fixed capital productivity

$W_1 = \frac{S_{jt}}{S_{jo}}$ = Weight related to wages

$W_2 = \frac{R_{jt}}{R_{jo}}$ = Weight related to raw material

$W_3 = \frac{f_{jt}}{f_{jo}}$ = Weight related to fuel

$W_4 = \frac{F_{jt}}{F_{jo}}$ = Weight related to fixed capital

At t=0 i.e. for the base year w_1 (i=1, 2, 3, 4) will be unity and so (8) and (9) turn out to be non weighted geometric mean of various partial productivity.

Relative efficiency (RE) is arrived at by dividing the efficiency of a particular industry with that of all industries of the region.

Symbolically, it can be written as

$$(RE)_{jt} = \frac{(E)_{jt}^{(k)}}{(E_{qt}^{(k)}}, \quad K=1, 2$$

The Index numbers of TFP, RTFP, E and RE can be obtained by using the following formula.

$$I_{(TFP)_{jt}} = \frac{(TFP)_{jt}}{(TFP)_{jo}} \times 100 \qquad (10\text{-a})$$

$$(RTFP)_{jt} = \frac{(RTFP)_{jt}}{(RTFP)_{jo}} \times 100 \qquad (10\text{-b})$$

$$I_{(E)_{jt}} = \frac{(E)_{jt}^{(k)}}{(E)_{jo}^{(k)}} \times 100 \qquad (10\text{-c})$$

$k=1, 2$

$$I_{(RE)_{jt}} = \frac{(RE)_{jt}^{(k)}}{(RE)_{jt}^{(k)}} \times 100 \qquad (10\text{-d})$$

Total factor productivity, in a static sense, is interpreted as a measure of the output per unit of resources foregone in its production. Moreover, the measure of total factor productivity reveals the impact of technical progress by comparing total output with a weighted combination of various inputs. We have studied (TFP) and (RTFP) of large industries of Gujarat for plan periods viz. 1961, 1966, 1970 and 1974. We have adopted the following three criteria while examining the values of

(1) $(RTFP)_{jt} < 1 \longrightarrow$ the jth industry is not fair industry for investment purpose at time t.

(2) $(RTFP)_{jt} = 1 \longrightarrow$ The jth industry is fair industry for investment purpose at time t.

(3) $(RTFP)_{jt} > 1 \longrightarrow$ The jth industry is better industry for investment purpose at time t.

In the part of anlytical study, we have interpreted the trend of efficiency of type-1 and type-2. Under the present stuby, we have selected large industries of Gujarat State for observing the trend of efficiency.

The industrial classification for ASI has been changed from 1973-'74 onwards, as such there is no one to one matching of industrial codes. However, in order to have knowledge regarding long term tendency of various productivity measures, we have made rough comparision of the codes, classified under these classifications, and it is furnished in Appendix-I. The concepts and definitions of various economic aggregates used in this paper are according to ASI (6).

The Empirical Base

As mentioned earlier, we have selected certain industries for the purpose. Each of these industries contributes more than 2.50% value added in the corresponding aggregate of Gujarat State Census factories for the year 1970. These industries can be mentioned as follows:

Industry code	Name of the industry	Percentage share in value added for the year 1970
231	Spinning, Weaving and finishing of textiles	43.31
311	Basic industrial chemicals (including fertilizers)	15.44
319	Manufacture of miscellaneous chemical products	6.72
360	Manufacture of machinery except electrical machinery	5.23
341	Iron and steel basic industries	2.59
		73.29

So we have selected five large industries, which cover nearly 73% of value added generated by Census sector factories.

In Table-1, the values of TFP and RTFP are furnished. Here, we have used whole sale price index numbers of manufacturing sector of India (1961=100) as a deflator for deflating the prices of output and various inputs, because the same is not available for the region separately. In order to know the trend in TFP and RTFP, index numbers with 1961 as the base year are given in brackets. Index numbers given in columns (4) to (7) suggest that during 1961 to 1966 TFP of Textile industries has increased by 27%. From 1966 to 1970 it has decreased by 46%. During the last phase of the period i. e. from 1970 to 1974, it has increased by nearly 51%. This 51% rise in TFP for the period 1970-74 may be presumably due to the fact that during 1970 to 1974 textile industries, other than cotton i. e. Nylon Teryline, Synthetic, have developed considerably in Gujarat. During one and half decade, TFP is highest in the year 1974 among the corresponding values of this industry for the various years which is Rs. 0.45 as profit per rupee of investment after all inputs.

TFP of Basic industrial chemicals decreases by 25% during the first phase of the period and it increases at faster rate from 1966 to 1970 and at lower rate during 1970-74, In 1974, the TFP is Rs. 0.86, which is the second highest among TFP of selected industries.

It is interesting to note here that Iron and Steel industries have shown an increasing trend towards TFP. It can be visualised from Table-1 that the rate of increment or marginal value of TFP, increased as time passes. This is really a good sign of progress. During one and half decade as much as 163% increment in TFP is registered by this industry. The industries manufacturing non-electrical machineries, though contributing only 5% in the value added generated by census sector factories of Gujarat, registered an increase of nearly 263% in TFP during 1961 to 1974. TFP of all industries in Gujarat decreases by 16% during 1961-66, increases by the same percentage during 1966-70 and again increases by 50% from 1970 to 1976.

Table 1

Sr. No.	Industry Code	Name of the Industry	Totol Factor Productivity				Relative Total Factor Productivity			
			1961	1966	1970	1974	1961	1966	1970	1974
1.	231	Spinning, weaving and finishing of textiles.	0.3386 (100.00)	0.4306 (127.17)	0.2758 (81.45)	0.4481 (132.34)	1.2123 (100.00)	1.8513 (152.65)	0.9843 (81.16)	1.0687 (88.12)
2.	311	Basic industrial chemicals (including fertilizers)	0.3229 (100.00)	0 2427 (75.16)	0.6535 (202.38)	0.8642 (267.64)	1.1565 (100.00)	1.0310 (89.15)	2 3323 (201.67)	2.0611 (178.22)
3.	319	Manufacture of miscellaneous chemicals products	0.4308 (100.00)	0.7037 (163.35)	0.7775 (180.48)	0.5960 (138.35)	1.5430 (100.00)	2.9894 (193.74)	2.7748 (179.83)	1.4214 (92.12)
4.	341	Iron and steel basic industries	0.1937 (100.00)	0.2206 (113.89)	0.3145 (162.36)	0.5086 (262.57)	0.6938 (100.00)	0.9371 (135.07)	1.1224 (163.78)	1.2130 (174.83)
5.	360	Manufacture of machinery except electrical machinery.	0.3145 (100.00)	0.4886 (155.36)	0.7457 (237.11)	1.1417 (363.02)	1.1264 (100.00)	2.0756 (184.27)	2.6613 (236.27)	2.7229 (241.73)
		GUJARAT	0.2792 (100.00)	0.2354 (84.31)	0 2802 (100.36)	0.4193 (150.18)	1.0000 (100.00)	1.0000 (100.00)	1.0000 (100.00)	1.0000 (100.00)

N.B. : Figures of parentheses given in columns (4) to (7) and (8) to (11) indicate index number of TFP and RTFP, respectively.

So far as index number of RTFP for the selected industry groups are concerned, it is visualised that manufacturing non-electrical machinery units and Iron and Steel basic industries have registered increasing trend continuously from 1961 to 1974. This analysis suggests that it is advantageous to invest more capital in these industries.

In Table-2, the values of efficiency type-1 (E. Type-1) and relative values based on this measure are furnished. This efficiency is a weighted geometric mean of partial factor productivity with respect to Labour and Capital. It is observed from the table that efficiency of textile industry goes down by 16% during 1961 to 1970 and it increases by 35% from 1970 to 1974. Hence, the last phase of the time can be considered as time of industrial growth for textile units.

It may be noted that the efficiency of the industry group 'Basic industrial chemicals, (including fertilisers)' shows cyclical motion during 1961-74. From 1961 to 1966, it reduces by 13%, it increases by 27% during 1966 to '70 again reduces by 31% from 1970 to 1974. The industrial units which produce miscellaneous chemical products, have registered 15% decrease during 1961-66. It is 86.46% in 1970 and is 35.57% in 1974, thereby indicating again a decrease of 51% in the last phase of the period. The efficiency of Iron and Steel basic industries has considerably gone down from 1961 to 1966. It increases from 23.10% in 1966 to 37.99% in 1970 and again decreases by 9% from 1970 to 1974. The efficiency of industrial units which produces non-electrical machinery has gone down by 15% from 1961 to 1966. Again, it decreases by 25% during 1966 to 1970. It registers an increase of 26% in the last phase of the period under study. The efficiency of large industrial sector of Gujarat State has decreased by 36% from 1961 to 1966 and increased by 6% from 1970 to 1974.

So far as R. E. index numbers are concerned, it is observed from the figures

Table 2

Sr. No.	Industry Code	Name of the Industry	Efficiency Type-1				Relative Efficiency			
			1961	1966	1970	1974	1961	1966	1970	1974
1.	231	Spinning. Weaving and finishing of textiles.	0.9642 (100.00)	0.8294 (86.02)	0.8079 (83.79)	1.1420 (118.44)	0.9174 (100.00)	1.2401 (135.18)	1.2164 (132.59)	1.5721 (171.36)
2.	311	Basic industrial chemicals (including fertilisers).	1.0851 (100.00)	0.9491 (87.47)	1.2470 (114.92)	0.9139 (84.22)	1.0324 (100.00)	1.4191 (137.46)	1.8774 (181.85)	1.2581 (121.86)
3.	319	Manufacture of miscellaneous chemical products	1.9268 (100.00)	1.6400 (85.12)	1.6660 (86.46)	0.6853 (35.57)	1.8333 (100.00)	2.4522 (133.76)	2.5083 (136.82)	0.9334 (51.46
4.	341	Iron and steel basic industries	1.6917 (100.00)	0.3907 (23.10)	0.6427 (37.99)	0.4899 (28.96)	1.6096 (100.00)	0.5842 (34.53)	0.9676 (60.11)	0.6744 (41.90)
5.	360	Manufacture of machinary except electrical machinery	0.8475 (100.00)	0 7234 (85.36)	0.5144 (60.70)	0.7343 (86.64)	0.8064 (100.00)	1.0816 (134.13)	0.7745 (96.04)	1.0109 (125.36)
		GUJARAT	1.0510 (100.00)	0.6688 (63.63)	0.6642 (63 20)	0.7264 (69.12)	1.0000 (100.00)	1.0000 (100.00)	1.0000 (100.00)	1.0000 (100.00)

N.B. : Figures of parentheses given in columns (4) to (7) and(8) to (11) indicate index numbers of F. Type-1 and RE. respectively.

furnished in columns (8) to (11) that R. E. of Textile industries increases by 35% and 39% during 1961-'66 and 1970-'74 respectively. The R. E. of industries producing basic industrial chemicals and fertilizers has continuously increased by 82% during 1961 to 1970 and it has decreased by 60% during 1970-'74. Miscellaneous chemicals producing industries have shown increasing trends towards R. E. during 1961-'70. But it has decreased considerably i. e. by 85% from 1970 to 1974. R. E. index numbers of Iron and basic Steel industries have shown cyclical movement during 1961-'66, 1966-'70 and 1970-'74. It is seen from the table that during 1961-'66, R. E. of industrial units manufacturing non-electrical machinery increases by 34%. It decreases by 38% from 1966 to 1970 and again increases. from 96.04% in 1970 to 125.36% in 1974.

In Table-3, the information pertaining to efficiency type-2, relative efficiency and index numbers based on them is furnished. E. Type-2 is based on partial productivity of raw material, fuel, wage bill and fixed capital, while E. Type-1 is based on partial productivity of labour and capital. In Type-2, capital is split up into various components. Hence, it is most likely that the values of E. Type-1 are likely to differ with the corresponding value of E. Type-2.

In Table-3, the values of E. Type-2 and index numbers based on them are furnished in column (4) to (7). It can be visualised that efficiency of textile industries has decreased by 36% during 1961-'66 and has increased from 61.43% in 1970 to 97.97% in 1974. The efficiency of industrial chemicals including fertilisers has decreased by 37% during 1961 to '66, remains almost stagnant during 1966 to 1970 and again decreases by 4% from 1970 to 1974. Industry group "Manufacture of miscellaneous chemical products" produces items like photochemicals, insecticides, fungicides and weedcides, drugs and pharmaceuticals, soaps and gly-

Table 3

Sr. No.	Industry Code	Name of the industry	Efficiency Type – 2				Relative Efficiency			
			1961	1966	1970	1974	1961	1966	1970	1974
1.	231	Spinning, Weaving and finishing of textiles	1.8644 (100.00)	1.1865 (63.63)	1.1453 (61.43)	1.8250 (97.89)	1.2594 (100.00)	1.2265 (97.99)	1.2157 (96.53)	1.7718 (140.69)
2.	311	Basic industrial chemicals, (including fertilizers)	1.7728 (100.00)	1.1189 (63.11)	1.1250 (63.46)	1.0460 (59.00)	1.1975 (100.00)	1.1666 (96.53)	1.1941 (99.72)	1.6155 (84.80)
3.	319	Manufacture of miscellaneous chemical products	3.0368 (100.00)	3.1340 (103.20)	2.7430 (90.33)	1.5013 (49.43)	2.0513 (100.00)	3.2393 (157.93)	2.9116 (141.94)	1.4573 (71.04)
4.	341	Iron and steel basic industries	1.4491 (100.00)	1.3134 (90.64)	0.9337 (64.43)	1.3230 (91.30)	0.9789 (100.00)	1.3577 (138.70)	0.9911 (101.25)	1.2845 (131.22)
5.	360	Manufacture of machinery except electrical machinery	1.8904 (100.00)	1.1276 (59.65)	0,7923 (41.49)	1.6500 (87.28)	1.2770 (100.00)	1.1656 (91.28)	0.8410 (65.86)	1.6019 (125.44)
		GUJARAT	1.4804 (100.00)	0.9676 (65.35)	0.9421 (63.64)	1.0300 (69.58)	1.0000 (100.00)	1.0000 (100.00)	1.0000 (100.00)	1.0000 (100.00)

N.B. : Figures of parentheses given in columns (4) to (7) and (8) to (11) indicate index numbers of F. Type 1 and RE, respectively.

carine, perfumea, cosmatics. The efficiency of this industry slightly increases i.e. by 3% from 1961 to 1966 and then decreases from 103.20% in 1966 to 49.43% in 1974. The efficiency of iron and steel basic industry has shown declining tendency from 1961 to 1970. It is increased by 27% during 1970-'74. The efficiency of industries, which manufacture non-electrical machineries has decreased by 58% during 1961 to '70, while from 1970 to 1974 it has increased by 45%. The efficiency of large scale industrial sector of Gujarat State has gone down by 36% from 1961 to 1970, and again it increases slightly i.e. by 6% during 1970 to 1974.

So far as the index numbers of R.E. are concerned, it is revealed from column (8) to (11) that R.E. of textile industries decreases by 3% during 1961 to 1970. From 1970 to 1974, R.E. of this industry increases by 44%. Basic industrial chemicals and fertilizers industries R.E. has decreased 3% from 1961 to 1966. It increases by same percentage during 1966 to '70. From 1970 to 1974 R.E. of these industries has gone down by 15%. R.E. of manufacturing miscellaneous, chemical products has increased by 58% during 1961 to 1966. From 1966 to 1974 it is continuously decreasing. Index numbers of R.E. for Iron and Basic industries has gone up by 39% during 1961 to 1966. Again, it decreases by 37% from 1960 to 1970. It increases by 30% from 1970 to 1974. The R.E. of industrial units producing non-electrical machinery continuously decreases from 1961 to 1970. During the last phase of the period, R.E. in this industry has increased from 65.86% in 1970 to 125.44% in 1974, thereby registering an increase of 60% during the same period.

The Resultant Profitability

1. In the year 1974, the units producing

basic industrial chemicals (including fertilisers) and factories manufacturing non-electrical machinery have generated profit more than 85% per rupee of investment after all inputs. Morever, the later have shown consistent increasing trend towards profitability during 1961-'74. So, these two industries can be considered as one of the best industries so far as investment is concerned.

2. Profitability of Iron and Steel basic industry has revealed increasing trend during 1961-'74 and it has become more than double during the period under study. This analysis suggests that the period 1961-'74 may be considered as the period of industrial growth for the Iron and steel industry.

3. The following three industries, out of selected five industries, have RTFP greater than unity for the ending years of planned periods i.e. 1961, 1966, 1970 and 1974. This fact leads us to conclude that each of these industries approaches toward profitability most consistently than the entire large scale industrial sector of Gujarat.
   (A) Basic industrial chemicals
   (B) Manufacture of miscellaneous chemical products.
   (C) Manufacture of machinery except electrical machinery.

4. During 1970 to 1974, profitability of large scale industrial sector of Gujarat State has increased by 50%, both the types of efficiency also increase by 6% during the same period. This analysis suggests that the time phase 1970 to 1974 may be considered as a period of industrial growth in Gujarat State.

5. The efficiency Type-1 and Type-2 of textile industry has increased considerably from 1970 to 1974. Moreover, during the same period profitability of this industry has increased from Rs. 0.28 to Rs. 0.45. This may be presumably due to the fact that the textile industry based on synthetic and fibre yarns has developed nicely during 1970-'74. In the year 1974, this industry has contributed nearly 48.45% in the corresponding State value added.

The Qualifying Remarks

1. For studying long term tendency of total factor productivity and efficiency we have made rough comparison between two industrial classifications (as mentioned in Appendix-I). So, the values of economic aggregates for the year 1974 are not exactly corresponding to the years 1961, 1966 and 1970.

2. ASI data are subject to the limitation that these relate only to those units submitting returns. However, since the degree of non-response varies from year to year within narrow limits, the productivity ratios are not likely to be affected significantly.

(3) The Data pertaining to ASI are according to calender year for the period 1960-'65, except for sugar and cotton ginning and pressing factories where the reference periods are July to June and September to August, respectively. The corresponding data for all industries are according to Financial year (i. e. 1st April to 31st March) from ASI 1965 onwards.

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Appendix-1

Classification of Indian Industries		*National Industrial Classification—1970*	
Code	*Description*	*Code*	*Description*
231	Spinning, weaving and finishing of textiles	231	Cotton spinning, weaving, shrinking, sanforising, mercerising and finishing of cotton textiles in mills
		232	Printing, dyeing and bleaching of cotton textiles.
		233	Cotton spinning other than in mills.
		234	Production of Khadi
		235	Weaving and finishing of cotton textiles in handlooms, other than Khadi.
		236	Weaving and finishing of cotton textiles in powerlooms.
		239	Cotton textiles not else-where classified.
		24	Manufacture of wool, silk and synthetic fibre textiles.
		25	Manufacture of jute, hemp and mesta textiles.
		262	Embroidery and making of crepes, laces and finge
		263	Weaving carpets, rags and other similar textile products.
311	Basic industrial chemicals, including fertilizers	310	Manufacture of basic industrial organic and inorganic chemicals and gases such as acids, alkalies and their salts. Gases like acetylene, oxygen, nitrogen, etc.
		311	Manufacture of fertilizers and pesticides.
		312	Manufacture of paints, varnishes and lacquers.
		316	Manufacture of turpentine, Synthetic regins, plastic materials and synthetic fibres like nylon, terylene except glass, etc.

Code	Description	Code	Description
319	Manufacture of miscellaneous products	313	Manufacture of drugs and medicines
		314	Manufacture of perfumes, cosmetics, lotions, hair dressings, tooth pastes, soap in any form, synthetic, detergents, shampoos, shaving products, cleaners, washing and scouring products and other toilet preparations.
		317	Manufacture of matches
		319	Manufacture of chemical products not elsewhere classified (including photo chemicals, sengitised films and paper).
341	Iron and steel basic industries.	330	Iron and Steel basic industries.
		331	Foundries for casting and forging Iron and Steel
		332	Manufacture of ferro-alloys.
360	Manufacture of machinery except electrical machinery.	35	Manufacture of machinery, machine tools and parts except electrical machinery.

(Contd. from page 263)

whose basic nature is good. He uses his power of discrimination—"VIVEKA"—all the time to decide the type of activities that he executes. He does not act impulsively. He studies carefully the facts, foresees consequences and reasons carefully in the best interest of all.

Productivity is not a new concept to the Indian ethos and culture. This concept has been in existence from time immemorial, even in historic times; however, it has gained immense and wide acceptability after the industrial revolution has brought into being new technologies and inventions. Productivity is a team work, and efforts should be made to improve and raise productivity every day. It is not gained by fits and starts. The concept of productivity has to be inculcated in the minds of all who constitute a work team. It should run through the veins from top to bottom. To introduce productivity norms is quite a simple affair, but to continue the productivity campaign in any unit, it calls for devotion to duty, systems and procedures, sacrifice and a host of other characteristics. Productivity cannot be gained in one day. Productivity has to be shared. One has to train one's mind aimed at improving and innovating productivity campaigns on a perpetual basis.

Thus, the demand of productivity, today is a thorough knowledge of technology and understanding of human factor. In addition, each person has to become aggressive good man in the crusade of productivity. This is the message of the Gita for productivity. It needs practice in spirit with the tools engineered by technology.

Some Determinants of Organisational Effectiveness

MISHRA, R.

Is Organisational effectiveness a function of specificity of organizational objectives, structure and process variables ?

The study forms an attempt to examine the organizational objectives, structure and process variables as moderators of organizational effectiveness. One hundred and fifty respondents (56 officers and 94 non-officers) from three public sector corporations in a state, were interviewed with the help of a schedule. The results showed a positive correlation between specificity of organizational objectives, centralization, autonomy, supportive control, shared decision making, fair reward and punishment, fair appointment and promotion criteria and free communication on the one hand and different dimensions of effectiveness on the other. Bureaucracy correlated negatively with effectiveness, although the correlation was not significant.

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Defining Variables

"To be effective is the job of the executive", says Drucker (1907, p. 1). The term effectiveness is often used interchangeably with productivity and efficiency (Sinha, 1980, p. 3). Florence and Brown (1958, p. 21) employed the term productivity to mean output from one particular factor of production or particular form of input and term efficiency to mean output from the total of inputs. The efficiency of an organisation has been measured by the amount of resources used for producing an unit of output (Etzioni, 1964, p. 8). Effectiveness generally means the extent of target realization (Sinha, 1980, p. 4). Steers (1976) observed that effectiveness is best judged against an organization's ability to compete in a turbulent environment and successfully acquire and use its resources. This suggests that managers must deal effectively with their external environments to secure needed resources. This approach recognized the concept of efficiency as a necessary, yet insufficient ingredient of effectiveness.

At what level should effectiveness be measured ? Logic suggests evaluation of organizational effectiveness on an organization wide basis. Steers (1976) argued that such an approach ignored the dynamic relationship between an organisation and its various parts. He suggested that the individual employee ultimately determined the degree of organisational success. If we are to increase our understanding of organizational process, we must develop models of effectiveness that enable us to the greatest possible extent, to identify the

nature of the relationship between individual processes and organisational behaviour. A comparison of the relative effectiveness of various departments or divisions is also useful.

Ganguli (1964, p. 43) observed that traditionally, effectiveness of an organisation was gauged in terms of its productivity or items related to it, like net profit. He also suggested to take into account the human aspects of organisational functioning in evaluating its effectiveness. Barnard (1938) held that an organisation can persist only under two conditions (1) it must accomplish the objectives of the system and (2) it must satisfy individual motives, which forms a prerequisite to their cooperation. Morse (1978) suggested consideration of three factors : individual characteristics, profit maximization and managerial job behaviour. While examining organisational effectiveness, Campbell (1973) has detailed the following five important measuress of effectiveness : (1) Overall performance, measured by employee supervisory ratings (2) Productivity, measured typically with actual output data, (3) employee satisfaction, measured by self-report questionnaires. (4) profit and (5) withdrawal, based on turnover and absenteeism. Drucker (1967, p. 20) suggested five habits of the mind that have to be acquired to become an effective executive. These habits included : (1) management of time, (2) Orientation to result, (3) setting and keeping of priorities, (4) decision making and (5) strength building.

Organisational objectives are the basic reasons for organising in the first place (Chakraborty, 1976, p. 5 and 0' Shaughnessy, 1976, p. 15). These objectives guide us where we are going and why. They provide a general blue print for organisational design and action.

"The organisational goal (objective) is that future state of affairs which the orgnisation as a collectivity is trying to bring about" (Etzioni, 1964, p. 6). O' Shaughnessy (1976, p. 16) views that formally and clearly setting objectives removes misunderstanding and confusion and facilitates communication within the organisation. It also removes the conflict among different levels of personnel and thereby contributes largely to organisational effectiveness. In fact, he emphasises, it serves as a criterion for judging the organisational effectiveness against it. Mwapachu (1978, p. 17) explains that the objectives determine the structure, role distribution and performance of the organisation.

Organisational structure is a complex concept with many facets, some tangible, others intangible. The concept has been defined as the set of relationships which exists among individuals and groups (Wickesberg, 1966, p. 46). Blau (1974, p.12) defined structure as the distribution, along various lines of people, among social positions that influence the role relations among these people. The first implication of these definitions is the division of labour. Another implication is that organisations contain ranks and hierarchy. The positions that people fill have rules and regulations that specify in varying degress, how incumbents are to behave in these positions.

Sells (1963) offered size, differentiation by subgroups and levels, autonomy with respect to outside control and support, control-reflecting degrees of centralisation, controls on members' behaviour, span of control, sanctions, flexibility, communication channels, communication facilities, openness of expression and role structure as crucial measures of organisational structure, while Porter and Lawler (1965) examined it in terms of total and suborganisational properties. The total organisational properties were size, tall-flat shape, centralized-decentralized while suborganisational properties were organisational levels, line and staff hierarchies, span of control and size of subunits. Indik (1968) included size, span of control, number of hierarchical levels, authority structure, communication structure and psychological distance between the decision makers and operating levels in the organisation. Pugh et. al. (1968) postulated specialization, form-

alization, standarization, centralization, configuration and traditionalism as the primary dimensions of organisational structure.

For the present study, bureaucracy and autonomy were taken as the variables of organisational structure. Two measures of bureaucracy were centralization and formalization. Blau (1967) and Hall (1962) pointed out the centralization of authority and formalization of activities as the indicators of the degrees of bureaucracy. Mansfield (1973) defined centralization to mean that a particular authority takes over the charges of others. In other words, centralization means vesting in an authority the maximum of power. Hall (1974) presumes formalization as an organisational technique of prescribing how, when, and by whom tasks are to be performed. A number of studies have been undertaken to examine the relationship between formalization and other aspects of bureaucratic structure as well as its effect on efficiency and satisfaction. Hage and Aiken (1967) found that formalization was rather weekly associated with a centralized decision-making system. Forehand and Gilmer (1964) proposed that formalization led to constraints upon individual freedom, poor creativity and lower satisfaction. Hall (1974) remarked that in a formalized system rules become more important than the goals. Indeed, they are means to attain goals.

An organisation is said to be enjoying autonomy to the extent that it does not have to depend on a higher authority outside its organisational periphery for major decisions. In other words, an organisation lacks autonomy to the extent that top management has to refer certain decisions to a higher level of authority outside the organisational unit being examined (Reiman, 1973). The phenomenon of autonomy has not been given much attention by the researchers although it is one of the basic tenets of organizations, especially the public sector corporations (Sapru, 1979). The report on "Management of growth of small industries in Bihar (1973-74)" by a team of ASCI officials recommended that autonomy was one of the essentialities for flexibility and speed which, in turn, would decide the general health of these public sector corporations.

A literature survey shows the absence of a commonly agreed definition of organisational and management processes even though there is an emerging concern pertaining to their features. An organization is formed with certain objectives in mind. To attain the objectives a number of activities are performed. Thus, organisational process may be defined in terms of activities which transform the inputs into outputs in the light of its envisaged goals and objectives. Lawler et. al. (1974) detailed the measures of organizational process as (1) performance review, (2) professional autonomy, and (3) informal budget account. Koontz and O' Donnell (1964) believed that management process had the elements of planning, organizing, staffing, directing and controlling.

The Problem

The study seeks to answer the following questions :

1. Is there any relationship betweeen specificity of objectives and organisational effectiveness ?
2. What is the relationship between bureaucratic structure and organisational effectiveness ?
3. Is the autonomy in organisations related to their effectiveness ?
4. What is the impact of supervision and administration on organisational effectiveness ?
5. Is the objective and fair creterion for reward and punishment and appointment and promotion related to organisational effectiveness ?
6. Does organisational effectiveness relate to inter-and intra-level support in the organisation ?

7. Is there any relationship between participation in decision making and organisational effectiveness ?

8. Does open-flow of communication lead to organisational effectiveness ?

The Hypotheses Formulated

To answer the above research questions, the following hypotheses were formulated in the light of research literature :

1. To the extent that organisations have specific objectives, they will be more effective.

2. More the organizations are bureaucratic, i.e. centralized and formalized less will be the organisational effectiveness.

3. To the extent the organizations are autonomous, there will be greater effectiveness among the organisations.

4. If the influence of the superior is overwhelming and if the technical experts are subordinated to administrators and bureaucrats, there will be less degree of effectiveness.

5. If reward and punishment as well as appointment and promotion are based on objective criteria there will be greater degree of effectiveness.

6. In an organisation where there is more of inter-and intra-level support, there will be greater degree of effectiveness.

7. If there is an opportunity for the employees to participate in the decision making there will be greater degree of effectiveness.

8. If there is unrestricted flow of communication there will be greater degree of effectiveness.

The Methodology of the Study

Settings : The study was undertaken in three public sector financial corporations with more or less interrelated activities. The three corporations catered to the needs of rapid industrialization of the state by floating different types of loan to the entrepreneurs. The three corporations were small to medium in size employing 60 to 150 persons. All the three corporations were run by a board of Directors and autonomous in nature.

Sampling : Fiftysix officers and 94 non-officers, drawn from the three corporations participated in the study. It was decided to cover all the employees belonging to the above two categories. Considering their negligible involvement and contribution in the higher level policy formulation and programme implementations, the inclusion of class IV employees was avoided.

Instrument : A questionnaire was developed to ascertain the proposed variables enumerated in the preceding section. Beforehand, a pilot study was undertaken. Employees were interviewed in depth with the help of an open-ended questionnaire followed by a thorough discussion with the high officials. Incidently, a seminar was held on the same problem where the operationalization of the variables was discussed at length. The final questionnaire was the outcome of these deliberations which provided sufficient clues and insights for developing the items. Initially, it was decided to construct 5-point scales but experience of the pilot study made the investigator opt for a 4-point one.

Extreme group comparison method was used for item analysis, while Spearman-Brown prophecy test was applied for ascertaining reliability of the scales. Nearly, 50% of the items were positively keyed while the other 50% negatively. A brief description of each measure is briefly given below:

(a) *The measure of specificity of objectives :* The subscale, consisting of 6-items, was developed to ascertain the degree to which objectives were clear, the organisation provided information regarding objectives and there were positions to attend to the activities concerned with achieving a particular

objective. The reliability score for the scale was found to be 98.

(b) *Bureaucracy (Formalization) :* This has been measured by a 4-item scale. The items involved the extent to which rules and regulations were strictly, followed, their observance got priority over urgency, etc. The reliability index was calculated to be .69 which makes the scale reasonably reliable.

(c) *Centralization :* One item intended to measure as to whether the decision making power was concentrated in the MD who happend to be the highest executive in the organisation.

(d) *Autonomy :* It was measured by a 4-item scale. This subscale intended to ascertain whether there was lack of autonomy and major decisions were taken outside the corporation with maximum of pressure from the secretariat. The reliability score of .93 was considerably good for the scale to be reliable.

(e) *Influence :* The subscale intended to measure the degree to which the superiors wanted their orders to be carried out without question, the professional experts were given freedom and autonomy in decision making and executives felt powerlessness before the outside forces. The coefficient for reliability was estimated to be .68.

(f) *Reward and Punishment :* The scale attempted to measure as to whether the employees were rewarded according to their performance, if the superiors indulged in favouritism, if appreciation and criticism followed personal whims of the boss, if the bosses tried to understand the problems of the employees and if the superiors were vindictive, etc. The reliability score for the scale came to be .93; hence, the scale can be considered reliable.

(g) *Appointment and Promotion :* This scale measured as to whether the procedures followed in this connection were objective and fair. The reliability score for the scale was found to be .66.

(h) *Inter-and Intra-support :* The scale, consisting of 8 items, enquired the degree to which the employees of the corporation had cliques of vested interests. Whether there was agreement over a decision at the same level or at different levels, whether superiors lent support at the time of crisis or general needs, whether the colleagues were mutually supportive in case of some urgent needs, etc. The reliability score for this scale was computed to be .96.

(i) *Decision-making :* The scale tried to measure the degree to which the decision makers listened to the employees, whether the ideas and experience of the employees were utilized by the decision-makers and whether the big bosses took decisions in whimsical manner. The reliability score for the scale came to be .72.

(j) *Communication :* Eight items were included in the scale which attemped to ascertain the degree to which superiors explained the decision clearly, the decisions were communicated quickly, and the employees at all levels exchanged information freely. It also tried to examine if the information was distorted or if there were pockets of information, manupulating them in their own way. The reliability index came to be .79.

(k) *Measures o feffectiveness:* Effectiveness is the extent to which an individual, under given circumstances, exerts himself to transform inputs into maximum outputs. This was measured at three levels superiors, subordinates and self.

The superiors' effectiveness is the rating of a superior by his subordinates.

This was measured by three items which probed the extent to which the superiors read their subordinates' files carefully, subordinates' perception regarding undue delay at their superiors' level and piling up of the files. A third item related to the rating of effectiveness of the superior on the whole. The reliability score for the scale was reported to be .62. A single item measured the effectiveness of one's section and another one that of organisation as a whole. Besides, the subjects were asked to rate, following Drucker's (1967) model of effectiveness, their superiors and subordinates on the management of time, orientation to result, setting and keeping of priorities and decision making. A 4-point rating was attached to each of the four items.

(I) *Objective Measures of Effectiveness :* It was decided to examine the official records, mostly in terms of profit and loss and business expansion. But since all the organisations did not have uniform patterns of record keeping and uniform concepts of profit and loss, the objective measures could not be relied upon and thus abandoned.

Procedure : First of all, the three organisational heads were requested to issue an official letter advising the individual employees to participate in the study freely. Thereafter, the investigator approached the employees individually according to their convenience and interviewed them.

Statistical analysis : Simple product-moment correlation was computed.

Results of the study :

Interrelationship among specificity of Objective and Structure and Process Variables.

The correlation between specificity of objective and bureaucracy (formalization) was not significant ($r=.07$, $df=148$, $p>.05$). This had a positive correlation with centralization ($r=.21$, $df=148$, $p<.01$) and autonomy ($r=.37$, $df=148$, $p<.01$).

Positive correlation existed between specificity of objective and influence ($r=.46$, $df=148$, $p<.01$), reward and punishment ($r=.53$, $df=148$, $p<.01$), fair criteria of appointment and promotion ($r=.58$, $df=148$, $p<.01$), inter-and intra support ($r=.50$, $df=148$, $p<.01$), participation in decision-making ($r=.64$, $df=148$, $p<.01$) and free communication ($r=.53$, $df=148$, $p<.01$).

Process variables influence, reward and punishment, fair criteria of appointment and promotion, inter-and intra-support, participation in decision-making and open communication were correlated positively and significantly ($p<.01$) with autonomy and centralization of the structural variables. Bureaucracy (formalization), however, was found to be uncorrelated to the measures of process.

Interrelationship between antecedent and outcome variables, specificity of objectives and effectiveness. All the variables of effectiveness, were correlated positively and significantly ($p<.01$) with specificity of organisational objectives.

Structure and effectiveness. Bureaucracy (formalization) was not correlated significantly with different variables of effectiveness ($p>.05$). However the relationship was negative. Centralization correlated positively and significantly ($p<.01$) with the three variables of effectiveness, i.e. efficiency of the subordinate, superiors' efficiency on management of time and the overall efficiency of the superior. Autonomy correlated positively with all the variables of effectiveness. The relationships were significant ($p<.01$) except for the relationship between autonomy and the effectiveness of the subordinate on the variable of setting and keeping of priorities which was not significant ($p>.05$).

Process and effectiveness. The rated effectiveness of superior, section and organization as a whole were positively ($p<.01$) related to the influence processes. Subordinates' effectiveness on the variables of management of time and orientation to result correlated positively and significantly ($p<.01$

and $p<.05$, respectively) with influence process. Superior's effectiveness on all the variables (i.e., management of time, orientation to result, setting and keeping of priorities and decision-making) was positively and significantly related with influence ($p<.01$). Fair criteria of reward and punishment correlated positively and significantly ($p<.01$) with all the variables of effectiveness. Fair procedures of appointment and promotion correlated positively with all the variables of effectiveness. The relationship was highly significant ($p<.01$) except in the case of appointment and promotion and subordinates' effectiveness on the dimension of decision-making. Inter-and intra-support correlated positively with all the variables of effectiveness. The relationships were all significant ($p<.01$) except with one's own effectiveness. Shared decision making correlated positively ($p<.01$)with all the variables of effectiveness. Free communication correlated positively and significantly ($p<.01$) with all the variables of effectiveness. The relationship of free communication with one's own effectiveness, however, was not significant.

Table 1

Correlation between Structural and Process Variables

	Bureaucracy	Autonomy	Centralization
Influence	.04	.42**	.29**
Reward and Punishment	.08	.47**	.31**
Appointment and Promotion	.08	.47**	.30**
Inter-and Intra-support	.10	.42**	.30**
Decision making	—.09	.49**	.29**
Communication	.03	.47**	.38**

**$p<.01$
*$p<.05$
df = 148.

Table 2

Correlation between specificity of objectives and the ratings of efficiency

	Specificity of Objectives
Efficiency of the Subordinate	.28**
Efficiency of the Superior	.49**
Own Efficiency	.26**
Efficiency of the Section	.37**
Efficiency of the Organization	.39**
Efficiency of the Subordinate on	
1. Management of time	.29**
2. Orientation to result	.38**
3. Setting and keeping of priorities	.31**
4. Decision making	.25**
Composite efficiency***	.38**
Efficiency of the Superior on :	
5. Management of time	.37**
6. Orientation to result	.34**
7. Setting and keeping of priorities	.40**
8. Decision making	.45**
Composite efficiency****	.48**

**$p<.01$, df = 148.
***Composite efficiency score is based on the totals for variables 1 through 4.
****Composite efficiency score is based on the totals for variables 5 through 8.

Table 3

Correlation between structural variables and the ratings of efficiency

	Bureaucracy	Autonomy	Centralization
Efficiency of the Subordinate	.02	.29**	.22**
Efficiency of the Superior	—.05	.40**	.21
Own Efficiency	—.17	.21**	.02
Efficiency of the Section	—.05	.23**	.12
Efficiency of the Organization	—.02	.30**	.13
Efficiency of the Subordinate on :			
1. Management of time	—.07	.40**	.08
2. Orientation to result	.00	.30**	.14
3. Setting and keeping of priorities.	.07	.12	.13
4. Decision making	—.01	.32**	.08
Composite efficiency***	.00	.34**	.13
Efficiency of the Superior on :			
5. Managemsnt of time	—.01	.32**	.25**
6. Orientation to result	—.06	.25**	.09
7. Setting and keeping of priorities	—.09	.35**	.19
8. Decision making	—.05	.29**	.19
Composite efficiency****	—.06	.37**	.21**

**p<.01, df = 148

***Composite efficiency score is based on the totals for variables 1 through 4.

****Composite efficiency score is based on the totals for variables 5 through 8.

Table 4

Correlation between Process variables and ratings of efficiency

	Influence	Reward and punishment	Appointment and promotion	Inter-and Intra-support	Decision making	Communi-cation
Efficiency of the Subordinate	.15	.33**	.31**	.38**	.41**	.36**
Efficiency of the Superior	.40**	.53**	.57**	.51**	.53**	.54**
Own Efficiency	.05	.21**	.24**	.17	.26**	.20
Efficiency of the Section	.34**	.44**	.45**	.49**	.45**	.50**
Efficiency of the Organization	.43**	.51**	.44**	.61**	.51**	.53**
Efficiency of the Subordinate on :						
1. Management of time	.25**	.37**	.31**	.32**	.35**	.40**
2. Orientation to result	.10*	.30**	.33**	.33**	.28**	.34**
3. Setting and keeping of priorities	.05	.31**	.31**	.27**	.24**	.27**
4. Decision making	.20	.26**	.17	.21**	.22**	.24**
Composite efficiency***	.18	.38**	.34**	.35**	.33**	.38**
Efficiency of the Superior on :						
5. Management of time	.29**	.41**	.41**	.38**	.42**	.41**
6. Orientation to result	.30**	.43**	.38**	.46**	.46**	.46**
7. Setting and keeping of priorities	.35**	.49**	.51**	.46**	.49**	.50**
8. Decision making	.36**	.50**	.47**	.43**	.50**	.51**
Composite efficiency****	.40**	.56**	.55**	.53**	.57**	.57**

*P<.05, df=148

**p<.01, df=148.

***Composite efficiency score is based on the totals for variables 1 through 4.

****Composite efficiency score is based on the totals for variables 5 through 8.

Discussion of Results and Conclusion

Specificity of Objectives and structure : Bureaucracy (formalization), centralization and autonomy were considered as the variables of organisational structure. The negative (though insignificant) correlation of the specificity of organisational objectives with the bureaucracy is contrary to our belief that in a bureaucracy there are fixed rules for everything (Weber 1946). The general practice followed in bureaucracy is that a distance is maintained between different points in the hierarchy, communication is restricted and there is an atmosphere of mistrust. Under such circumstances there are chances that highups would restrain from explaining the objectives in detail and the employees in general would not care to know either.

The positive relationship with centralization indicated that when the decision making authority was vested in the top management, there were chances of greater objective clarity. But this goes contrary to the common belief. It seems that in a centralized organisation, the man at the top is more concerned for making decision by himself. He, at the best, provides information to those who have to implement the decisions.

Specificity of Objectives and process : Dimensions of process taken into account were influence, reward and punishment, appointment and promotion, inter-and intra-support, decision making and communication.

A significant positive correlation between specificity of objectives and influence suggested that where the influence of the superior was not overwhelming over the subordinates, the objectives were clear and specific. A positive correlation between specificity of objectives and objective and fair criteria of reward and punishment implied that the more the reward and punishment were contingent upon fair and objective criteria the greater was the likelihood of the objectives being more clear; because the practice was likely to prompt the employees to work hard acquainting themselves with the minutest details of job including the organisation objectives. The positive correlation between specificity of objectives and fair criteria of appointment and promotion can be explained in the same manner. A positive correlation between specificity of objectives and shared decision making meant that if the employees were involved in decision making, there were greater chances that the objectives would be more clear. It happens so because when the employees are made party to the decisions, they are likely to be provided with proper inputs in terms of organisational philosophy, its objectives and limitations. Similar relationship between free communication and specificity of objectives can be explained in the same manner.

Organisational Structure and Process Variables : Both centralization and autonomy had positive correlations with all the variables of process. It implied that with more autonomy and centralization, it was likely that there would be more freedom for self-judgement. The reward and punishment would be based upon objective criteria and the appointment and promotion procedure would also follow objective criteria. Under such organisational structure employees would support each other irrespective of their levels, and the participation in decision-making would be more pervasive. The communication system would be open from all directions.

Such a relationship seems to be possible only to the extent that autonomy is being enjoyed by an organisation. In a dependence-prone system like ours (Sinha & Sinha, 1974), the employees develop personalized relationship with the higher authorities which in turn influence their behaviour. Though the man at the top-point dominates the decision, he may also consider the dependency need and preference for personalized relationships of the employees and as a result he will provide nurturance. In such a situation, even centralized decision making will have positive effects.

Specificity of Objectives and effectiveness : A positive and significant relationship

between specificity of objectives and effectiveness can be attributed to the fact that when objectives are clear, the employees may work without tension. A positive correlation between specificity of objectives and role clarity has been reported by Mishra (1981) which indicates that when objectives are clear the roles of the employees are also clear and the employees work full throttle without strain.

Structural variables and effectiveness : Bureaucracy correlated negatively with almost all the dimensions of effectiveness. Dayal and Dayal (1978, pp. 53-56) argued that "the system (bureaucracy) promotes mediocrity by suppressing swift action in preference to slow rule-bound action" (p. 56). Appleby (1961, 1965), Verma (1973), Prasad (1974) and Pauda (1978) saw the inefficiency of bureaucracy because of the delay, formality, ritualism, dominance of rules and procedures over objectives and lack of delegation of responsibilities, etc.

A positive correlation between autonomy and effectiveness can be explained in terms of role clarity in an autonomous organisation which in turn led to efficiency of the individuals leading to organisational effectiveness (Mishra, 1981). Centralization correlated positively with the reported efficiency of the subordinates on the dimension of management of time. It so happens in a centralized organization that decision is taken at the top or near the top (Reiman, 1973) based on the work done by a number of subordinates who willingly follow the demands of the top. Thus, the superiors' ratings of his subordinate as efficiency on management of time can be justified. The positive correlation between overall organizational effectiveness and centralization can be due to the fact that the man in whom the authority to take decision is vested perceives his organisation to be effective because it is he who makes all the decisions.

Process Variables and effectiveness : The positive correlation between influence and effectiveness shows that when the influence of the superior is accepted, superiors allow the subordinates to make their own judgement and when the professional experts are granted autonomy in decision-making, there is greater degree of efficiency at all levels and on all dimensions of effectiveness. This result supports Kahn et. al (1964, p. 75). Reward and punishment and appointment and promotion following an objective and fair criteri on produce effectiveness. This may be because objectivity and fair criteria induce in the employees a sense of certainty and they are likely to predict the outcome of their performance in a better way resulting into greater effectiveness. A positive correlation between effectiveness and inter- and intra-support suggests that when the rank and file support each other, the work is likely to be performed in a better way. The positive correlation between shared decision making and effectiveness suggests improved productivity as a consequence of the employees' involvement in the decision-making (Pandey, 1977; Srivastava, 1976). Pelz and Andrews (1966) related overall communication flow to better performance and this supports the findings on positive relationship between open communication and effectiveness.

To conclude, the hypothesis pertaining to a positive correlation between specificity of objective, autonomy, supportive influence, objective criterion of reward, punishment and appointment and promotion, inter-and intra-support, shared decision-making and free communication on the one hand and effectiveness on the other was established. The hypothesis pertaining to a negative correlation between centralization and effectiveness, however, could not be confirmed.

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Motivating For Productivity

STANISLAO, J.

Since productivity is a result of the behaviour of organisation members, motivating this behaviour forms a prerequisite to productivity

Motivating or influencing is a major management function which must be performed in order for an organisation to have long-run success. Planning and organising will determine how an organisation will get where it wants to go and motivating the human resources will help the organisation to get there. The article focuses on people variables which managers must consider when trying to get the workers to become and remain productive. Communication, leadership, and motivation will have a predominate influence on this organizational objective.

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General Characteristics of Motivation

Motivating is the process of directing the activities of members in the organization to obtain management system objectives. Motivating involves focusing on the people within the organization dealing with such issues as morale, arbitration of conflicts and developing good working relationships among workers. As with planning and organizing activities, the motivating function is another component of the overall management system.

The process of motivating workers involves the performance of four primary management activities. The primary management activities are: leading and directing, influencing, considering groups, and communicating. Of all these management activities communication is referred to as the fundamental management skill.

Communication is the proces of sharing information with other individuals in the organizational system. The manner in which you communicate frequently will have a direct or indirect bearing on how effective you are in motivating workers.

Leadership is defined as a process of directing the behaviour of others toward the accomplishment of some organizational objective. An attempt will be made to stress individuals' ability in order to match the individuals and their leadership style with both the leadership situation and their followers. The review of literature indicates that "Motivation" can be defined as the inner state of an individual that causes that individual to behave in a way that ensures the accomplishment of some goal. There are numerous motivation models and only a few will be discussed in this article. Strategies will be presented so that managers can use motivation techniques to increase their productivity.

For a manager to be successful, a manager must be able to *manage groups* of people. A group is defined as any number of people or workers who interact with one another, who are psychologically aware of one another, and also perceive themselves to be generally divided into two types; informal groups and formal groups. The informal groups develop somewhat naturally and the formal grous are established by management. Managers can increase their effectiveness when they understand concepts regarding the relationship between the size of the work groups, the status of the work group members,

and the cohesiveness of the work group.

Communicating - Fundamental To Motivating

Motivating is the process of guiding the organization to obtain the organizational planned objectives and goals. It is important to establish that all management activities are generally accomplished through communication. Since communication skill is an essential tool to managers, communication skill is frequently referred to as the fundamental management skill.

Communication is the process of sharing information with other individuals wiihin and outside the organizational structure. Information can further be defined as any thought or idea that managers desire to share with others. All individuals who aspire to be in a management or leadership role be able to effectively communicate under a variety of different conditions and situations. Therefore, a manager must understand how interpersonal communication operates, the relationship between interpersonal communication and feedback, and the importance of nonverbal vs. verbal interpersonal communication.

Successful communication is a communication situation in which the information source intends to share ideas with others. There are three essential elements to communication with others in the organization. The first is the *source*, or the individual who wishes to share information with another. The second element is the *signal*, or the message to another by the source. The third element is the *destination*, or that person with whom the source wishes to share information.

To be successful as communicators, managers must be able to use communication feedback and both verbal and nonverbal communication techniques. *Nonverbal* communication is sharing information without using words to encode thoughts. Factors used to encode thoughts in nonverbal communication include gestures, vocal tones, facial expressions, and body expressions. Beside vocal tones, facial expressions, and gestures, space and smell can influence the impact of a verbal communication. Non-verbal messages also can add or substract content of verbal message. For example, during a conversation, the manager might express approval by words in the message while the nonverbal factors express disapproval. This type of situation creates commnication ambiguity.

To be effective communicators, manager must not only understand communication techniques dealing with individuals, but also be able to handle organizational communication. Organizational communication direct ly relates to the goals, functions and structure of organization. Organizational success, to a major extent, is determined by the effectiveness of organizational communication. Organizational communication can be formal. or informal. *Formal* organizational communication follows the lines of the organization chart and can be either upward, downward or lateral. The *informal* organizational commnication typically follows personal relationship patterns within the organization. Informal organizational communication generally exists because workers have a desire to know information that the formal organizational communication does not provide them. The informal communication network or *grapevine* has a number of distinctive characteristics : (1) it is used to serve the self-interest of the people within the organization; (2) the grapevine springs up and is used irregularly within the organization; and (3) it is not controlled by top executives, who may not be able to influence its content.

Clearly, the grapevine is a factor with which all managers must deal with. To minimize grapevine rumors, managers will distribute maximum information through formal communication channels. Some managers use the grapevine network to gain information feedback that could be very valuable in improving the organization. Exactly how individual managers should deal with the grapevine, depends on the specific organizational situation in which the managers find themselves.

Managers can use a variety of different strategies to encourge the flow of formal organizational communication. One of the strategies is *listening* attentively to messages that come through formal channels. Frequently, listening shows workers that managers are interested in what they have to say and as a result, encourage workers to use formal communication channels. Another strategy managers can develop is to support the flow of *clear* and *consise* statements through formal communication channels. Receiving an ambiguous message through organizational channel

can only discourage workers from using the formal and encourage the grapevine network. A third strategy, managers can ensure and encourage that workers have free access to the use of formal communication channel within the organization system.

Leading and Managing-an Integral Component of Motivation

Leadership is the process of directing the behaviour of others to the achievement of some specific objective or goals. Directly, it means to cause workers to perform in a certain way in order to accomplish their objective. Let me make this clear, leadership is not the same as managing. Although some managers are leaders and some leaders are managers, leading and managing have different activities.

Successful leaders tend to possess the following characteristics :

(1) *Intelligence* — including judgment and verbal ability

(2) *Achievement* — such as scholarships, athletics, etc.

(3) *Emotional* — mature and stable

(4) *Dependability* — drive to achievement

(5) *Skill*— participate socially

(6) *Status*—a desire for socio-economic position

In essence, no trait or combination of traits guarantees that a leader will be successful. Therefore, leadership is much more complex than simply describing traits.

Today, leadership study has shifted from the *trait* approach to the *situational* approach. The situational approach to leadership is based on the assumption that all instances of succesful leadership are a little different but all require a unique combination of leaders, followers, and leadership situation. A successful leadership is a function of the leader, the follower and the situation. In other words, the leader, follower and situation must be appropriate with one another if a leadership is to be successful.

The *manager* makes the decision and communicates it to the various members of the organization. The manager's behaviour is characterized by : (1) the manager identifying a problem; (2) the manager analyzing various alternatives available to solve the problem: (3) Selecting the alternative, and (4) requiring the workers to implement the chosen alternative.

As manager shifts from making decisions by maintaining high control and allowing little subordinate freedom, they tend to be autocratic and are called "boss-centered leaders". Managers who display leadership behaviour with minimum control and allow subordinates to participate tend to be democratic and are called "subordinate-centred leaders"

Managers should be aware of forces within themselves that influence their determination of how to make decisions as a leader. Management values is the first force. This consists of how management perceives management values, management relationship to the organization, personal growth, growth of subordinates, and company economic status. The second force within the manager is the manager's level of confidence in his workers. The third force within the manager is his strength as a leader with respect to the workers; and the fourth force is the manager's tolerance for ambiguity.

Managers should be aware of forces within subordinates that influence the manager's determination to make decisions as a leader. To successfully understand subordinates, a manager should know that each subordinate is somewhat different and somewhat alike. Workers who enjoy a considerable amount of freedom resent the manager who makes all decisions alone.

Managers should be aware of forces coming from the situation that influence management decisions as a leader. The first such situational force involves the type of organization in which the leader works. Besides the organizational situation is the effectiveness of group members working together. Different groups have different degrees of confidence in their ability to solve problems. A third situational force that influences a manager's determination of how to make decisions as a leader is the problem to be solved. As a group loses the necessary expertise to solve a problem, a manager should move toward more boss-centered leadership. Finally, a fourth situational force involves the time available to make a decision. The less time available to make a decision, the more impractical it is to have that decision made on

influence by the group.

Motivation Process

New and old managers need to understand the motivation process. Motivation is an individual's inner state that causes that individual to behave in a way that ensures the accomplishment of some goal. Sometimes motivation explains why people behave the way they do. The more management understands workers' behaviour, the better able they are to influence that behaviour and make it more consistent with the accomplishment of organizational objectives. Since *productivity* in all organizations is a result of the behaviour of organization members, influencing this behaviour is a manager's key to increasing productivity.

Motivation theory is based on the concept that felt needs cause human behaviour. Motivation theory also infers that motivation strength or the desire to perform some behaviour is determined primarily by the perceived value of the results of performing the behaviour and the perceived probability that the behaviour performed by the individual will cause the result to materialize. As these parameters increase, motivation strength increases.

A strategy managers can use to motivate organization members relates to design of jobs members perform. For some time, industry made jobs simpler and more specialized to increase worker productivity. A negative result accompanies this work simplification and specialization. As the job becomes simpler, the job becomes more boring and less satisfying to the individual

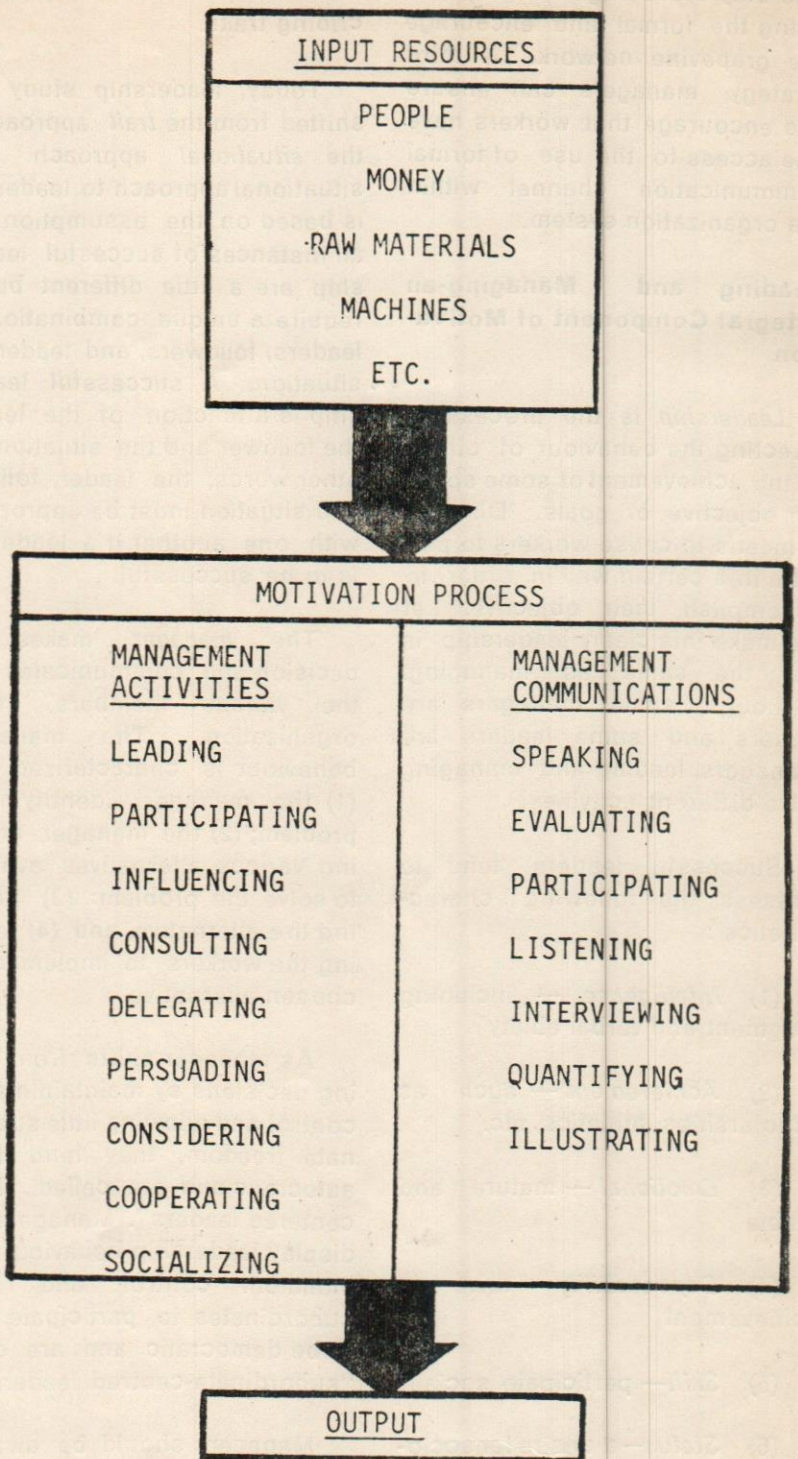

FIGURE-1

The Fundamental Management Skills to Motivate the System

TEN COMMANDMENTS FOR GOOD LISTENING

1. Stop talking.
2. Put the talker at ease.
3. Show the talker that you want to listen.
4. Remove distractions.
5. Empathize with the talker.
6. Be patient.
7. Hold your temper.
8. Go easy on argument and criticism.
9. Ask questions.
10. Stop talking.

FIGURE-2

A Manager Must be a Good Listener to be Successful in Motivating Workers

worker. As a result, productivity decreases.

To overcome this job boredom, there is job rotation. Job rotation is moving workers from job to job or not requiring the workers to perform only one simple and specialized job over long runs. Job enlargement is another strategy to overcome work boredom. Job enlargement advocates indicate that jobs become more satisfying as the number increases. The process of incorporating motivators in job situations is called job enrichment.

Another more recent job-design strategy for motivating workers is based on a concept called *flextime*. The main thrust of flextime is that it allows workers to complete their jobs within a forty-hour work week they arrange themselves. The choices of starting and stopping can be as flexible as the organizational situation allows.

Another strategy that management can use in motivating workers is *behaviour modification*. Behaviour modification focuses on encouraging appropriate behaviour as a result of the consequences of that behaviour. Behaviour that is rewarded tends to be repeated, while behaviour that is punished tends to be eliminated. Behaviour modification programmes typically involve the administration both of rewards and punishments. The administration of rewards generally is stressed since rewards have more effective influence on behaviour than punishment.

The most effective management style over the long-run effect is when management has complete trust and confidence in their workers. Workers feel free to discuss their job with superiors and are motivated by such factors as economic rewards based on a compensation system developed through participation and involvement in goal setting. In this situation information flows upward, downward and, horizontally. Conversely, when managers who attempt to initiate this system probably face some productivity decline initially, but an increase in productivity over the long run.

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Designing Cellular Manufacturing Systems

BASAK, P. C.
and
D. K. TRIPATHY

How large companies using Functional layout can move to a cellular system design, a rapid production management technique, to extrapolate the total manufacturing system

The term 'Cellular manufacture' is of relatively recent origin. A considerable amount of research work over the past two decades has been done to solve the planning and control problems of the large functional factory using the computer but with little success. The development of cellular manufacturing organisation in the 1960's forms the first vital alternative to functional factory layout during the past industrial revolution period. Substantial amount of time and effort is required to effectuate a change from functional to cellular layout. The article describes procedure for designing the cells for rotational and non-rotational components in the Central Repairing Shop of a large integrated steel plant with the aid of a technique based upon workpiece statistics and existing machine tool distribution.

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Emergence of the Cellular Systems

It has long been acknowledged by production and industrial engineers that the most economic method of manufacturing engineering products occurs when flow line production of components can be established. The organisational problems of a factory with three hundred machines and five hundred workers are radically different from one with thirty machines and forty workers, but we still try to apply the same method of Control Organisation to both. Cellular manufacture has emerged after intensive study and innovation which has offered a new framework for batch manufacturing companies and an improved production system could be designed. This leads not only to the design of manufacturing cells of machines dealing with families of components, but also affects methods of planning and control, the system of job evaluation and wage payment and social structure of the workshop.

Cellular manufacturing system has become familiar with many terminologies like 'Group Technology', 'Group Production', 'Group Machining', 'Machine Grouping', 'Cell System'. According to Professor V. B. Solaja, Director of Institute of Machine Tools, Belgrade, 'Group Technology is the realisation that many problems are similar and that by grouping similar problems, a single solution can be found to a set of problems, thus saving time and effort,. A cellular system which involves various aspects of production, environment, people and management, has developed into a total manufacturing system. A cellular system is envisaged to become fundamentally a new approach to production management.

Cell system is rapidly gaining importance as a major advancement in the field of batch production. However, a factor inhibiting many managements from adopting this mode of production is the time and effort required to change from functional to cellular layout. A prime constituent of this task lies in the need to classify and code workpieces by the use of a classification scheme which consume considerable effort and yet, because of factors such as improved production methods, changes in batch sizes and differences in future component patterns, the cells which result may still require modification before implementation.

By the use of the relationship of rotational and non-rotational

components the cells may be speedily formed with the aid of a technique which is based upon workpiece statistics and the existing machine tool distribution.

Analysis for Designing the Systems

The allocation of machine to cell is done according to the relationship between machines and workpieces, by using the proportion of rotational and non-rotational parts within a company. For example, if X per cent of components are rotational and Y per cent are non-rotational and if B is the number of turning machines, then assuming that all rotational parts, in general, require turning operations and all non-rotational parts require surfacing operations, a relationship can be derived thus :

$$X : Y \text{ as } B : A$$

where A is the number of machines required for non-rotational parts (surfacing machines).

In general for non-rotational parts the surfacing and drilling/boring machines tend to be equal in number. So the machining requirements for non-rotational parts become (a) a quantity of surfacing machines, (b) a quantity of drilling/boring machines. Having divided the total quantity of machine tools into two sections, namely, rotational and non-rotational parts it is necessary to further sub-divide the parts so that machines may be allocated to specific cell. The research of Optiz, Kolac and Burbidge has established a relationship among the different types of components and machine requirement for general purpose machine shop.

For rotational,

Turning	Milling	Drilling
3	1	1

For non-rotational,

Surfacing	Drilling/Boring
1	1

Using this method and after due consultation with Foremen and Production Engineers, Machines may be allocated to different Cells and be capable of machining components falling within the cell. However, no consideration has been made to special purpose machines which also constitute part of the shop floor production capacity. In general, these machines are few and can be allocated to cells as required.

The Case Example of a Steel Plant

The investigation has been carried out in the Central Repairing Shop (CRS) of a large integrated steel plant which is basically a machine shop. The present mode of layout in machine shop is the conventional functional layout. It manufactures 15% of total requirement of spares in urgent and breakdown situation. The batch size of 84 per cent of orders received by Central Repairing Shop are below the quantity of 50.

For the purpose of analysis the whole spectrum of workpiece is divided into rotational and non-rotational components. It is found that 64.6% of components are rotational and the rest 35.4% of the component are non-rotational. The number of machine tools used at present in Central Repairing Shop for the production of spares are given below :

Lathe	—	9 Nos.
Milling	—	3 Nos.
Drill	—	4 Nos.
Planer	—	3 Nos.
Shaper	—	2 Nos.
Grinding	—	3 Nos.
Slotter	—	1 No.
Vertical boring	—	1 No.
Horizontal boring	—	2 Nos.
Gear hobbing	—	1 No.

Let,

X = Perecentage of Rotational Component = 64.6

Y = Percentage of non-rotational Component = 35.4

B = Number of turning machines = 9

A = Numbr of surfacing machines for non-Rotational work.

Using the relationship
X : Y : B : : A

The number of surfacing machines for Non-Rotational work is found out, which gives

$$A = \frac{B \times Y}{X} \frac{9 \times 35.4}{64.6} = 4.93$$

So, the number of surfacing machines require for Non-rotational component is 5.

The total number of drilling and boring machines are to be equal to surfacing machines. Thus, about 5 machines in any combination of drilling and boring machine will be required for non-rotational parts.

Number of specific surfacing machines required for Non-rotational components are :

Planer	— 2 Nos.
Shaper	— 1 No.
Milling	— 1 No.
Surface grinding	— 1 No.

Number of specific drilling and boring machines for non-rotational components based on the availability are :

Drilling	— 2 Nos.
Horizontal boring	— 2 Nos.
Vertical boring	— 1 No.

Machines for Rotational Parts

When the machines required for non-rotational parts are subtracted from total population of machines, which remain are for the rotational components. So, the list of machines for rotational components are given below :—

Lathe	— 9 Nos.
Milling	— 2 Nos.
Drill	— 2 Nos.
Cylindrical Grinding	— 2 Nos.
Gear Hobbing	— 1 No.
Slotter	— 1 No.
Planer	— 1 No.
Shaper	— 1 No.

It is now necessary to classify the parts by the use of anyone of the Coding System, so that it will help to create small Cells for both rotational and non-rotational Components. Out of all available classification systems, Opitz classification method has been selected for the analysis of the present work. The Opitz Coding System Consists of a primary Code of 5 digits and Secondary Code of 4 digits. It is not the purpose of this paper to go into detail of this Coding System.

As a first step of forming families of Components, it will be helpful to classify and arrange them in ascending order of the magnitude of their group technology Code number. As the each digit in the classification system signifies the shape and other features of Components, the components with identical Code numbers tend to be very much similar to each other. So, it is easy to form families if the similarity in shape precedes similarity in manufacture. With the use of Opitz Code each group of the rotational and non-rotational Components again Sub-classified into two groups.

a) Group—1 : Disc Type and Short Cylinder Components Starting with Code Number O and 1.

b) Group—2 : Long Cylinder Components Starting with Code Number 2.

c) Group—3 - Non- rotational Components Starting with Code Number 6

d) Group—4 : Non-rotational Components Starting with Code Numbers 7 and 8.

The percentage utilisation of the machines in each group is calculated with the assumption that the shop is working for 300 days in a year with 2 shifts of 8 hours each. The number of machines required for each group with their percentage utilisation are presented below in tabular form.

Groups for Rotational Components

Group - 1

Machine	No. Off.	Percentage Utilisation
Lathe	4	83.64
Drill	1	31.94
Cylinderical Grinding	1	2.41
Milling	1	12.87
Gear Hobbing	1	9.53
Slotter	1	3.47

Total number of Machines required for Group-1 is 9.

Group - 2

Machine	No. Off.	Percentage Utilisation
Lathe	5	96.33
Drill	1	14.57
Cylindrical grinding	1	18.35
Milling	1	28.41
Planer	1	2.79
Shaper	1	3.34

Total Number of machines required for Group-2 is 10.

Groups for Non-Rotational Components

Group - 3

Machine	No. Off.	Percentage Utilisation
Planer	2	57.6
Vertical boring	1	27.6

Horizontal boring	1	69.2
Drill	1	18.4

Total number of machines required for Group-3 is 5.

Group - 4

Machine	No. Off.	Percentage Utilisation
Shaper	1	70.7
Horizontal boring	1	46.6
Drill	1	11.5
Milling	1	13.63
Surface grinding	1	19.3

Total number of machines required for Group-4 is 5.

The Novelty of the Design

The novelty of this technique is the rapidity with which the group technology cell can be formed. The speed of application of this method depends upon the specific working conditions. The effectiveness of this procedure depends to some extent upon the accuracy and quantity of information. In general large companies have more problems and cell system is more effective in such environments. So, slight inaccuracies in information should not significantly affect the final result.

This technique is only suitable for existing companies already using functional layout and it is not applicable to 'green field' situations. A company already using functional layout would assume that the existing machines have the potential to perform all the necessary operations within that firm after the implementation of cellular manufacturing systems.

Inspite of the rapidity of this method, it also requires the assistance of coding and classification system to sub-classify the rotational and non-rotational cells. It also does not give the layout of cell. So, for finding out the layout of cell, the Line Analysis method of Production Flow Analysis as advocated by Prof. Burbidge will give an additional dimension to this technique. The cell system approach provided a new impetus to management, a renewed sense of purpose to people and a new environment of working — to extrapolate a total manufacturing system.

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Synthesis of Optimal Dairy Product Lines

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How linear programming can be applied to evolve an optimal product mix for a milk processing plant under social, technological, resource availability and market constraints

This study represents an inquisitive effort to assort a major production management problem in a multi-product dairy farm. For optimisation exercise, pragmatic production situations were developed within a myriad of technical, economic and marketing constraints. The programmed solutions highlighted the crucial role of package in dairy product diversification. The study unravelled the complementarity between various resources and the need for effective resource management for higher profits.

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The Problematic Situation

Provision of liquid milk and milk products for human consumption has been the concern of recent efforts engineered to augment the milk production in India. The emergence of milk marketing infrastructure under public sector can be attributed to the obvious inadequacy and predatory nature of the traditional subsistence-oriented, private milk marketing system. Product quality becomes increasingly important partly because the widening radius of distribution necessitates better hygienic standards and partly because the expanding market inevitably leads to consumer demand for consistency of product characteristics such as flavour, shelf life, etc. The economic viability of dairy plants, especially those in public sector is still a moot question, largely because the management methods are seldom brought to a level of efficiency and effectiveness commensurate with the technical methods of production. The problem is complicated owing to a larger choice available for manufacturing milk products. This manufacturing choice is further multiplied when each produce line may be approximated by different routes. The problem then, essentially boils down to evolving a product mix for a milk processing plant under social, technological, resource availability and market constraints. Several quantitative management tools are available to generate meaningful solutions to such problems. A sizeable body of literature on the application of programming models (especially linear programming methods) in Indian Industry is now available. However, such application has not been explored in dairy industry so far. The present study is thus an attempt to fill this crtical gap of information by seeking to determine the optimum product-lines under varying technical and economic considerations and to identify the areas of resource maneuverability in the case study plant.

The Plant Under Study

The Milk Products Factory (MPF), Vijayawada, commissioned in April, 1969 has presently a handling capacity of 1.25 lakh litres. The surplus milk after meeting the liquid milk requirements of Vijayawada town is diverted for the manufacture of various dairy products. Although it has held the record of manufacturing products like ice-cream mix, whole milk powder, skim milk powder, mango powder, etc., the

factory has confined, of late, to the production and marketing of fewer popular products. The production figures for those in the merchandising line during the month of the investigation (January, 1979) and for which the costing and optimisation was carried out are presented in Table 1.

Table 1

Product Lines at Milk Products Factory, Vijaywada (January, 1979)

Product Specification	Symbol	Product Units
Ghee one kg loose	GLON	850
Ghee thirty-four kg lot	GTFR	225
Ghee seventeen kg lot	GSEN	1820
Ghee two kg lot	GTWO	4860
Ghee one kg lot	GONE	5350
Ghee half kg lot	GHAF	3580
Baby food one kg loose	BLON	2340
Baby food twenty-five kg lot	BTFV	2170
Baby food one kg lot	BONE	65640
Baby food half kg lot	BHAF	10500
Toned milk one litre lot	TONE	50760
Toned milk half litre lot	THAF	19,28860
Doodh Peda one kg lot	DPED	745
Industrial casein one kg lot	CASN	98

The Linear Programming Approach

Fourteen products listed in the above table were chosen as activities for the study. Each product resulted in a separate identity and commanded regularity of production and market admissibility. The byproducts like sterilized flavoured milk and buttermilk were kept out of the purview for the reason that their production is not market-oriented. These products, by and large, are supplied to schools as part of benevolent school-lunch programme. The returns to fixed factors has been considered as the goal to be maximised. This is because each product contributes towards covering fixed overheads. This dividend, in the present case, essentially works out to be the difference between selling price and prime cost (Table 2)

Resources considered to be limiting were steam, refrigeration, cold room space, storage space, capital provision for plant maintenance, direct labour, electricity and butter fat. The structural coefficients or the technical coefficients of production were estimated after thorough follow-up of various production processes. The collection and testing of this data took, by far, the major portion of the study by the investigating team. Restrictions reflecting resourse availability, installed capacity and technical feasibility were also suitably incorporated.

Mathematically, the generalised problem boils down to maximise :

$Z = C_1X_1 + C_2X_2 + \ldots + C_jX_j + \ldots + C_nX_n$ subject to the conditions :

$a_{11}X_i + a_{12}X_2 \ldots + a_{1j}X_j + \ldots + a_{1n}X_n \leq b_1$.

$a_{21}X_1 + a_{22}X_2 + \ldots + a_{2j}X_j + \ldots + a_{2n}X_n \leq b_2$

$a_{11}X_1 + a_{12}X_2 + \ldots + a_{i.}X_j + \ldots + a_{ijnj}X_n \leq b_i$

$a_{m1}X_1 + a_{m2}X_2 + \ldots + a_{mj}X_j + \ldots + a_{mn}X_n \geq b_m$

where the C_j for $j=1, 2 \ldots n$; bi for $i=1, 2 \ldots m$; and aij are all constants, and $m < n$, and the decision variables $n_jO \geqslant j=1, 2 \ldots n$

If bi is the available amount of resources i, then aij is the amount of resource i that must be allocated (technical coefficients) to each unit of activity j. The contribution to fixed factors in our case per unit of activity j is equal to Cj. These estimates are furnished in Table 2.

Competitive market situations and market realisations were introduced through specification of activity quantities by setting the restriction $X_j = X_j$. The proclivity of butter fat diversion to loose ghee, as observed in trial runs might not be desirable when baby food continues to be much in shortage in Andhra Pradesh and country as a whole. Ghee is no more than a household delicacy, serving the interests of consumers in high income brackets. Baby food, on the other

Table 2

Structural Coefficients and Resource Availability For the Case-Study Plant.

Product	Steam (kg)	Refrigeration (kcal)	Cold room space (sq. ft)	Storage space (sq. ft)	Maintenance capital (Rs.)	Direct labour (min)	Electricity (kwh)	Butter fat	Contribution to fixed factors (Rs)
GLON	2.085	1.179	0.0062	0.0092	0.0028	3.082	0.235	0.995	3.04
GTFR	64.634	34.374	0.1496	0.2754	0.0714	94.350	7.072	33.830	88.74
GSEN	33.626	19.312	0.0850	0.1462	0.0408	48.977	3.757	16.915	40.97
GTWO	4.296	2.284	0.0118	0.0182	0.0052	6.030	0 448	1.990	5.34
GONE	2.137	1.157	0.0062	0.0092	0.0028	3.181	0.262	0.995	1.67
GHAF	1.112	0.726	0.0033	0.0048	0.0165	1.788	0.156	0.498	0.63
BLON	6.077	21.381	—	0.0058	0.0049	5.593	1.654	0.190	6.17
BTFV	147 700	481.050	—	0.1025	0.0925	119.650	37.175	4.750	150.00
BONE	6.155	20.526	—	0.0058	0.0049	5.995	1.592	0.190	5.14
BHAF	3.173	11.499	—	0 0033	0.0026	3.027	0.888	0.095	2.11
TONE	0.525	5.136	0.0012	—	0.0006	1.082	0.072	0.030	0.82
THAF	0.278	2.695	0.0008	—	0.0004	0.636	0.037	0.015	0.37
DPED	0.408	2.810	0.0019	0.0022	0.0007	3.926	0.087	0.150	9.12
CASN	12.458	—	—	0.0013	0.0003	35.588	1.375	0.015	12.40
Total availability	1968000	8742250	3150	11000	5200	2120000	250000	120000	

hand, has the tendency of becoming popular among the middle class in recent times as the alternative food for babies. It is felt, therefore, relevant to bound the ghee activities around the base level of 56,300/kg.[1]

One major area of the product-mix problem is related to the extent of resource manoeuvrability under imposing technical and economic situation. Very often some crucial factors might stem from the general routine operating schedule and product balance. For instance, generation of steam and operation of refrigeration schedules might be hampered by technical defaults. Skilled labour might also be in dearth at some point of time. In such circumstances, the management is faced with the problems of economising the product scheduling vis-a-vis maintaining the market share. Extension of optimisation exercise, therefore, deemed essential to reconcile such factor limitations in the case study plant. Additionally, optimal plans were generated under increased supply of some vital resources like electricity and butter fat.

Appropriate slack variables are added to make the constraint condition a constraint equation. Although our case presents a typical mixed—integer problem, some activities being under the constraint to have integer values

1. Less popular and prestigious products like *Doodh Peda* and toned milk one litre (sachet) lot were also bounded from above, around their existing level of production.

because of their bulkiness and indivisibility character, the dearth of computational facilities at Indian Agricultural Statistics Research Institute, New Delhi refrained us from undertaking the solution to mixed-integer programming problem. As such integer parts approximation in TEMPO was resorted to solve our case without forsaking clarity and validity to the extent required.[2]

2. Tempo is a mathematical programming system which offers the latest advances in computing techniques for linear programming and its extension. For the exposition of the execution process, see Burrough's Corporation, Tempo Mathematical Programming System. Detroit, Michigan, 1976.

The optimum plan scenario

The results of optimisation exercises are given in Table 3. The information in column 2 pertains to the base level (existing) resource availability and those furnished in column 3 to 10 represent different resource Scenario under consideration.

Under base level resource position, a visible increase of BTFV and THAF by 2088(52200kg) and 231445(115723 it) units, respectively was observed against the existing level of production. The optimal plan called for a summary rejection of casein all the packed lots of ghee, baby food one kg lot and half-a-kg lot. The exclusive proclivity towards loose ghee and to some extent larger lots of baby food, namely BTFV, signposts the need to look for less expensive, flexible packaging for these small size-lots. This is because the share of package assumed inverse relation with the lot size. The optimal product-mix (Col. 2) resulted in under-utilisation of storage space, maintenance capital, steam, cold room space and refrigeration (Table 4). The glaring higher valuation of electricity as compared to butter fat indicated the intense consumption of electrical power in the case plant.

When steam was set at 40 per cent limitation, the optimal

Table 3

Optimal Product-Mix Under Different Resource Profiles

Product	Optimum at baselevel	Steam 40% limitation	Refrigeration 30% limitation	Cold room 40% limitation	Direct 20% limitation	Electricity 10% limitation	Elect. 10% additional	Buffer Fat % limitation	Buffer Fat % additional
1	2	3	4	5	6	7	8	9	10
GLON	56300	56300	56300	38535	—	56300	56300	54216	56300
GTFR	..	..	..	350	..	350	264	..	350
GSEN	..	..	..	..	..	..	..	..	..
GTWO	..	2328	13417	..	..	858	..	..	5914
GONE	..	..	..	..	..	..	..	..	..
GHAF	..	..	..	..	..	..	..	..	..
BLON	..	72662	..	..	..	..	..	..	..
BTFV	4258	..	1760	4395	3950	3322	5888	4034	4038
BONE	..	..	..	..	..	..	..	..	..
TONE	51000	51000	..	51000	..	51000	51000	51000	51000
THAF	2160305	2200000	1920000	1920000	1920000	2200000	2011505	2200000	2102880
DPED	800	800	800	800	800	800	800	800	800
CASN	..	..	200	200	..	200	..	200	..
Returns to fixed factors (1000 Rs.)	1656	1496	1227	1570	1310	1571	1721	1643	1666

Table 4

Resource Usage and Valuation

Resources		Slack activity	Shadow prices (Rs.)
Steam	('000 kg)	603 (30.6)	0
Refrigeration	('000 kg)	627 (7.2)	0
Cold room space	(sq. ft)	962 (30.5)	0
Storage space	(sq. ft)	9978 (90.7)	0
Maintenance capital	(Rs.)	3749 (72.0)	0
Direct labour	('000 min)	0	0.41
Electricity	('000 kwh)	0	2.60
Butter fat	('000 kg)	0	0.94

Figures in parentheses are percentages to base resource availability.

production plan tilted in favour of ghee, toned milk and baby food loose one kg, BLON. Under 30 per cent refrigeration, while ghee again was preferred (the product-mix heavily banking on GTWO), the production of toned milk scaled down in comparison with the optimum at base level resource position. Restriction on cold room space might result in marked downfall of ghee and toned milk. When direct labour was cut short by 20 per cent, the optimal product-mix totally weaned away the ghee production. The situation, when electricity was held up by 10 per cent, resembled to the one related to steam storage although ghee was less sought for, and baby food more desired. Interestingly, when electricity was assumed to be available to the tune of 10 per cent over the base level, baby food was preferred at the cost of ghee and toned milk. In case of lesser fat availability again, ghee production was kept at low ebb with marginal jacking up in the levels of toned milk and baby food. The reverse was true when butter fat availability was raised by 10 per cent marking the production plan abounting with ghee. Judging by the magnitude of returns to fixed factors, it can be generalised that refrigeration and direct labour constraints had perceptible even unsavoury, dent on the returns. What is more striking is the observation that increase in power supply brought

Table 5

Resource Usage and Valuation Under Different Resource Profiles

Resources	Steam 40% limitation		Refrigeration 30% limitation		Cold room 40% limitation		Direct Labour 20% limitation		Electricity 10% limitation		Electricity 10% additional		Butter fat 10% limitation		Butter fat 10% additional	
	ER	SP	ER	SP	ER	SP	ER	SP	ER	SP	ER	SP	ER	SP	ER	SP
Steam	0	0.99	50.6	0	33.1	0	43.2	0	35.1	0	26 6	0	31.0	0	30.2	0
Refrigeration	11.6	0	0	0.29	12.9	0	19.0	0	9.9	0	7.2	0	5.9	0	8.8	0
Cold room space	28.5	0	35.1	0	0	337 38	51.1	0	29.0	0	34.6	0	31.5	0	29.6	0
Storage space	90.4	0	91.4	0	91.8	0	96.3	0	91.1	0	90.0	0	91.6	0	89.7	0
Maintenance capital	72 3	0	77.7	0	74.2	0	78.2	0	72.9	0	71.8	0	72.3	0	71.9	0
Direct labour	3.0	0	20.0	0	7.3	0	0	1.26	2.2	0	0	0.41	0.1	0	0	0.41
Electricity	14.4	0	37.2	0	0	4 03	12.8	0	0	3.80	0	2.60	0	3.76	0	2.60
Butter fat	0	0 53	0	2.35	15.0	0	60.0	0	0	1.83	0	0.94	0	2.17	0	0.35

R = Excessive resource in per cent; SP = shadow price in rupees.

home more returns as compared with the increase in butter fat.

The programmed solutions also provided insight into the nature and extent of resource utilisation and accounting. The results in Table 5 reveal that butter fat and electricity continued to exert, due to their stringency, pressure on product-mix in all the situations. A part of fat remained unutilised when cold room space was limited by 40 per cent and direct labour by 20 per cent. This emanates from the lower order of production, principally, of ghee and toned milk. For that matter, when ghee was favoured under steam and refrigeration limitations, the entire amount of butter fat was utilized, or rather this factor became stringent. Although direct labour was short of supply in the optimal plan with base resource level, due to lesser availability of complementary resources like steam, refrigeration, cold room space, electricity and butter fat, this factor could not be entirely committed to the various production lines.

Conclusions

The study has brought to the limelight the complementarity between various resources employed and the need for intelligent resource management in dairy processing. The investigation highlighted, among other things, that packaging is a crucial and delicate problem to reckon with in product diversification.

Minimising Coal Distribution Cost

SINHA, K. P.
and
S. R. CHAUDHURI

If care is taken to ensure that routes are not overloaded in any case and distribution through overloaded routes is diverted through underloaded routes at the cost of transportation, substantial saving in coal distribution with the added advantages of reduced delay in transportation can be accomplished at national level

The geographic concentration of India's coal fields necessitates long distance coal transportation for all consumers. Thermal power plants are the largest consumers, consuming about 32% of India's total coal production. At present, there is no systematic procedure for coal transportation from coal stocks to power stations. In addition to this, the coal carrying rail route capacity which limits the maximum rate of transportation on any rail route is not being considered and this causes delay.

In this article, an attempt has been made to develop a coal distribution schedule purporting to minimise the coal distribution cost at the national level within the constraints of rail route capacity and grade of coal. Further, to cope with the handling of large amount of data involved in the problem, a second generation IBM-1401 computer avilable at Ranchi was used. The total amount of saving expected, as per the suggested distribution schedule, is Rs. 280 x 10^6 for 20 million tons of coal handling.

Dr. K. P. Sinha is Professor and Head, Department of Production Engineering, Birla Institute of Technology, Mesra, Ranchi. Mr. S. R. Chaudhuri is Engineer (Mech.), Shaft design department, C. M. P. D. I. Ltd., Ranchi.

Bottleneck in Coal Distribution System:

The geographic concentration of India's coalfields necessitates long distance transportation of coal to its consumers. The proportion of total shipment carried by Indian Railways has increased from 75% in 1974-75 to nearly 79% in 1976-77 and is likely to reach 81% by 1985-86.

The railways carry coal over an average distance of 600 kms in trainloads of about 2000T each. The total amount being 12,00,000 ton km. Coal movement accounts for obout 30% of all the originating traffic moved by Indian Railways. Locomotives themselves consume about 14% of India's coal production.

Some 143 bulk consumers consisting of 9 railways, 7 steel plants, 78 power plants, 51 cement plants consume about 68% of total hard coal shipment. Fifteen thousand small industries all over the country account for 22% of the shipment while 20,000 brickfields and 6,000,000 domestic consumers share 5% each. Steel plants take 17% of total coal shipment, power sector uses 32% of the total shipment.

Thermal power plants have yearly arrangements with coal producing authorities and sales department of coal India Ltd. about the mode of shipment of coal. Thermal power plant authorities of different regions of India negotiate contracts for this reason.

Mainly the agreements and contracts deal with the following variables.

1. Source from where coal is to be procured.
2. Grade of coal/Grades of coal-or product or grade mix of coal to be supplied.
3. Quantity of coal to be supplied along with a schedule of supply.

In normal situations coal is

transported by railroutes to different thermal power plants. The coal stocks arrange with the concerned Railway authorities and allotment of wagons are made accordingly. Box wagons having capacities varying from 22 tons to 56 tons are used. One rake consists of 23 wagons (56 tons wagon each) or 46 wagons (22 tons wagons each). These rakes are hauled via many rail routes to different thermal power stations. The routes are fixed as per the availabilty of the routes or as per the convenient route as felt by railway authorities. Thus, the cost of transportation is high as well as the present arrangement causes inconvenience.

To improve the existing system of distribution of coal, it is necessary to prepare a proper transportation schedule to cope with the present requirement without any bottleneck. This paper aims at this.

The Transportation Problem

Distribution of coal to various thermal power plants is basically a transportation problem with some added constraints and complexity. Within a given time period each shipping source (i.e., coal stocks) has some certain shipping ability and each destination **i.e., thermal power plants, has** certain requirement. (with a given cost of shipping).

The objective function of coal distribution problem remains the cost minimisation of transportation and also some other constraints. The constraints are as explained here. Each power station is linked to a group or one coal stock by one or more railroutes in series. These railroutes have definite load capacities. And any solution which may be desired optimal may overload a series of route capacities. But in the proposed system care has been taken to see that routes are not overloaded in any case and distribution through overloaded routes is diverted through underloaded routes at the cost of transportation. This will save a lot of delay in transportation.

Vogel's Approximation Method (VAM) :

For solution to this transportation problem authors have used VOGEL'S APPROXIMATION METHOD (VAM) and handled the same by a second generation (IBM-1401) computer available at Ranchi.

Codification of Data (Step 1)

Codification is needed to represent alphabetic names of thermal power stations, coal stocks, grades of coal and routes. Each of these assigned coded either of two or three digits, numericals. This will also save computer processing time.

Documentation and Storage of Data (Step 2)

(a) Demand by thermal power stations are given as follows :-

			(Code)
Name of Thermal Power Station	Patratu		007
Grade of coal required	II		02
Quality of coal required	1980	0.61	00.61
	1981	0.71	00.71
	1982	0.81	00.81

For all thermal power stations these are recorded, and they are converted to punched cards. These punched cards are fed to the computer to create demand file on a magnetic tape.

(b) Production potentials of each coal stocks are given as below :

These are available from advanced planning.

			(Code)
Name of coal stock	Dhori		068
Grade of coal produced	II		02
Coal stock estimated for	1980	0.21	00.21
	1981	0.21	00.21
	1982	0.25	00.25

For all coal stocks these are recorded and transferred to another magnetic tape to create a production file.

(c) Distance from each coal stock to each thermal power plant is given as below. This has also to be linked with railroute. Distances are measure of costs. There may be some cases where no rail-routes are possible to link one stock. The distances for such routes are shown as very high figure (9999) so that these routes will not be considered automatically.

		Code
From	Raniganj	009
To	Patratu	007
Distance	430	0430
Route—1	And-Dhan	03
Route—2	Dhan-Rnch	07
Route—3	Rnch-Path	68
Route—4	Nil	00

For all possible combination of these, distances are recorded and transferred to a magnetic tape to create a distance file.

(d) Capacity of each rail route is given as below. These are available from railway authorities. The data are recorded in the following fashion and converted to magnetic tape files.

		Code :
Rail Route	And. Dhan	03
Capacity (Million Tonne per year)	30.00	30.00

Matrix and Transportation Model Formation (Step 3)

With the help of sorting programme which is available as a standard programme, all data are seperated in the following fashion.

a) Yearwise and gradewise demand of coal by thermal power plants.

b) Yearwise and gradewise coal stocks (availability) by different coal stocks.

Matrix formation will be done with the help of demand file, availability file and distance file. A part of this Matrix is shown in exhibit 1.

The figure enclosed in the small rectangle (*) represents distance (x 100) kms. The right side figure (**) represents route codes through which the coal has to move.

Computer Programme and Flow Chart (Step 4)

A Computer programme was developed to solve this transportation problem. The language used in FORTRAN—IV VOGEL'S APPROXIMATE METHOD was utilized in the programme.

The computer (IBM-1401) takes about 40 minutes to solve this programme. The Flow chart of the programme is shown in exhibit 2.

Exhibit 3 shows the result obtained for coal grade 1 for the year 1 (1980-81). It gives the optimum allocation in terms of million tons of coal from coal stock to thermal power stations for a particular grade and year. This type of result was obtained for each grade of coal for each year under consideration.

From the above results, the total loading on each rail route was determined. The route capacity and route loading of some routes are shown in exhibit 4. From the exhibit, it can be clearly seen that some routes are overloaded while some are underloaded. The over loaded routes will cause delay in transportation. This over loading of routes was solved by re-routing of excess amount of coal through other routes which were underloaded and available in close vicinity of the former route.

The re-routing procedure is described below :—

1 Reduce the allocation from the coal stock by which it is exceeding the route capacity.

2. Search the next route which is underloaded and reaches the same power station and record that.

3. Increase the route loading as obtained in Step-2 by the amount obtained from Step-1.

4. If no route is available arrange to send it by some other mode of transport i.e., trucks, etc.

Conclusions

1. The proposed scheme of coal allocation and route loading results in substantial saving particularly in higher range of coal distribution with the added advantage of reducing delay in transportation. For 20 million tons of coal distribution per year the approximate saving comes out to be of the order of Rs. 280×10^6.

2. For better coordination with Railways to get correct allotment of wagons and for better coal movement, this proposed method can be used as a very useful tool. Also fluctuations in demand and availability can be handled with ease by this method.

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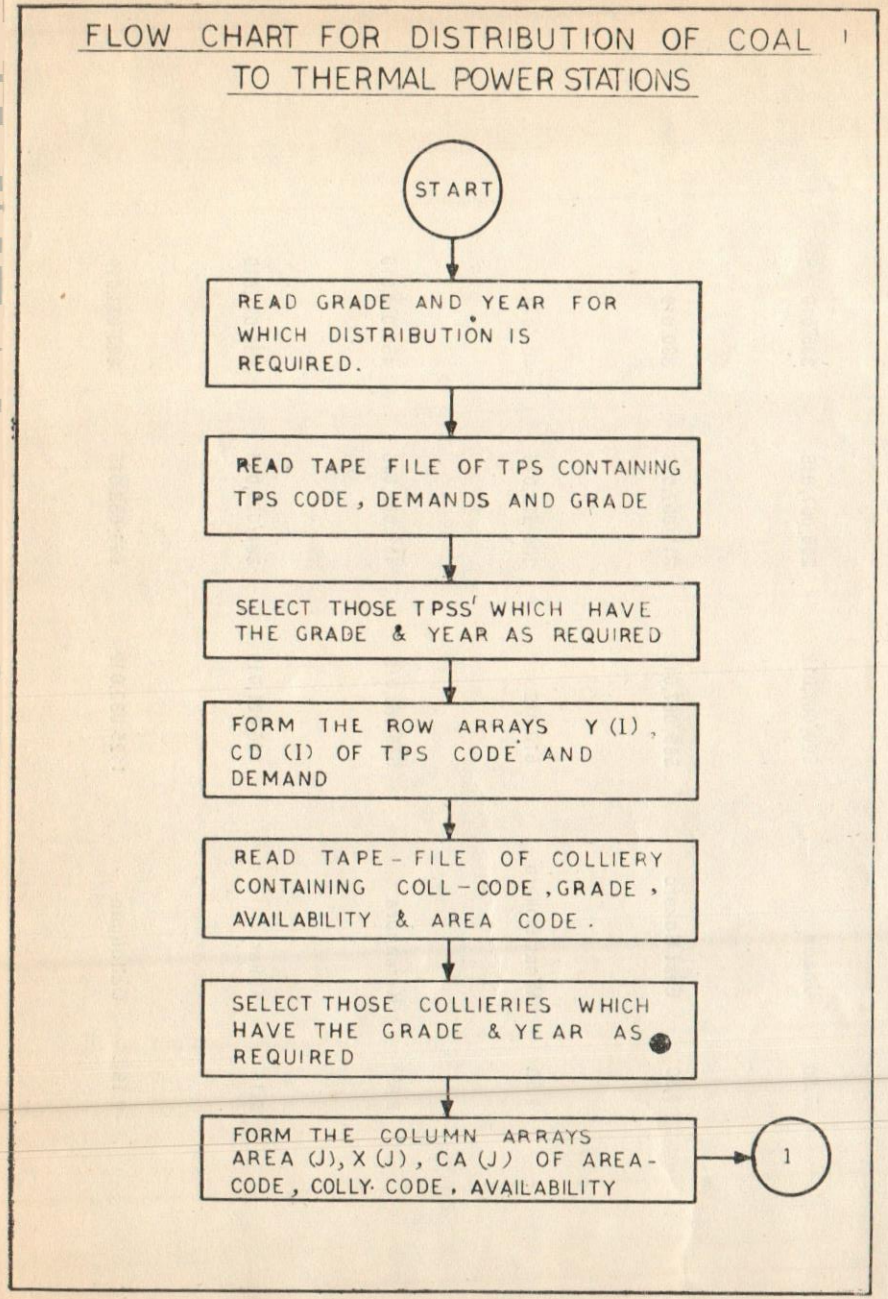
3. Chaudhuri S. R., "An attempt to minimise coal distribution cost at national level", *Unpublished Post graduate dissertation*, XISS, Ranchi.

Exhibit 1

Showing Formation of Transportation Problem Matrix (Sample)

DEMAND MT/YR AVAILA-BILITY		0.87	0.90	1.00
	THERMAL POWER PLANTS	FARAKKA	KOLAGHAT	CESC
	COAL STOCKS			
	Distance/ Routes/Km	380/012	180/015	194/019
		* **		
7.50	Raniganj	445/011,012	190/015	259/019
7.50	Jharia	520/067,012	266/067,015	335/019
2.50	East Bokaro	565/067,012	311/067,015	380/019
2.50	West Bokaro	610/012	300/012,015	401/019
3.85	Karanpura	685/065,012	459/065,015	458/021,019
2.15	Khilari	886/021,012	394/021,015	586/021,019
2.15	Daltongani	1125/033,012	623/033,015	823/033,019


FLOW CHART FOR DISTRIBUTION OF COAL TO THERMAL POWER STATIONS
START
READ GRADE AND YEAR FOR WHICH DISTRIBUTION IS REQUIRED.
READ TAPE FILE OF TPS CONTAINING TPS CODE, DEMANDS AND GRADE
SELECT THOSE TPSS' WHICH HAVE THE GRADE & YEAR AS REQUIRED
FORM THE ROW ARRAYS Y(I), CD (I) OF TPS CODE AND DEMAND
READ TAPE-FILE OF COLLIERY CONTAINING COLL-CODE, GRADE, AVAILABILITY & AREA CODE.
SELECT THOSE COLLIERIES WHICH HAVE THE GRADE & YEAR AS REQUIRED
FORM THE COLUMN ARRAYS AREA (J), X (J), CA (J) OF AREA-CODE, COLLY-CODE, AVAILABILITY
1

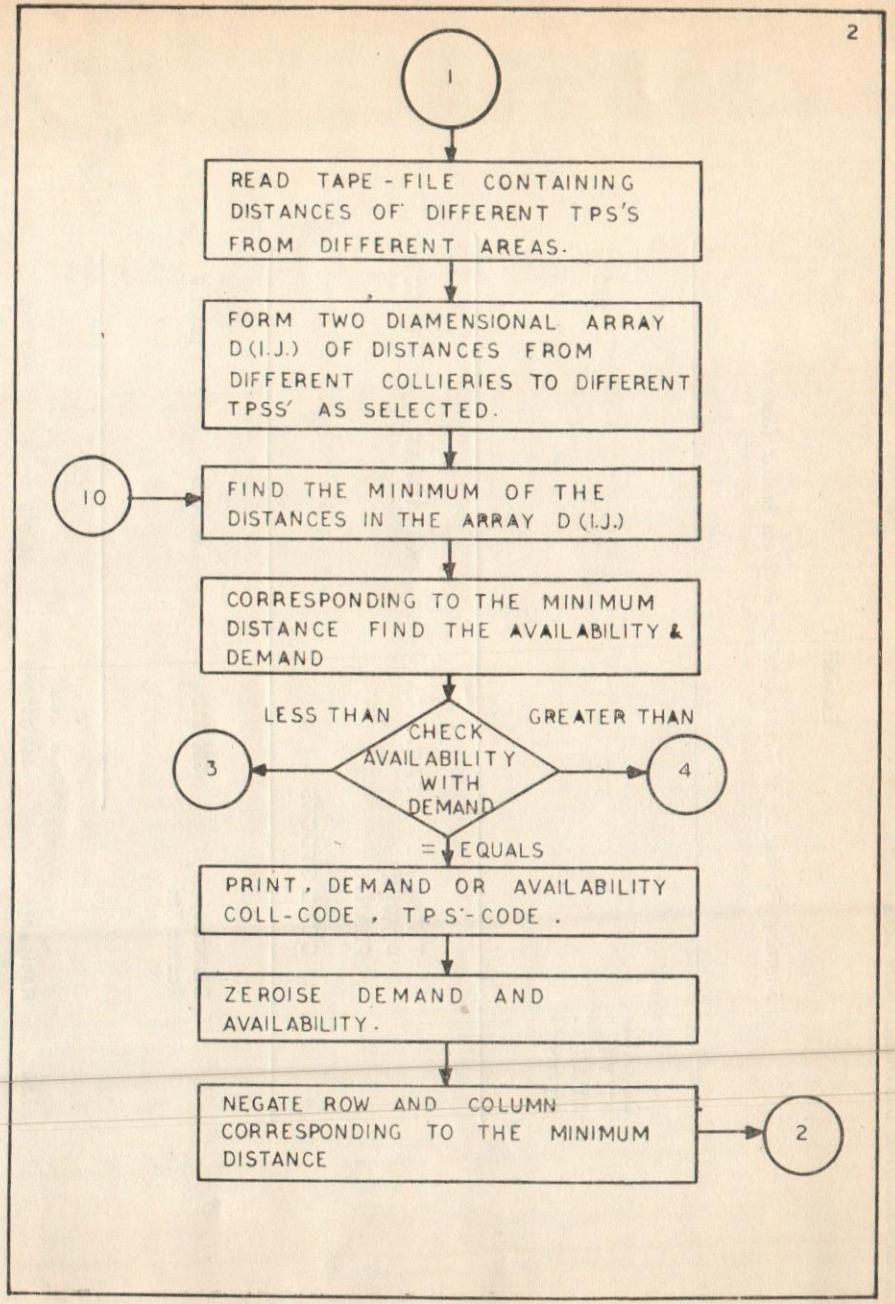
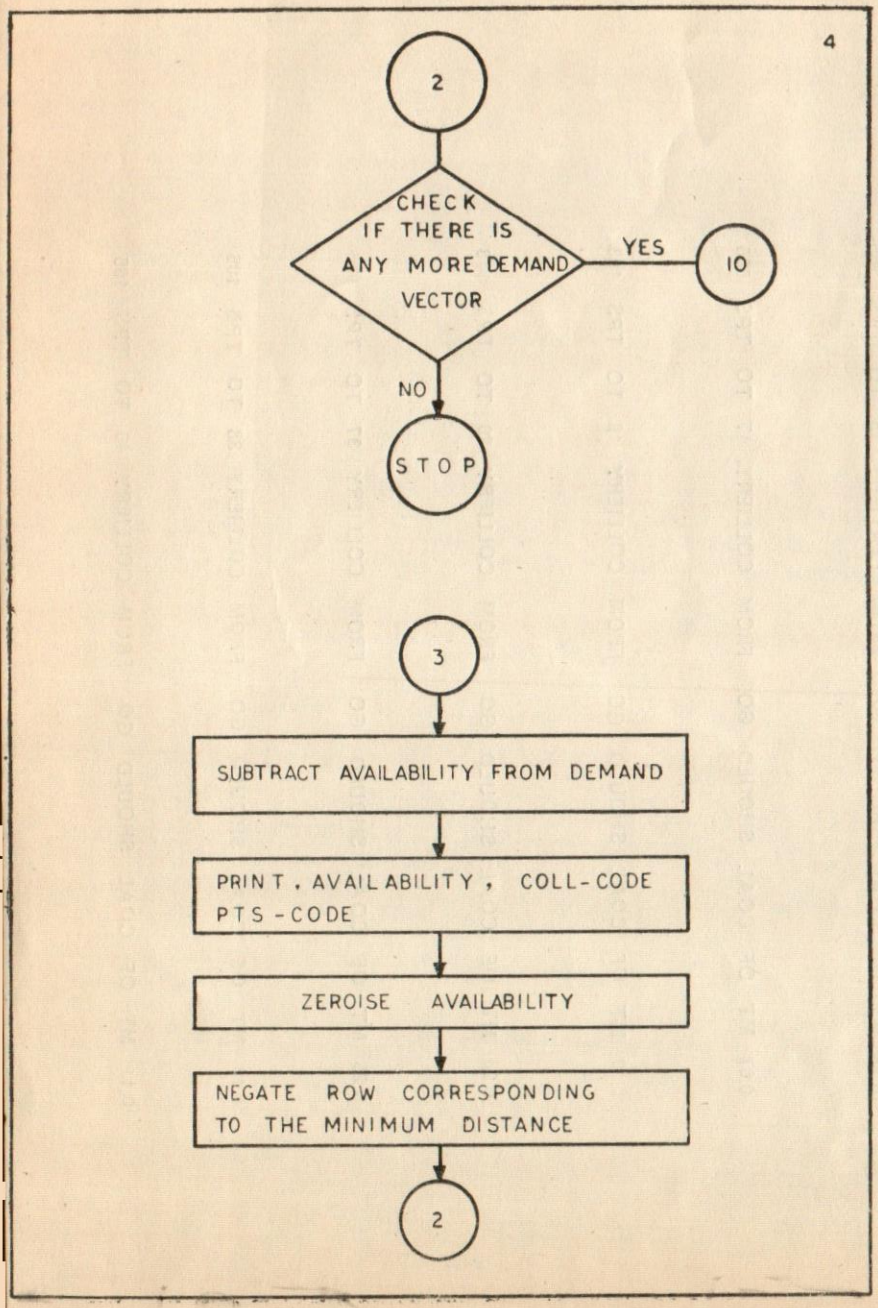

2
1
READ TAPE-FILE CONTAINING DISTANCES OF DIFFERENT TPS'S FROM DIFFERENT AREAS.
FORM TWO DIAMENSIONAL ARRAY D(I.J.) OF DISTANCES FROM DIFFERENT COLLIERIES TO DIFFERENT TPSS' AS SELECTED.
10
FIND THE MINIMUM OF THE DISTANCES IN THE ARRAY D(I.J.)
CORRESPONDING TO THE MINIMUM DISTANCE FIND THE AVAILABILITY & DEMAND
LESS THAN
CHECK AVAILABILITY WITH DEMAND
GREATER THAN
3
4
= EQUALS
PRINT, DEMAND OR AVAILABILITY COLL-CODE, TPS'-CODE.
ZEROISE DEMAND AND AVAILABILITY.
NEGATE ROW AND COLUMN CORRESPONDING TO THE MINIMUM DISTANCE
2

Exhibit 2


4
2
CHECK IF THERE IS ANY MORE DEMAND VECTOR
YES
10
NO
STOP
3
SUBTRACT AVAILABILITY FROM DEMAND
PRINT, AVAILABILITY, COLL-CODE PTS-CODE
ZEROISE AVAILABILITY
NEGATE ROW CORRESPONDING TO THE MINIMUM DISTANCE
2

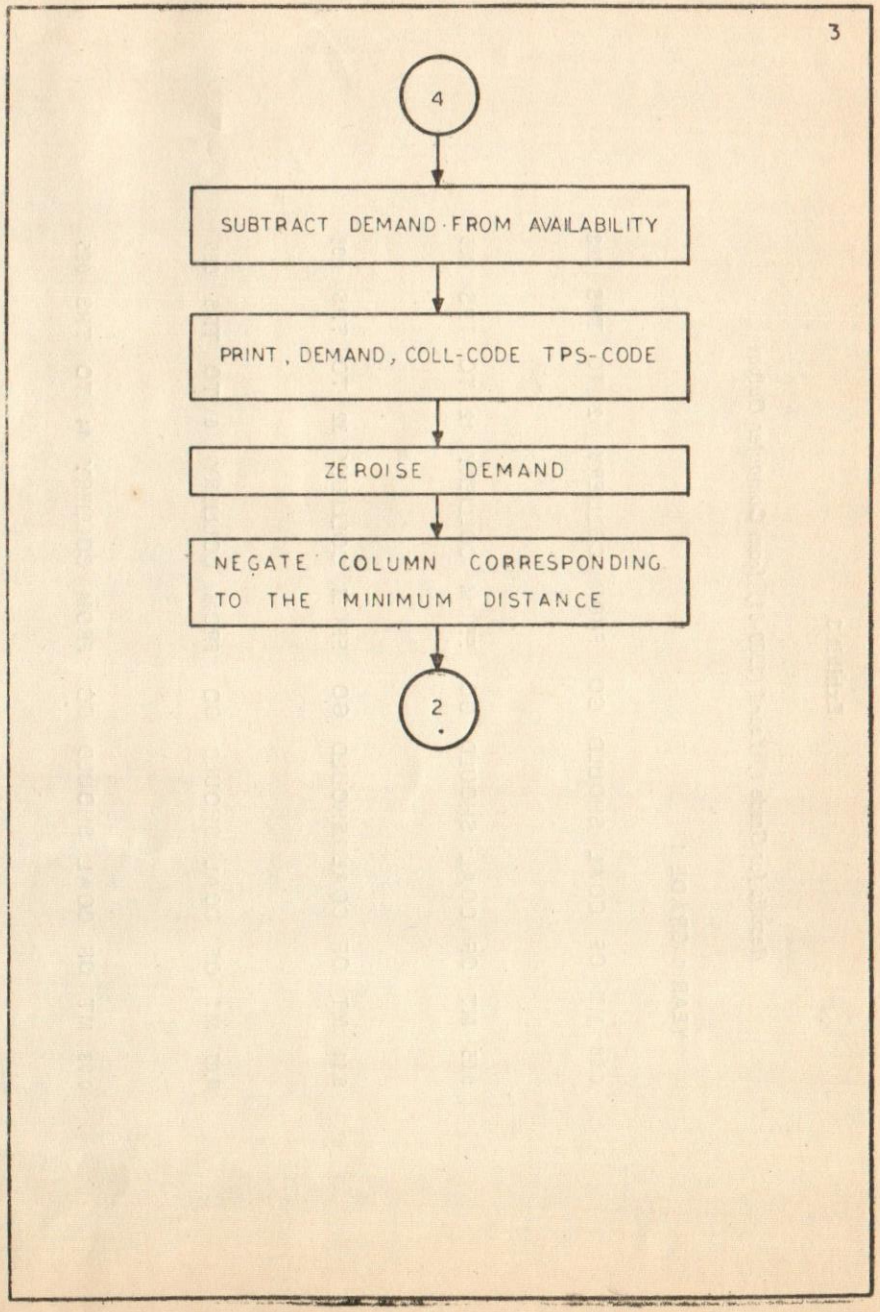

3
4
SUBTRACT DEMAND FROM AVAILABILITY
PRINT, DEMAND, COLL-CODE TPS-CODE
ZEROISE DEMAND
NEGATE COLUMN CORRESPONDING TO THE MINIMUM DISTANCE
2

Exhibit 3

Results for Grade 1, Year 1 (1980-81) from Computer Output

YEAR 1 GRADE 1

0.06 MT OF COAL SHOULD GO FROM COLLIERY 2 TO TPS 103

0 05 MT OF COAL SHOULD GO FROM COLLIERY 12 TO TPS 005

0.11 MT OF COAL SHOULD GO FROM COLLIERY 32 TO TPS 006

0.07 MT OF COAL SHOULD GO FROM COLLIERY 6 TO TPS 085

0.03 MT OF COAL SHOULD GO FROM COLLIERY 14 TO TPS 095

0.13 MT OF COAL SHOULD GO FROM COLLIERY 15 TO TPS 106

0.07 MT OF COAL SHOULD GO FROM COLLIERY 17 TO TPS 005

0.10 MT OF COAL SHOULD GO FROM COLLIERY 19 TO TPS 103

0 23 MT OF COAL SHOULD GO FROM COLLIERY 20 TO TPS 108

0.25 MT OF COAL SHOULD GO FROM COLLIERY 37 TO TPS 065

0.13 MT OF COAL SHOULD GO FROM COLLIERY 38 TO TPS 105

0.11 MT OF COAL SHOULD GO FROM COLLIERY 40 TO TPS 105

Exhibit 4

Route Capacity Vs Route Loading

ROUTE CODE	CAPACITY OF ROUTE	LOAD ON ROUTE		REMARKS
001	1.00	0.90	OK	
002	1.00	0.09	OK	
003	1.00	0.20	OK	
004	1.00	0.70	OK	
005	1.00	0.25	OK	
006	1.00	1.25	X	Over loaded
007	1.00	1.15	X	—do—
008	1.00	1.20	X	—do—
009	1.00	1.20	X	—do—
010	2.00	1.50	OK	
011	2.00	1.50	OK	
012	1.50	1.70	X	—do—
013	1.00	1.20	X	—do—
014	1.00	0.85	OK	
015	1.00	0.25	OK	
016	0.20	0.09	OK	
017	0.10	0.21	X	—do—
018	0.50	0.37	OK	
019	0.80	0.38	OK	
020	0.70	0.48	OK	
021	0.50	0.38	OK	
022	0.20	0.21	X	—do—
023	0.90	0.84	OK	

PRODUCTIVITY

Silver Jubilee Issue, Vol. XXIV(3), October–December 1983 : Rs. 30

The Editorial Board of the *Productivity* has decided to bring out a special silver jubilee issue in October-December 1983 during silver jubilee year of the National Productivity Council. Eminent academicians and practitioners in India and abroad are requested to contribute papers on the following topics :

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10. Motivation in Productivity System
11. Communication in Productivity System
12. Group Processes in Productivity
13. Cultural Factors in Productivity
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18. Improving Productivity in Government
19. Economic Incentives for Productivity
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27. Productivity in Service Organisations
28. Productivity in Small Scale Industries
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43. Quality-Productivity Relationship
44. Productivity and Organisational culture
45. Productivity and Organisational development

Section 'F' : **Managing Productivity System**

46. Management for Productivity
47. Planning Productivity System
48. Corporate Decisions and Productivity
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An Invitation to Management Thinkers & Writers

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'Indian Management', the journal of All India Management Association, invites contributions from managers, academicians, teachers and researchers of management, and free-lance writers and others who have a point of view on the management and industrial scene in India.

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(f) Short, balanced and impartial reviews of new and interesting books in management and related areas. Please ensure that a copy of the book is enclosed alongwith the review.

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Analysing The Impact of Credit On Small Farms

Why the small farmers avail of the credit facilities provided by different agencies in Patiala district of the Punjab State

SINGH, J.
and
J. S. GILL

Borrowing behaviour of small farmers depend upon several factors including the cost of and return from credit As the analysis of results in this study shows, the borrowers revealed greater credit needs than non-borrowers. Increased availability of capital by borrowing enabled the farmer to obtain nearly the same amount of net returns per acre as that of the later. Because of scarcity of capital nearly one-fourth of the total available land with existing level of technology and nearly two-fifths of land with improved level of technology remained fallow. There was a significant increase in the returns to fixed farm resources of the borrowers both at existing and improved level of technology.

Dr. J. Singh and Mr. J. S. Gill are working with the Department of Economics and Sociology, Punjab Agricultural University, Ludhiana.

The Relevance of the Analysis :

The recent technological advance in agriculture being capital intensive increased the demand for credit especially in case of small farmers (i.e., those with operational holding size upto 3 hectares) who are economically much behind the large farmers and represent the majority (i.e., 68.89) of the farming community (as indicated in *Statistical Abstract of Punjab*, 1976).

The credit in the farm sector is supplied by various institutional and non-institutional agencies. Although the role of institutional credit agencies has been on the increase in the recent past, the role of non-institutional agencies in advancing credit to the small farmers is imperative. Whether it is desirable for the small farmers to go in for credit or not depends, apart from many other considerations, upon the cost of and return from it. It is, therefore, contentious to examine the impact of credit on production in case of small farmers so that they are in a position to take rational borrowing decisions.

Methodology :

Collection of Data :

The study was conducted in Patiala district of the Punjab State. The multistage simple random sampling design was adopted with block as the primary unit and cultivator as the ultimate unit of the study. From the randomly selected Sirhind block of the district, 3 per cent (i.e., six) villages were selected at random. The ultimate sample comprising 30 borrowers (i.e., those who had received agricultural credit) and 30 non-borrowers was selected from the total population of the small farmers with operational holding below 3 hectares from the selected villages. The data were collected for the year 1976-77 through survey method with the help of schedules specifically designed for this project. The information was collected regarding land, labour and irrigational resources, existing input-output coefficients, production pattern, liquid capital resources with the

farmers and credit obtained from institutional and non-institutional sources.

The Model Used :

The simple linear programming model was used for achieving the objectives of the study. The model used is outlined below :

$$\text{Maximise } Z = \sum_{j=1}^{n} C_j X_j$$

Subject to :

$$\sum_{j=1}^{n} a_{ij} X_j \leq bi$$

$$X_j \gtrless O \quad j=1,2 \ \ldots \ ,19$$
$$,=1,2\ldots\ldots\ldots,19$$

Where :

Z = Total returns to fixed farm resources

C_j = Returns to fixed farm resources from jth enterprise

X_j = Level of jth activity

b_i = Availability of ith resources

a_{ij} = Input of ith resource for jth activity.

The various constraints used in the model are explained below:

(a) *Land Constraint :* The maximum availability of land was the total operational area. Although there were enterprises which promised relatively higher returns per acre, acreage under these crops was restricted depending upon the mental reservation of the farmers and the suitability of land for growing them. Therefore, some maxima were fixed for such enterprises. Similarly some minima were fixed to meet the requirements of family and farm including fodder activities raised for the maintenance of livestock.

(b) *Human Labour Constraint :* The human labour resource restriction was examined by assessing the available permanent labour resource comprising family labour and permanently hired labour on the farm.

The labour required for maintenance of farm machinery and equipment, purchase of various inputs and other fixed farm activities like paying the electricity bills and labour required for unforeseen events as illness, visits to relatives, social ceremonies, etc. wasdeducted from the total availabilty of adult man hours for farm planning.

(c) *Capital Constraint :* The cash earmarked for kharif crops and that reserved for rabi crops was separately worked out by deducting the expenses on fixed activities and family needs from sale of previous crops produced plus amount borrowed. The working capital needed for selected crop enterprises was identified as cost of seed, fuel, manures and fertilizers, irrigation, plant protection measures, hiring of machinery for different crop operations and cost of post harvest marketing operations. The working capital needed for dairy enterprise included the cost of purchased wheat, bhusa, fodders, gur, etc., alongwith the veterinary charges. The cash requirements for casual labour in the peak periods was directly included in the matrix.

To estimate the impact of credit on production and farm income, the following situations were examined :

Situation I : Optimal plans were derived for borrower and non-borrowers separately with the owned capital resources at existing level of technology.

Situation II : Provision of credit was made under situation I.

Situation III : Optimal plans were derived for borrowers and non-borrwers separately with the owned capital resource at improved level of technology.

Situation IV : Provision of credit was made under situation III.

Findings of the Study :

The following are the findings of the study :

(a) **Impact of Credit on Farm Production :**

The existing cropping pattern of borrower and non-borrower farms is presented in Table 1. On an average the borrowers put area under wheat to the extent of 79.71 per cent of total area during the rabi season. The non-borrowers had 76.30 per cent of total area under wheat. The area under maize was 27.05 per cent of the total cultivated area in case of borrower farmers and 25.19 per cent in case of non-borrower farms. The paddy was cultivated on 40.58 and 40 per

Table 1

Existing Production Pattern of Borrowers and Non-borrowers (Synthetic farm Situation, Patiala district, 1976-77)

Enterprise	Acreage under the enterprise		Difference (in percentage area)
	Borrowers	Non-borrowers	
Kharif Season			
Maize	1.12(27.05)	0.68(25.19)	1.86
Kh. Fodders	0.55(13.29)	0.39(14.44)	1.15
Sugarcane	0.24(5.80)	0.20(7.41)	1.61
Paddy	1.68(40.58)	1.08(40.00)	0.58
Groundnut	0.27(6.52)	0.18(6.67)	0.15
Cotton	0.17(4.11)	0.10(3.70)	0.41
Fallow land	0.11(2.65)	0.07(2.59)	0.06
Sub-total	4.14(100.00)	2.70(100.00)	—
Rabi Season			
Wheat	3.30(79.71)	2.06(76.30)	3.41
Rabi fodders	0.53(12.80)	0.39(14.44)	1.64
Sugarcane	0.24(5.80)	0.20(7.41)	1.61
Fallow land	0.07(1.69)	0.05(1.85)	0.16
Sub-total	4.14(100.00)	2.70(100.00)	—
Milch animals* (Animal Units)**	2	1	1
Cropping intensity	195.66	195.66	—

* Difference is significant at 0.05 level of significance.

** Figure round off to one.

Note : Figure in parentheses indicate percentages.

cent of the total kharif area by the borrowers and non-borrowers, respectively. The area under sugarcane, groundnut and cotton was 5.80, 6.52 and 4.11 per cent of the total kharif area in case of borrowers and 7.41,6.67 and 3.70 per cent in case of non-borrowers. The difference between borrowers and non-borrowers in per cent area under all these enterprises was found to be statistically non-significant. However, dairy was the only enterprise in which non-borrowers had significantly lesser number of milch animals than the borrowers.

(b) Optimal Production Plans of Borrower Farmers :

The impact of credit on optimal production plans of borrower farmers at existing and improved level of technology was analysed and is presented in Table 2. Had the borrowers not provided with credit, they would have to optimise their production pattern with owned capital. The normative plan with owned capital of borrowers shows 49.52 per cent of kharif area under paddy. The area under sugarcane was 18.36 per cent of the total available area for cultivation. The owned capital of borrower farmers was not enough to utilise whole of the land for cultivation. Thus, 21.01 per cent and 32.25 per cent of the total area in kharif and rabi season was kept fallow.

As the capital was relaxed by providing additional funds in the form of credit, these farmers managed whole of the area under crops, both in kharif as well as rabi season. A remarkable change in the cropping pattern was also observed. The area under paddy increased significantly, viz., from 49.52 per cent to 81.64 per cent of the total kharif area and that under wheat the increase from 38.89 per cent to 82.85 per cent of the total rabi area was also statistically significant. This could be possible only if the farmers would have obtained credit.

The optimal plans at improved level of technology were again prepared with owned capital of borrowers and with total available capital (including borrowed capital) with them. As will be seen from Table 2, with the introduction

Table 2

Optimum Enterprise-mix of Borrower's (Synthetic Farm Situation in Patiala District, 1976-77)

Enterprises	Optimal plan at existing level of technology		Optimal plan at improved level of technology		Difference in acreage in column 2 & 3	Difference in acreage of column 4 & 5	Difference in acreage of column 2 & 5
	With owned capital (acreage) 1	With borrowed capital (acreage) 2	With owned capital (acreage) 3	With borrowed capital (acreage) 4			
Kharif Season							
Maize	—	—	—	—	—	—	—
Kh. fodders	0.46(11.11)	0.46(11.11)	0.46(11.11)	0.46(11.11)	0.00	0.00	0.00
Sugarcane	0.76(18.36)	0·30(7.25)	0.76(18.36)	0.76(18.36)	0.46	0.00	0.00
Paddy	2.05(49.52)	3.38(81.64)	1.28(30.92)	1.87(45.17)	1.33*	0.59	0.18
Groundnut	—	—	—	—	0.00	0.00	0.00
Cotton	—	—	0.15(3.62)	—	0.00	0.15	—
Fallow land	0.87(21.01)	—	1.49(35.99)	1.05(25.36)	0.87	0.44	0.18
Sub-total	4.14(100.00)	4.14(100.00)	4.14(100.00)	4.14(100.00)	—	—	—
Rabi Season							
Wheat	1.61(38.89)	3.43(82.85)	1.21(29.23)	1.90(45.89)	182*	0.69	0.29
Rabi Fodders	0.41((9.90)	0.41(9.90)	0.41(9.90)	0.41(9.90)	0.00	0.00	0.00
Sugarcane	0.76(18.36)	0.30(7.25)	0.76(18.36)	0.76(18.36)	0.46		
Fallow land	1.36(32.85)	—	1.76(42.51)	1.07(25.85)	1.36	0.69	0.29
Sub-total	4.14(100.00)	4.14(100.00)	4.14(100.00)	4.14 (100.00)	—	—	—
Buffalo (animal units)	1	1	1	1			
Cropping intensity	146.14	200.00	121.50	148.79			

*Significant at 0.2 level of significance
Note : Figures in parentheses indicate per cent area.

of borrowing activity, the area under paddy increased from 30.92 per cent to 45.17 per cent of the total available area during kharif season. The cotton crop which was raised on 3.62 per cent of the kharif area, was totally out in the optimal production plan with borrowed capital at improved level of technology. In rabi season, the area under wheat increased from 29.23 per cent to 45.89 per cent.

(c) Optimal Production Plans to non Borrower Farmers

The normative plan with owned capital at existing level of technology showed 63.71 per cent of the available kharif area under paddy, 60.37 per cent of the rabi area under wheat (Table 3). Due to restricted supply of capital 21.11 per cent of total kharif area and 25.56 per cent of total rabi area was kept fallow. When the capital constraint was relaxed, the fallow land during rabi season was also utilised. The area under wheat increased from 60.37 to

Table 3

Optimum Enterprise-mix of Non-borrowers (Synthetic Farm Situation in Patiala District, 1976-77)

Enterprise	Optimal plan at existing level of technology		Optimal plan at improved level of technology		Difference in acreage of columns (2) & (3)	Difference in acreage of columns (4) & (5)	Difference in acreage of columns (2) & (5)
	with owned capital (acreage)	with borrowing (acreage)	with owned capital (acreage)	with borrowing (acreage)			
Kharif Season							
Maize	—	—	—	—	—	—	—
Kharif	0.41(15.18)	0.41(15.18)	0.41(15.18)	0.57(21.11)	0.00	0.16	0.16**
Sugarcane	—	0.50(18.52)	0.50(18.52)	0.50(18.52)	0.50*	0.00	0.50*
Paddy	1.72(63.71)	1.60(59.26)	0.22(8.15)	0.66(24.45)	0.12	0.44	1.06**
Groundnut	—	—	—	—	—	—	—
Cotton	—	—	1.12(41.48)	—	—	1.12	—
Fallow land	0.57(21.11)	0.19(7.04)	0.45(16.67)	0.97(35.92)	0.38	0.52	0.40
Sub-Total	2.70(100.00)	2.70(100.00)	2.70(100.00)	2.70(100.00)	—	—	—
Rabi Season							
Wheat	1.63(60.37)	1.82(67.41)	0.21(7.78)	0.79(28.26)	0.19	0.58	0.84**
Rabi fodder	0.38(14.07)	0.38(14.07)	0.38(14.07)	0.52(19.26)	0.00	0.14	0.14**
Sugarcane	—	0.50(18.52)	0.50(18.52)	0.50(18.52)	0.50*	0.00	0.50*
Fellow land	0.69(25.56)	—	1.61(59.63)	0.89(32.96)	0.69	0.72	0.20
Sub-total	2.70(100.00)	2.70(100.00)	2.70(100.00)	2.70(100.00)	—	—	—
Buffaloes (animal unit)	1	1	1	2			
Cropping Intensity	153.33	192.96	123.70	131.12			

* Significant at 0.2 level of significance
** Significant at 0.05 level of significance
Note : Figures in parentheses Indicate per cent area.

67.41 per cent of the total rabi area. A new enterprise, namely, sugarcane was introduced in the optimal plan, covering 18.52 per cent of the total available acreage.

At improved level of technology, the optimal production plan with owned capital revealed 16.67 per cent and 59.63 per cent of the total available area, respectively, during kharif and rabi seasons, lying fallow. Such a higher percentage of fallow land indicated the capital intensiveness of the improved technology and scarcity of funds. When the borrowing capacity was provided, the area under wheat increased from 7.78 per cent to 29.26 per cent of the total rabi land available. Also, the dairy enterprise was encouraged as the number of adult milch animal units increased from one to two. In kharif season, the area under paddy increased from 8.15 per cent of the total area in the season to 24.45 per cent.

(d) Credit Requirements

Table 4 shows that the total Creditor equirements of borrowers at existing level of technology were Rs. 402.50 during kharif season and Rs 707.50 during rabi season. At improved level of technology, they needed a credit of Rs 581.38 during kharif season and Rs 817.01 during rabi season. The annual credit requirements of non-borrowers at existing and improved level of technology came out to be Rs 294.26 and Rs 327.45, respectively. The total and per acre credit requirements of the non-borrowers were lesser because they had relatively higher amounts of the owned capital with them.

(e) Impact of Credit on Returns

Table 5 shows that with the existing production pattern the borrowers obtained Rs 5211.28 per annum on an average as the returns to fixed farm resources. When the plan was optimised at existing level of technology, it resulted in an increase of Rs 1025.66 per annum in the returns to fixed farm resources. If borrowers were not provided credit and they were to optimise the return to fixed farm resources with their own capital, the returns per annum at existing level of technology would have been Rs 4894·46. This showed that with the availability of credit, they could increase their returns to fixed farm resources per annum by Rs 1342.48. If they had adopted improved technology, the increase in returns to fixed farm resources over the optimal returns (with owned capital and existing level of technology) would have been Rs 1666.09 per annum. This increase was significant at 0.05 level of significance.

The non-borrowers were having relatively higher level of owned capital and smaller size of operational holding. Even then if they were allowed to borrow, they could increase the returns to fixed farm resources to Rs 3909.59 per annum with the optimal production plan at existing level of technology. This showed an increase of Rs 657.09 over the returns with existing production pattern. When they adopted improved technology alongwith borrowing facility they could get Rs 673.25 higher than the returns they were getting with the existing production plan.

The per acre increase in the returns to fixed farm resources of borrowers was to the extent of Rs 324.27 (significant at 0.2 level of significance) with existing level of technology and Rs 402.43

Table 4

Credit Needs of the Small Farmers of Patiala District for Normative Plans (Synthetic Farm Situation, 1976-77)

	Per farm		Per acre	
	Borrowers	Non-borrowers	Borrowers	Non-borrowers
At existing level of technology :				
Kharif capital	402.50	100.05	97.22	37.05
Rabi capital	707.50	194.21	170.89	71.93
Total	1110.00	294.26	268.11	108.98
At improved level of technology :				
Kharif capital	581.38	220.77	140.43	81.77
Rabi capital	817.01	106.68	197.34	39.51
Total	1398.39	327.45	337.77	121.28

Table 5

Returns to Fixed Farm Resources with various Production Plan of Borrowers and Non-borrowers (Synthetic Farm Situations in Patiala District 1976-77)

(in rupees)

Particulars	With existing production plan	With optimal production plan at existing level of technology with		With optimal plans at improved technology with		Differences between columns			
		Owned capital	borrowed capital	Owned capital	borrowed capital	(2)&(4)	(2)&(6)	(3)&(4)	(3)&(6)
Per Farm									
Borrowers	5211.28	4894.46	6236.94	5633.45	6560.55				
Non-borrowers	3252.50	3332.35	3909.59	3694.6	3826.02				
Per Acre									
Borrowers	1258.96	1182.24	1506.51	1360.74	1584.67	247.55*	325.71**	324.27*	402.43***
Non-borrowers	1204.63	1234.23	1448.00	1369.39	1454.08	243.37	249.45*	213.77	219.35

* Significant at 0.2 level of significance
** Significant at 0.1 level of significance
*** Significant at 0.05 level of significance

(significant at 0.05 level of significance) with improvement in the level of technology as well. This increase in case of non-borrowers was Rs 213.77 with optimal plan at existing level of technology and Rs 219 85 with optimal plan at improved level of technology.

The Benefits from Credit

The borrowers had relatively lesser amount of owned funds and thus their credit needs were higher than the non-borrowers. With the increase in availability of capital by borrowing they were following a cropping pattern like that of non-borrowers and getting almost the same level of net returns per acre. When the optimum enterprise-mix of the borrowers was prepared with owned funds, apart from some changes in the cropping pattern, almost one fourth of the total available land with existing level of technology and about two-fifths of land with improved level of technology remained fallow. This was due to the scarcity of capital. The per acre credit requirements worked out to be Rs 268.11 at existing level of technology and Rs 337.77 at improved level of technology in case of borrowers. The relaxation of capital constraint for borrowers helped to utilize all the available land and the enterprise-mix shifted towards highly paying enterprise in the optimal production plan and as a result, a significant increase in the returns to fixed farm resources of the borrowers both at existing and improved level of technology, was noticed.

Evaluating Technological Improvement

What core sector industries need to do before moving to modernisation

RAY, J. K.

Our industries are investing large sum of money towards technological improvements. These improvements are in the form of modification to the existing plant/ process, mechanisation and automation, etc. Benefits from such projects are not always assessed scientifically. Since large capital outlay is involved in improvement/ modernisation projects, it is emphasised that scientific analysis should be carried out regarding the technical and financial benefits. This can be studied by productivity based approach as described in this paper. The concept has been explained by an example pertaining to steel industry.

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The productivity based approach

Our industries are spending large sum of money for incorporating technological improvement on plant equipment / production processes. Such improvements are in the form of modifications to existing equipment, mechanization and automation, etc. This has become more widespread as a result of energy crisis which has plagued almost all the industries. Aggregation of such technological improvements is termed as 'Modernization' with which we are all familiar these days. Since modernization / technological improvement calls for capital outlay, the benefits are to be assessed in physical and financial terms. The author proposes the use of productivity based approach in such cases. The concept has been exemplified with the help of a case study of a steel rolling mill.

Defining productivity

The traditional concept of productivity is to compute the ratio of output to input. The limitation of this simple concept is that it does not take into consideration the inter-relationship of output with plant capacity, investment and profit. This has limited application in managerial decision making since this cannot be used as a basis for planning and evaluation. The present analysis will begin with the assumption that the management's primary measure of aggregate performance is the rate of profit (before tax) on investment. Profit on investment can be a suitable indicator for measuring improvement in performance, particularly when capital investment is involved. Productivity can be taken as synonymous with profit on investment.

$$\frac{\text{Profit}}{\text{Investment}} = \frac{\text{Profit}}{\text{Output}} \times \frac{\text{Output}}{\text{Capacity}} \times \frac{\text{Capacity}}{\text{Investment}}$$

$$= \left(\frac{\text{Product Value}}{\text{Output}} - \frac{\text{Total Cost}}{\text{Output}}\right) \times \frac{\text{Output}}{\text{Capacity}} \times \frac{\text{Capacity}}{\text{Investment}}$$

Nomenclature :

$\frac{\text{Product Value}}{\text{Output}}$ is called the Unit Price (p)

$\frac{\text{Total Cost}}{\text{Output}}$ is called Unit Cost (c)

$\frac{\text{Output}}{\text{Capacity}}$ is termed as capacity utilisation (u)

$\frac{\text{Capacity}}{\text{Investment}}$ is the capacity per rupee invested (k). This is termed as Productivity of fixed investment.

Therefore $r=(p-c) \times u \times k$ where r is the $\frac{\text{Profit}}{\text{Investment}}$

What is investment ?

By investment is meant net fixed investment. This is defined as follows :

Net fixed investment=Original investment — depreciation

Net fixed investment would change from year to year even if there is no additional investment since accumulated depreciation would change. The above method of determining productivity is sensitive to the accounting system being followed for calculating depreciation allowance. However, for the same organisation, if the policy for depreciation allowance is consistently followed, the concept of net fixed investment can be used for ascertaining current value of capital facilities. For measuring the effects of technological change, net fixed investment is to be computed before change and also after change (i.e., existing and proposed). This has been illustrated by the example as described herein.

The Parameters for Study

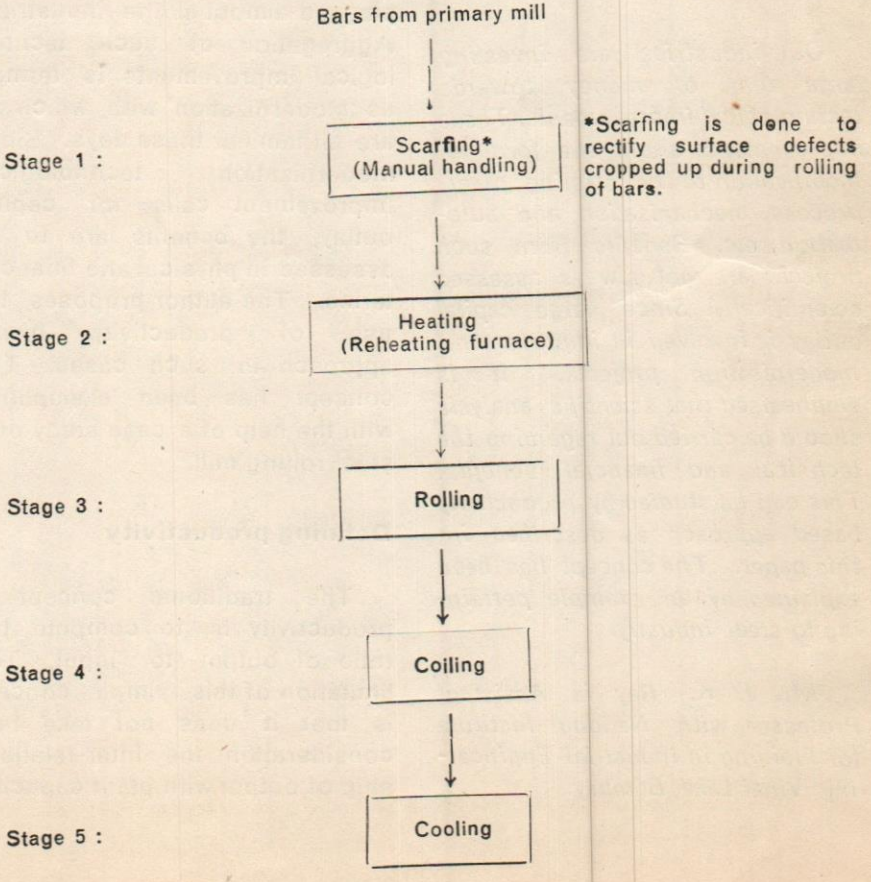
The four parameters (p, c, u, & k) act as managerial control ratios. If the objective of modernisation/technological improvement is to change product mix, p would change since the realisation from the product would vary. p would increase if products of more value are produced. In some cases the objective of the technological change is to bring down the input cost. In such cases c would come down. Capacity utilisation (u) would increase if the bottlenecks/constraints are removed. Productivity of fixed investment (k) would vary depending on the ratio of incremental capacity vs incremental investment. The inter-relationship between output, capacity, investment and profit can be studied by the above four parameters.

The Case Example

The case example refers to the steel rolling mill (strip/skelp mill) as exists in our integrated steel plants (SAIL & TISCO). Indian steel industries are spending crores of rupees for modernisation. These studies are being undertaken by consulting firms and also by plant authorities. Normally, these studies compute the benefits from the whole plant. Technological improvements are also being incorporated in different units (rolling mills, etc.) requiring smaller investment to the tune of lakhs or a few crores. Even in such cases, the effects of technological change can be quantified by the use of productivity concept as described above. This is explained in the following paragraphs.

(a) **The operation of strip/skelp mill :**

This is explained by means of a flow diagram as shown below :



(b) Introducing Improvement :

In the existing system of production of strip/skelp, handling of bars is mostly manual. This creates bottleneck in scarfing. The rate of output of scarfed bar is not matched to the output rate of furnace. This causes delay in charging bars into the furnace. This delay can be minimised/ eliminated by improving upon the method of handling. Improvement on fuel economy is also possible by incorporating airpreheater/ recuperators. In the present case, technological improvement is sought to be done in stage 1 and 2. This will increase output and also reduce operating cost. The details are furnished in table 1.

(c) Technical and cost data

Technical and cost details for the existing and the proposed system are given in table-1.

(d) Computing Productivity

Based on the data as shown in table-1, productivity has been computed. This is shown in table-2. The existing level of profit is 29%. This can be increased to 34% as a result of technological changes to be incorporated at an additional cost of one crore of rupees. In this case the product

Table 1

Technical and Cost details

Item	Existing	Proposed (to be achieved after technological improvements are incorporated)	Remarks
1, Capacity (tonnes per year)	150,000	150,000	Capacity remains unchanged.
2. Output (tonnes per year)	120,000	125,625*	Details are shown below.
3. Net fixed investment (Rs in crores)	25	26	Additional one crore is to be
4. Profit (Rs per tonne) = (Net sales realisation—Total cost) Net Sales realisation = Gross realisation—Deduction (excise duty, Freight charges, etc.) Total cost = cost of material + cost of conversion (Fuels, operating supplies, depreciation)+ works overhead	600	700	invested (75 lakhs in handling and 25 lakhs in Furnace improvement). Sales realisation remains unchanged; costs decrease by Rs 100/t due to reduction in material and energy cost.

*Current output is 120,000 t p.a. Mill capacity is 150,000 t p.a. Mill capacity is not fully utilised because of delay in charging in the furnace, shift-changeover and other delays. Total delays account for 1.6 hr in a 8 hr shift. Charging delay is 0.3 hr/shift. It is hoped that by mechanisation of handling, scarfing and bar feeding will be faster. Therefore, delay of 0.3 hr would be eliminated. Extra production if this delay is eliminated amounts to 5625 t p.a. Other delays remain unchanged even after technological improvement is incorporated.

Computation : Production/actual hr $= \frac{120{,}000}{12} \times \frac{1}{25} \times \frac{1}{6.4 \times 3}$ (25 days in a month—3 shifts in a day)

$= 20.83$ t

Extra hrs available/yr = (0.3 x 3) x 25 x 12 = 270

Extra production (t p.a.) = 270 x 88.75 = 5625

Anticipated production after technological improvement = 120,000 + 5625 = 125625

Note : The above figures do not pertain to a particular plant. The data has been moderated.

Table 2

Computation of Return on investment (Overall Productivity index)

Method	p—c Unit Profit	u Capacity utilisation	k Productivity of fixed investment	r Profit on investment (overall productivity) (p—c) xuxe	Improvement in Productivity
	Rs/t		t/Rs		(%)
Existing	600	$\frac{120,000}{150,000}$	$\frac{150,000}{25,00,00,000}$		
	600	0.80	0. 6x 10-³	0.29	
Proposed	700	$\frac{125,625}{150,000}$	$\frac{150,000}{26,00,00,000}$	$\frac{.34-.29}{.29}$ x 100%	
	700	0.84	0.58 x 10-³	0.34	= 17%

Table 3

p	c	u	k	r
Same	Decrease	Same	Same	Increase*
Increase	Same	Same	Same	Increase
Same	Same	Same	Decrease	Decrease**
Same	Decrease	Same	Decrease	Depends (r is increased if the decrease in e is offset by increase in (p - c)

*If input costs (materials, fuels, & supplies, etc.) decrease as a result of technological improvement and capacity increase is proportional to incremental investment (e remaining same), value of r is increased compared to existing profit (r). In this case, it might be worthwhile to incorporate technological improvement.

**If capacity does not increase as a result of additional investment, productivity of fixed investment (e) is decreased. There may be cases when no benefit in terms of product value, cost and capacity utilisation is likely to be achieved even after money is spent in the name of technological improvement. In some of our industries, excessive money has been invested on automation and computerisation. The marginal saving in cost is not offset by the decrease in productivity of fixed investment. As a result, profit (overall productivity) has declined.

value would remain unchanged since the product mix is not being altered. Input cost would be brought down by Rs 100/t as a result of lesser material and fuel cost. Capacity utilisation would increase by 4% as a result of faster flow of materials and lesser delays. The productivity of fixed investment would slightly decline as a result of additional investment. This would be offset by the increase in other parameters. The net effect is that 17% of productivity increase is envisaged as a result of proposed change.

(e) Using managerial control ratio (p. c. u & k) in Decision Making

The net effect of investment would depend on the increase or decrease of managerial control ratios with respect to the existing/original value. It does not imply that additional investment would always turn out to be a worthwhile proposition. The pattern of change in net productivity as a result of changes in p, c, u & k is shown in table-3.

The concluding remarks

The need for modernisation in our industries cannot be underestimated. This is specially true for core sector industries like coal, cement, steel, etc. Since there is scarcity of capital in our country, the projects should be assessed scientifically before any decision is made. The proposed approach may be helpful in this respect.

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Productivity and The Wage System

OSOBA, A. M.

Is there an interdependance between productivity and wages in public and private sector organisations in Nigeria ?

Wages are frequently determined through the process of collective bargaining. Some of the factors that have been introduced into the collective bargaining process by workers and their trade unions usually relate to increased profitability of the enterprise, what obtains in another firm, and the inflationary tendencies of the economy. The employer, on the other hand, has always stressed productivity in evolving wage system. While the productivity of the economy as a whole is more relevant in the determination of the minimum wage, wage adjustments within private enterprise and public organisations should be based inter alia on the productivity of the worker himself. To some extent productivity had featured prominently in wage negotiations in the private sector in Nigeria, but the wages commissions set up by the public sector have only attempted to come to grips with the variable. This paper attempts to highlight how productivity relates to the issue of wage determination and how the particular process adopted for the determination of wages, in turn, affects the productivity of the individual worker and that of the nation as a whole.

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The Wage Determination System

The usual system of wage determination involves collective bargaining. This is what it should be, but not necessarily what it is. Collective bargaining is a relationship between organisations-business or otherwise and trade unions. Thus, there are two main forces in the bargaining system, the workers' union and the employer or employers' union. Sometimes the government comes in as a third party. The trade union or workers' union is the most active in the bargaining system. The management mainly respond or refuse to respond to the demands of the union, although in responding they could also lay down their own conditions for settlement. Collective bargaining can only exist if workers first join together to form labour or Trade Unions.

A Trade Union is a continuous association of wage earners for the purpose of maintaining or improving the conditions of their working lives. The main reasons why workers join trade unions are to enjoy the society and respect of other workers to gain economic security and comfort, to win greater independence in and control over

their own affairs and secure a general feeling of high integrity.

Collective bargaining is basically a leadership function. It requires someone who has a lot of bargaining skill, who can make quick decisions and has expert knowledge and foresight. That is why the Union executives exercise great powers. The workers do not mind all these. What they are interested in is the protection of their jobs and a reasonable pay packet. They are always willing to delegate much powers to the union executives as long as they are rewarded with higher wages for their labour.

The unions negotiate agreements and the processes by which the agreements are 'negotiated', administered and enforced are included in the "collective bargaining". The term 'collective' indicates that all the conditions of the bargain apply in the same proportion to all members of both workers' and employers' unions. Collective bargaining does not end with the signing of the agreement. The contents of the agreement signed must be observed, obeyed and lived under by both the workers and management through the years for which it is scheduled.

Provision is usually made in virtually all agreements for the "grievance procedure", which among other things, takes care of problems arising from the interpretation of the agreement or adjustments.

In Nigeria, wage system constitute the main issue in collective bargaining negotiations. The employee regards wages primarily as a source of income which directly or indirectly affects his standard of living, his status in the community, his general well being and his future economic security. The employer on the other hand regards wages as an item of labour costs which affects his total costs and hence the competitiveness of his good or service, the efficiency of his workers and his level of profit.

The criteria usually used in the determination of wages are based on measures of equity, need, and contribution to increased productivity. The criteria that are most commonly used are thus cost of living, comparability of wages, existing minimum wage, ability of the company to pay the productivity of the worker and his purchasing power. As mentioned earlier, the employees usually emphasise the cost of living, the minimum wage, and purchasing power criteria while the employers' posture in the negotiation is funded on his ability to pay and the productivity of the worker. The other criteria are employed by both sides to support their arguments depending on the conditions surrounding the issue of negotiation.

The criteria of wage comparability is usually adopted when it can be argued that any compensation offered by an employer to his employees must necessarily be effected by other employers in that industry, industry area or geographical region. The cost of living argument, which usually has to be substantiated by statistical data, is adopted by the workers' union if rising or by the employers if it is falling. The minimum wage argument is that, which from the point of view of the worker, is commensurate with a decent level of standard of living. The inability to pay argument, on the other hand, is always advanced by the employer though usually unproved. Most unions now acquire enough information to establish the ability of a firm to pay higher wages, before they go to the negotiation table.

The union uses the purchasing power criterion in an economic sense, arguing that if consumers (workers) are unable to buy new goods and services on the market, production will have to fall in order to reduce the stock of goods, and unemployment will rise. Depending on the economic situations, therefore, wage negotiating groups will often exchange their positions on a particular wage issue. In this way, the criterion employed could either be an offensive or defensive weapon.

The criteria discussed above could be used to negotiate the whole structure of wage system in the public, private or both sectors. It could also be adopted in determining the minimum wage for an establishement, industry or geographic region. Similarly they are employed in the granting of wage increments either on an annual, or other periodic basis.

However, as it will be observed later in this paper, the system of wage determination in Nigeria does not really conform with the above theory. While everyone is aware of collective bargaining, the government has made greater use of wages commissions to restructure or adjust wages.

What Productivity System Involves

Generally, productivity refers to the relationship between the factors of production and the output from the employment of those resources. This relationship is a proportional one and productivity could be said to have increased if the employment of a given amount of input, results in the production of a larger volume of output, or if the same volume of output is producible with a lesser unit of input. The main factors of production are labour, capital, raw materials and entrepreneurship. Output and input can be measured in physical or value terms. In Nigeria the productivity of one of the factors of production, labour, is the most relevant in the issue of wage determination although reference is sometimes made to the productivity of other factors employed in the production process.

The productivity of labour is not easily determined especially since it is not the only factor responsible for the production of any product. Further, it is not an easy task to determine the productivity of any factor of production for that matter. Over the years, however, various researchers have attempted to evolve different measures of labour productivity. It is usually based on the output or value added of an establishment and the weighted manhours or number of employees that went into the production of that commodity. The problem of measuring labour productivity arises mainly from the difficulty in determining output, for example, in the public sector and agreeing on the exact measure of the labour input.[1]

The Role of Productivity in Determining Wages

Economic factors should carry considerable weight in the system of wage determination. But in Nigeria as Fashoyin rightly found out, "bargaining power is transitory and is dependent on or, determined by factors other than economic".[2] Productivity is one of the economic factors referred to here. Although the employer is quite willing to pay a worker what he might regard as his 'economic price,' he also expects that this cost which is a major component of his industrial cost should be as close to the productivity of the worker as possible. While striving to improve on his economic position, a worker should also put the interest of the whole establishment at heart. It is important for the workers to note that the profit of the enterprise, the ability of the employer to pay their basic or incremental wages and so on, depend very much on their own productivity.

There is no doubt some workers could be quite inefficient or unproductive. Some spend hours or days attending hospitals for illnessess. Some remain idle for a couple of minutes within their shifts under different pretences. Some go off their jobs minutes, or even half an hour before their break period is expected to begin. A lot hide in the toilets for longer than normal after only a few hours of work. The amount of hours lost as a result of such actions may, no doubt affect the productivity of these workers and that of the establishment as a whole. On the other hand, some establishments have been known to really commend the efforts of its workers. Some have confirmed that many of its employees are highly productive and have helped the establishment to reach its production target and even gone beyond it on some occasions.

When comparisons are made in Nigeria between the productivity of the workers in the private sector and those in the public sector, some observers have often concluded that workers in the private sector are more productive than those in the public sector, hence they recommend that there should be wage differentials between both sectors.

Up to now, there has been noticeable wage differentials in the salaries of people in the private sector and those in the public sector.

Table 1 gives an idea of what the average salaries looked like for two categories of staff at the lower and upper levels of the wage structure in 1979. The data reveal that except for workers in commerce, clerical officers in the public service hitherto attracted the lowest initial salary. The commerce figure is so low because of a few low paid workers in some small establishments usually sole proprietor enterprises. The upper echelon of the salary scales is lowest in the public service. The same goes for the upper management cadre. Very few people in the public service earn more than Naira 14,000 a year. In the private sector these days, many Directors earn more than Naira 30,000 and a large percentage of upper management

staff in the private sector earn much more than Naira 14,000. It cannot be argued that the productivity of those individuals that earn close to Naira 30,000 a year is twice that of those who earn Naira 14,000 a year. In fact, a few people have moved from the public service on a salary that is less than Naira 14,000 a year to one that is more than the productivity of that very individual. The fact only goes to confirm that many other factors besides productivity are taken into consideration in wage determination. Nonetheless, productivity is still believed to be a very crucial factor in justifying wage differentials between different sectors of the economy.

It is for this reason that antagonists of the minimum wage concept have brought in the issue of productivity to reinforce their arguments. The protagonists of the minimum wage concept, for example, the Adebo Wages and Salaries Reivew Commission in 1970 stipulated that the purpose of the minimum wage is to prevent an employer from exploiting his worker.* That is, it is, to prevent him from taking undue advantage of workers' ignorance or the poor bargaining power of the worker thereby paying him what the society considers to be the tolerable minimum wage. The antagonists of the system argue that the minimum wage concept as put forth in Nigeria, could constitute a deterrent to increased productivity. This is because for one thing, average productivity could not be regarded as being equal in all establishments within a given geographical region. Ability to pay could also not be expected to b˘ uniform across board. Insistence on a minimum wage also usually results in the substitution of capital for labour. Many workers are retrenched and the few workers left in the establishment are often overstretched leading to a reduction in the efficiency of the worker. Besides, the establishment of a high minimum wage even if it can be justified by an observed increase in productivity trend, would lead to an unnecessary upward revision of other levels of wages and salaries which is not necessarily justifiable by increased productivity.

Table 1

Summary of Salaries and Fringe Benefits of two categories of workers by sector, as on 31st March, 1979

Staff Category & Fringe Benefits	Public Service	Manufacturing	Mining & Petroleum	Commerce	Banking
A. Clerical Officer					
a. Salary	1,500	1,667	2,063	1,444	1,777
	1,752	2,754	3,156	2,415	3,646
b. Housing Allowance	180	141	567	n.a.	323
c. Car Basic/Transport Allowance	120	127.5	388	125.2	289
d. Leave Allowance	80	70.8	144	63.2	141
e. Annual Bonus	0	127.6	142	84.8	226
B. Permanent Secretary on GL/17, Company Director					
a. Salary	12,996	10,005	10,669	10,410	10,652
	14,268	18,935	17,633	19,190	15,483
b. Housing Allowance	660	1,476	1,545	2,062	2,163
c. Car Basic/Transport Allowance	540	2,515	1,222	1,345	1,051
d. Leave Allowance	190	445	712	344	381
e. Annual Bonus	0	680	636	756	1,256

Note : Top level executives are invariably provided with free car, and domestic staff. This applies to the different sectors although the private sector is sometimes more generous about this.

Those who advance the last postulate in the preceding paragraph really have a big point there. The fact that the entry point to a salary structure is unified within and between industries and sectors kills the impetus in primary job-seekers to strive hard in order to enter the wage structure at a high level of the lower part of the wage structure. When a higher minimum wage level is introduced,

* The Adebo Salaries and Wages Review Commission was established in 1970 and completed its assignment in 1971.

the other salary levels have to be adjusted upward even if no commensurate increase in productivity has been observed. Thus, when workers regularly get pay rises which they do not expect, there is a general lax in the attitude of the workers to improve their productivity, since they do not have to struggle too much to get more.

It is in the same vein as that in the foregoing paragraph that many labour economists detest the automatic annual award of salary increments hitherto practised in the Nigeria pubilc service. In that sector, the rate of yearly increase on each salary scale is predetermined and constant. Until very recently, these rates were automatically applied to the salary of each worker. In the private sector on the other hand, annual salary increments are not fixed. Each worker is treated on his own merit. How much salary increment he gets and how often he gets one, depends on his individual productivity. This procedure is in many cases very well applied in the private sector and is therefore not always a cause of friction between employees and the employers. It is noteworthy that the employers in the public sector have come to appreciate this fact that annual increments should not be granted to workers as a matter of course, but that it should be based on the assessment of the productivity of the individual worker, in the form of a recently introduced continuous assessment practice. Even within the short period that this practice has been introduced, a new trend in the awareness of workers on the emphasis being laid on productivity is becoming observable, no matter how incipient. It is hoped that this self-consciousness would create a new atmosphere of increased productivity especially in the public sector which has often been regarded as lagging behind the private sector in productivity rate.

Estimating Productivity Trends in Nigeria

Various attempts have been made at estimating the trends in the productivity of the industrial sector in this country. Most estimates have concentrated on this sector because it is basically the only sector for which relatively comprehensive data are available. Using the figures of value added and employment available for 1963 to 1974 some estimates of productivity for those years are presented in Table 2. The calculated index of productivity reveals that industrial productivity rose from a base year value of 100 in 1963 to 134 in 1966. In 1968, by which time the civil war was beginning to have an adverse effect on many things, the level of productivity dropped sharply from 134 in 1966 to only 72.** From then on the indices in Table 2 showed that industrial productivity rose gradually to about 177 in 1972, and 371 in 1976. The growth in productivity over the years was on the average due to sharp rises in total value added rather than decreases in the level of employment. The level of employment actually fell over the eleven year period for which data were available but fell less sharply than the rate at which total value added rose. The implication of this observed trend is that the fall in the level of employment alone could not explain the upward productivity trend. Other factors too must have contributed to this noticeable rise in productivity.* The factors could include improved infrastructural facilities, resulting in falling operating costs which in turn yielded higher value added. The decline in the growth of employment, though not wholly responsible for the growth in productivity is nonetheless significant. There is justification therefore for rewarding labour for its increased efficiency over the years under review.

The three post independence National Wages and Salaries Review Commissions were set up after 1963 (the base year period for the estimation of productivity trend on Table 2). At Table 3 shows, the Morgan Salaries and Wages Review Commission in 1964 compensated labour with a 30 per cent increase in salaries and wages. By 1971 the Adebo Wages and Salaries Commision also awarded a 30 per cent pay rise. The Adebo Commission stressed that in future wage negotiations, the incidence of cost-of-living should not be made the main issue. The commission felt that other factors such as productivity would have to be taken into account. Thus, the commission brought the productivity issue clearly into focus in the process of wage determination. Subsequent wages commissions

** 1967 is not included in the analysis because the data for that year are not available. This year really marks the beginning of the civil war in Nigeria.

* It is important to note that the seemingly upward rise in productivity in the 1970s becomes less so when the productivity figures are deflated by the current value of the naira of the base year is shifted to say 1970.

Table 2

Growth of Value Added, Employment and Productivity in the Industrial Sector 1963-1974, 1975-1976

Year	Value Added			Employment			Productivity		
	A	Annual Change	Index No.	B	Annual Change	Index No.	A/B	Annual Change	Index No.
	Naira million	%	1963—100		%	1963—100	'000	%	1963—100
1963	109.900	—	100	65,798	—	110	1.67	—	110
1964	137.466	25.08	125	76,342	16.02	116	1.80	7.78	107
1965	172.592	25.55	157	95,614	25.24	145	1.80	0.00	107
1966	147.360	—14 62	134	65,272	—31.73	99	2.25	25.00	134
1967	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.
1968	103.836	—29.53	94	86,728	32.87	132	1.20	—46.67	72
1969	145.114	39.75	132	102,532	18 22	156	1.42	18.33	85
1970	196.359	35.31	179	127,162	24.02	193	1.54	8.45	92
1971	221.224	12.66	201	145,445	14.38	221	1.52	—1.29	91
1972	494.555	123.55	450	167,470	15.14	255	2 95	94.08	177
1973	580.357	17.35	528	162,012	—3.26	246	3.58	21.36	214
1974	720.949	24.23	656	175,299	8.20	266	4.11	14.80	246
1975	n. a.	n a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	290
1976	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	371
Average	275.43	25.93		115,425	11.91		2.17	12.18	

n. a. = not available

Source : Calculated from data obtained from Federal Government of Nigeria—*Economic and Statistical Review*, 1979. The index of productivity for 1975 and 1976 were extrapolated from the data from the same source mentioned above; data for the other variables were not available, for these two years.

Table 3

Post Independence National Wages Commissions and Percentage Final Wages and Salaries Awards

Commission	Year	Final Award %
Morgan	1964	30
Adebo	1970-71	30
Udoji	1974	100
Udoji Modified	1977	7*

*This award was made for workers on salary grade level 01—07 only.

tried to come to grips with the productivity aspect but were basically handicapped by the lack of data on labour productivity in general and especially that of productivity in the public sector.

By 1974 when an approximately 100 per cent award was made by the Udoji Commission, the data on Table 2 reveals that there has been cumulative increase of 146.1 per cent in labour productivity since 1963. Furthermore, when the level of productivity in 1974 is compared with that in 1971 when the last salary award was made by Adebo, the

cumulative percentage increase of productivity was 170.39 per cent. Thus, while there was no evidence that these figures were available for the use of the commission at that time, the award made seemed commensurable with the cumulative rate of growth of productivity of the workers. Trends in the economy however did not justify that observation. In fact the true fact of the case is that the awards by the various commissions always semed to have contributed immensely to fanning the inflationary tendencies in the economy. The annual growth rate in the level of productivity between 1963 and 1976 averaged 12.18 per cent. This figure falls far short of the rate of percentage increase in the salaries and wages awards over that period. The adverse effect of the awards on the economy could therefore be said to have been due to the fact that while the cumulative increase in productivity was quite high, the average annual change was much lower than the awards made. This raises a fundamental statistical problem of which measure of productivity increase is more relevant in wage determination, that is, whether one should use the annual or the cumulative.

It should be noted at this point, however, that it is not only the amount of award that fans inflation in Nigeria. The usual announcement effect is even more crucial. To the ordinary trader or businessman who is ready to increase profit any time, there is usually a sudden mark-up on the prices of existing stock of commodities whenever the government announces its plan to increase the wages, or in fact, the fringe benefits of workers. It does not matter to these exploiters whether the percentage increase is less than one or more than a hundred. The workers too do not help the situation. The granting of arrrears of wages and salaries to workers usually seem to put too much money in their hands that they cannot dispose of sensibly. Almost invariably such incidences have led to sharp increases in the demand of the workers for consumer goods and luxuries whose prices skyrocket overnight. According to Diejomaoh and Olaloku, in Nigeria, the composite consumer price index in 1970 and 1971 rose at a rate almost equal to the Adebo award during that period. Similarly, consumer prices especially foodstuff roseby about 50 per cent when the almost 100 per cent salary award was made by the Udoji Commission.[3]

It would be interesting to know what the rate of increase in productivity has been since 1976. That would have helped to determine the economic sense in the recent workers' unions' demandfor a basic minimum wage of Naira 300 a month. If any productivity data were used to buttress the argument for this increase, the unions must have adopted the cumulative rather than annual rates. If past experience is anything to go by, any higher minimum wage award will not help the situation. The advocates of this 200 per cent increase in minimum wage with other possible concomitant salary adjustments could not have justified their demands with the productivity increase argument.

Beyond productivity

Conflicts in the process of wage determination system in Nigeria have been occurring and will no doubt persist for as long as the productivity variable is emphasised. Workers' unions will usually put forward arguments to counteract those in favour of the use of this variable but it is something that just has to be accepted by all sides. One thing we need to note, however, is that productivity in any establishment does not depend wholly on the efficiency of the worker. The level of productivity or rate of productivity growth also depends on organisational and technical factors, for example, proper supervision, type of equipment, the layout of the factory and system of assigning functions. These factors in fact contribute to the efficiency of the worker. One would like to emphasise that on some occasions when the worker is really interested in his job, certain factors do militate against the efficient performance of it. Such factors include inadequacies in the educational system as well as health and migration problems.

The inadequacies in the educational system could be due to the usual emphasis in Nigeria on book training and certificates to the neglect of on-the-job and professional or vocational training. Hence, it is not uncommon to come across a worker who is very sound on paper but is unable to apply the knowledge and deliver the goods at his work place. Such persons have not been availed the opportunity of technical training and therefore have to rely on those who have had extensive technical training but are not as academically sound as they are, to put them through. Enough diseases abound in our society and could render one

useless and incapacitate the individual from performing his domestic functions, and even mental or physical work in the places of employment. Ignorance has been found to be a major cause of persistent illness amongst workers, and so is the inadequacy of health care delivery and unhygienic conditions of living resulting from over-crowding especially in urban centres.

The problem of migration also inhibits the productivity of the worker. In consonance with Yesufu's findings almost two decades ago, workers still migrate from their homes to industrial centres or from subsistence farming in the rainy season, to paid employment in the dry season.[4] Some workers who migrate from their homes to the industrial centres where they take up wage-earning employment, sometimes find it difficult to setttle down at work. Similarly, a man who goes forwards and backwards from one job to the other may not settle down in his paid employment. This is why many industrialists believe that unsettled labour is usually inefficient, lazy and unreliable. A good many individuals are unable to detach themselves from their homes. They also sometimes wish to be relieved from the hustle and bustle of city life. Where his home town is not too far from the city.

A worker could actually prefer to live in his village or town and commute from there, with the risk of getting too late to work as a result of a traffic hold-up.

It is for the foregoing reasons that many people hold the view that the productivity issue in the process of wage determination should not be overflogged. There is no doubt that it should be emphasised but credence should be given to the human defects which infrequently has an adverse influence on the level and rate of productivity growth of the workers individually and collectively. These explanations would, however, not be valid for all time. It is important also for employers to note that while they are prompt to make an issue of declining productivity in arguing against wage increases, they should in turn be more receptive to the idea of compensating employees for increased productivity even before the workers make a grievance issue of it. This induces workers to continue to be productive. Workers do not only have to be compensated for increased productivity with publicly announced pay rises, which usually leads to volatile gyrations in prices. They could be rewarded with other productivity incentives like unannounced cash benefits, provision for free food at work in the form of luncheon tickets etc., free transportation and free medical care, reimbursement for school fees paid on family members and so on. All of these are likely to contribute to the success of the campaign for increased productivity among workers. They will also enhance the acceptability of productivity as an ingredient in the process of wage determination. Finally, in order to relate productivity to wage determination system, productivity data must be made more readily available. The statistics should be as up to date as practicable and the statisticians must be ready to go beyond the present scope of providing industrial productivity data only and aim at assembling the data for other sectors in the economy. The analysis in this paper has been more or less restricted to the industrial and public sector, because data on productivity in agricultural and other sectors are not readily obtainable. It is hoped that the data gap will be filled by the appropriate organs of government in the not-too-distant future.

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Value Management For Productivity

GOPALAKRISHNAN, R. V.

If few organisations, especially in private sector, have gone to value management to accomplish improved productivity, cost effectiveness, teamwork and multiplier gains, why not more during this 'Productivity Year'

Value Management (VM) is increasingly gaining ground in India as a management methodology. It may well emerge, in the eighties, as one of the most appropriate organisational integrators for ensuring improved productivity, cost effectiveness and consumer-satisfaction. Organised VM involves multi-disciplined teams of managers, and progresses through different phases systematically. It questions the basic functions of products and/or services and the means of achieving the needed functions. The VM Team approach which is described in this paper, is uniquely selective, creative and conclusive. Suitable dovetailing of Employees' Suggestion and Contractors' participation Schemes will augment the VM gains. Apart from improving cost-effectiveness VM enhances inter-departmental team-work and hence, organisational productivity. Better-valued goods should spur further demand for them and thus help to improve the economic growth and prosperity of our nation.

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Historical Perspective

Value Management(VM)—also known by several other names such as Value Analysis, Value Assurance, Value Engineering and Value Improvement—is being increasingly adopted by productive enterprises in India, *not* for its sophistication as a management methodology, but for its uniqueness in cutting *quickly* across the departments and achieving better productivity, cost effectiveness and consumer satisfaction.

How Lawrence Miles developed the Value Analysis Team Approach during the '40s in USA is now a part of history[1]. Commissioned to find substitutes for the scarce raw materials, Miles went on to identify the function of each component, evaluate the function and find alternate ways of performing the function. Involving his peers from other departments regularly in this process, he diluted their resistance to change and effected significant time-compression in developing substitute materials, which performed the needed functions *reliably*—and at lower costs too :

This Value Analysis methodology, evolved in GEC-Purchasing, was adapted in the '50 by the Engineers of the US Navy Bureau of Ships under the name 'Value Engineering'. The Society of American Value Engineers' (SAVE)came into being in 1959. Several other countries embraced VM as an effective integrator fostering better cost-effectiveness, communication and teamwork in their organisations.

Directives to improve value

In the early '60s, Robert McNamara, the then US Secretary of Defence, while grappling with the escalating cost over-runs in defence projects, recognised Value Engineering (VE) as a *key* element 'in the drive to reduce costs' and issued a directive in 1962 for its inclusion as a mandatory requirement by the Armed Services Procurement Regulations. The VE Programme[2] was incorporated in 1964 as a part of a Cost Reduction Programme, already on in the Department of Defence (DoD) aiming at a cost reduction goal of $6,000 million progressively by 1970.

DoD defined VE as a systematic effort directed at analysing the functional requirement of the

DoD systems, equipments, facilities and supplies, for the purpose of achieving essential functions at the lowest total cost, consistent with the needed performance, reliability, quality and maintainability'.

DoD's use of VE consisted of two elements : an in-house VE effort, performed by Defence personnel and a VE programme for contractors, to stimulate them to develop and submit VE Change Proposals for changing those contract specifications, purchase descriptions or statements of work, which they felt imposed costly non-essential requirements. The incentive was provided by giving the contractor a pre-determined share of the audited gains resulting from the proposal he submitted.

Innumerable seminars and workshops were held for Defence personnel and contractors for this purpose. Direct responsibility for VE programme in DoD was assigned to the Secretaries of Army, Navy and Air Force.

Continuous Pressure

The US Comptroller General[3] (the counterpart of India's Comptroller and Auditor General) had been reiterating a keen, vigorous and *longstanding* interest in the use of VE, as a means to help reduce Government acquisition and ownership costs, as "our purpose is not primarily to expose but to propose." Encouraged by the impressive gains from the VE Programme of DoD, (maximum returns as high as 82:1), other Government Departments such as National Aeronautics and Space Administration, Transportation, Health, Education and Welfare, effectively introduced suitable VE-incentive clauses in their contracts.

The US Post Office Department earnestly embraced Value Management in 1967. It was heartening for them to save as much as $700,000 per year, by analysing the value of their largest-selling stamp alone—the 13$—denomination selling 3.6 million pieces a year—and rationalising its size from 0.84" x 0.99" to 0.66" x 0.78". What a striking contrast to our P&T Department's contribution in this Productivity Year of hiking the postal rates for the Inland letter from 25 P to 35 P and for the envelope from 35 P to 50P. If our P&T Department is specifically committed to contain costs, it could use the Value Management Team Approach and many others to achieve 10-20% improvement in cost-effectiveness year after year.

In the '70s, the Public Building Service of the General Service Administration (the counterpart of our Central Public Works Department) adopted Value Management for better cost-effectiveness in construction.[4] In 1973 alone, they saved $2.5 million—a return of $13.7 for every dollar invested in their Value Program.

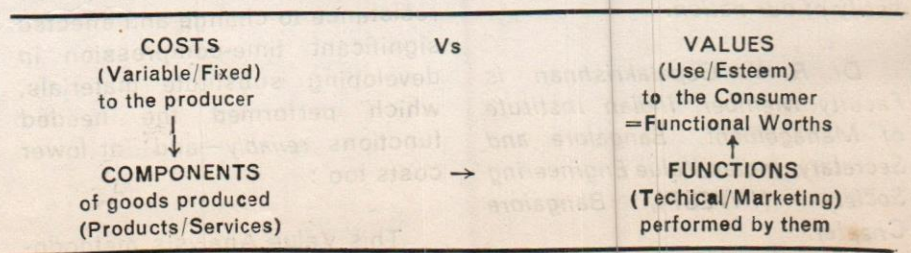
Jimmy Carter sought the Governorship of Georgia State in the early '70s on the promise that he will not levy an extra cent from the tax-payer during his tenure. On his getting elected, Carter adopted Zero-Base Budgeting[5] — an extension of Value Engineering into Administration for Georgia in 1973.

This methodology 'forced' each Department-head to examine and evaluate different ways of performing the functions required of the Department, while requisitioning its annual budget grants. This process of evaluating functional worth with the service-cost helped the departments establish their priorities *right* and locate unnecessary costs. The result was that the administrative costs were not only contained but reduced, while the quality of service improved considerably.

The VM Concept

VM is, at best, the right combination of many proven tools and techniques in the management process. While it is hailed as a 'simple' methodology, the approach is organised and systematic; and it progresses through different phases of work, demanding a lot of effort from the members of the VM team.

Fig. 1 : *The VM Concept of Cost and Value*



Basically VM recognises that while the costs to the producer are related *only* to the components of goods produced, the values to the consumer, viz. the 'use value' and/or the 'esteem value', are really related to the technical and/or the marketing functions performed by the components of goods. (Refer Fig. 1).

The best value to the consumer is considered in VM to be equivalent to the lowest-cost-combination of designs, materials processes and procedures, which enables the producer achieve the needed functions *reliably* in the goods produced.

Organisations in distress have found VM very effective in spotting unnecessary features and procedures and thus eliminating unnecessary costs of the order of 10-20% associated with them. Many others have derived multiplier gains by dovetailing VM with their annual planning process and with their Employees'/Contractors' Suggestion Schemes.

Uniqueness of VM

What are some of the unique features of VM ? First and foremost is its swift *selectivity*. VM can help organisations in identifying the few areas of opportunity having the scope for maximum gains through it.

The first phase of VM, viz. the Project Selection Phase enlists all desirable projects—presently at any stage in their life-cycle, viz. new projects in the proposal, initial or design or proto-type stage and/or products in construction, production or obsolescene stage and/or service systems.

All these projects are then compared through numerical evaluation or paired-comparison techniques to select the *few* projects for planned VM efforts in the upcoming period. This priority-listing should help the Top Management to select, initiate and sustain appropriate multi-disciplined teams of Senior Managers—part-time or full-time - on the critical few VM projects.

Selectivity of VM penetrates further into the quick unearthing of a *few* functions, for the performance of which 'excessive' costs are mostly incurred. This is done by comparing the worth of the function, performed by each component with the cost of the component. Many methods exist for evaluating functions[6].

Illustratively for a product with say, 100 components performing 150 functions—both basic and secondary—a VM team can evaluate the functions by any of the available methods and may well conclude that the costs for performing some specific 10-20 functions are reckoned at 50-60% of the total costs, while their functional worths are put at 30-40% of the total.

Thus, at the very second phase of the VM Team Approach, viz. the Information Phase, the team can spot the *few* functions, which have the most scope for improving cost-effectiveness to the tune of 10-30% of total costs. This selective identification brings in the sharper focus and consequently the significant time-compression.

Three VM Projects

Three examples may be cited to illustrate the selectivity of the VM Approach. The first project was a scourer, the profitability of which had dwindled due to escalating costs of its ingredients. The cost-functional worth comparison evolved by the VM team, was as shown in Table 1.

It was evident that, in the wisdom of the VM team, the two functions—'protect skin' and 'make foam'—entailed excessive costs, disproportionate to their worths. A sharp focus on alternate ways of performing these two functions brought in the bulk of the VM gains expeditiously !

The second VM project was

Table 1

VM Project : Scourer X Cost—Functional Worth Comparison

	Component	Cost %	Basic	Function	FW %	C—FW %
1.	AAA	15	Make	Foam	11	4(II)
2.	BBB	21	Bleach	Colour	28	
3.	CCC	28	Loosen	Soil	27	1 (III)
4.	DDD	20	Protect	Skin	8	12(I)
5.	EEE	13	Provide	Odour	13	
6.	FFF	3	Induce	Attraction	13	
7.	Scourer	100	Clean	Utensil	100	17

Table 2

VM Project : 'Power Distribution System' Cost Functional Worth Comparison

	Component	Cost %	Basic	Function	FW %	C-FW%
1.	Transformers	26	Change	Voltage	22	4 (II)
2.	Conduits	24	Provide	Protection	16	8 (I)
3.	Conductors	13	Transmit	Power	20	
4.	Emergency generators	11	Provide	Emergency-power	15	
5.	Switchgears & Panels	16	Switch	Power	17	
6.	All others	10	Several	Functions	10	
7.	Totals	100	Distribute	Power	100	12

a Power Distribution System for which the concerned team came up with the following cost—functional worth comparison (Refer Table 2).[8] It was evident that functions 'Provide Protection' and 'Change Voltage' incurred costs more disproportionate to their functional worths. These functions are then taken to the next phase, viz. the Creative Phase, for alternate ways of performing them. Final evaluation of alternatives led to the installation of lower-cost plastic conduits suitably encased and a different type of distribution system eliminating some transformers.

The third VM project[9] was a metropolitan slum improvement programme, brought to a recent VM Workshop by the officers of the concerned Metropolitan Development Authority. Developmental projects of this nature envisaged to cost over Rs. 40 lakhs per urban slum are undertaken on loans from World Bank. Organised VM team-efforts, if made at their design stage itself, can help to conserve *at least* 10% of their costs.

The VM team's cost—functional worth comparison is shown in Table 3.

Needless to say, that the two functions 'Impart Education' and 'Remove Darkness' — were selectively taken on further, to develop alternate ways of performing them.

VM Taps group-creativity

The second unique feature of the VM Team Approach is that it taps the enormous creative potential of the team-members as they move on to the third phase, viz. the Creative Phase. The team takes each of the selected functions and seeks ideas on : What *else* can perform this function ?

Techniques such as brainstorming are made use of, for maximising idea - generation. Groups contribute more than double the number of ideas than individuals. The team leader spurs the team's creativity further by :

(1) Ruling out criticism/judgement on ideas;

(2) Welcoming 'wild' ideas/ extension of ideas;

(3) And going for more 'quantity' of ideas than 'quality'.

Table 3

VM Project : A Metropolitan Slum Improvement Programme Cost—Functional Worth Comparison

	Component	Cost Rs. lakhs	%	Basic	Function	FW %	C—FW %
1.	Water Supply	6.07	14.3	Supply	Water	32	
2.	Sewerage System	6.13	14.5	Dispose	Waste	21	
3.	Street Lighting	9.60	22.7	Remove	Darkness	10	10.7 (II)
4.	Schooling	10.50	24.8	Impart	Education	12	12.8 (I)
5.	Cottage Industries	1.60	3.8	Train	People	6	
6.	Road Development	6.95	16.4	Provide	Access	17	
7.	Miscellaneous	1.50	3.5	Improve	Environment	2	1.5 (III)
8.	Slum Improvement	42.35	100.0	Improve	Slum	100	27.0

The VM team on Slum Improvement, for example, generated as many as 45 ideas for performing the function 'Impart Education' and 43 for 'Remove Darkness', thanks to this 'non-evaluative' Creative Phase.

Yet another unique feature of VM is its quick, consistent and evolutionary technique of idea-evaluation, by which *a very few* most promising ideas are short-listed for alternatively performing the function. Those few ideas are, then, subjected to exhaustive critical appraisals, performance testing and conclusive evaluations for arriving at the best and the most attractive alternative for implementation.

This fourth phase of the VM Approach, viz. the Evaluative Phase, consumes a lot of time and effort of the VM team in arriving at their final recommendations. The evaluationary technique consists of :

(1) Listing out the criteria for idea-evaluation, such as reliability, maintainability, life-cycle-costs (this is an innovative combination of initial costs, operating costs and maintenance costs), ease of procurement, acceptability to the consumer and time for implementation. The VM team is free to choose their 'own' critical-few criteria, as they deem most appropriate;

(2) Developing suitable yardsticks (many prefer a simple scale 1-10) for each criterion, benchmarks along the scale reflecting suitable weightages;

(3) Numerically evaluating each idea consistently against the same yardsticks on the same criteria and totalling the points for each idea;

(4) Finding an apt 'cut off' total score for short-listing the very few ideas 'most-promising'. Forced Decision Matrix[10] is a similar quantitative methodology also used for this idea-Evaluation.

The VM team on the Slum Improvement Programme, for example, finally short-listed two ideas for each of the two functions for more detailed evaluation. For the function 'Impart Education', the two most attractive alternatives were found to be :

(1) A dormitory type of building ; and

(2) A building, for the 'combined' operation of Primary School and High School on shift-basis.

The envisaged cost-savings on either of these alternatives were put at 25-30% of the present cost or about Rs. 2.5—3 lakhs.

The two alternatives for the second function 'Remove Darkness' were :

(1) Flood-light illumination, increasing the distance between lamp-posts; and

(2) Lighting from Bio-gas plant, suitably developed in conjunction with the public-convenience sceptic-tank units. The former was envisaged to save about 15% or Rs. 1.4 lakhs, while the latter could be much more attractive in saving nearly 30% or Rs. 2.8 lakhs of investment.

The short-listed few ideas are thus subjected by the VM team to more rigorous appraisals. The team-members, now involved in collaborative final decision-making, interact with specialists, suppliers, sub-ordinates and any others, who can help them come to conclusions.

Proto-types are made, new designs are incorporated and/or rigorous trials are done to conclusion. Feed-back from consumers, top management, shop-floor personnel and others, as is required, are sought for finalising the most attractive alternative.

Because of the intensive involvement of concerned people in the final decision-making, resistance to change is significantly diluted. Quite often, the organisation gets more ready for the impending change.

Multiple Gains from VM

A VM team of 5-10 Managers, from different disciplines *most* concerned with the project, can effect a 10-30% improvement in cost-effectiveness, if it works either on a full-time basis for 3-4 months or on part-time, viz. meeting 2 hours a week or 4 hours a fortnight, over 8-12 months. A full-time VM Co-ordinator can facilitate many VM teams in parallel.

The most impressive cost-savings by intensive VM team efforts are reported from the Japanese industries, where voluntary quality-circles and value-circles of shop-floor employees

have richly contributed to the gains. Table 4 indicates the VM gains achieved[11].

In the Indian scene, MICO had undertaken as many as 105 VM projects over the last nine years and gained recurring cost-savings of the order of Rs. 10 crores. Besides MICO, there are many enterprises in India as TISCO, Escorts, Walchandnagar Industries Limited, ACC and International Instruments Limited, who dovetail their planning of VM efforts into their annual planning process. What about the Government and the Public Sector ?

Table 4

VM Cost-Gains as % of Turn-over

Enterprise	No. of Employees	No. of VE Coordinators	VE Coordinators per 1000 Employees	Cost-gains %
JAPAN				
1. NEC	7,100	41	6	6.6
2. Hitachi	138.690	278	2	5.7
3. Matsushita	12,170	58	5	1.5
INDIA				
1. MICO	6,800	3	0.5	0.5

(1) If the Government is committed to contain costs and improve their services, it should reflect in the Secretaries to the Government preparing an *agreed* short-list of about 100 VM projects which, in their combined wisdom, have the scope for cost-effectiveness to the tune of 20% of the total cost. It should reflect in the initiation of appropriate VM Teams of Senior Administrators for those VM Projects.

(2) All developmental projects and programmes exceeding Rs. 50 crores each and all contracts exceeding Rs. 10 crores each should *mandatorily* have the VM approach before their final approval for their execution.

(3) Suitable incentive clauses should be incorporated in all contracts over Rs. 10 lakhs encouraging contractors to challenge specifications and propose changes for Value improvement. A predetermined share of audited gains may be given to the contractors in recognition for their efforts.

(4) Better value-consciousness has to be created among Government personnel. This is a massive effort requiring collaboration with several institutions.

Institutions of Management Education such as Indian Institute of Management, Bangalore have been introducing the VM methodology to hundreds of practising Managers and Administrators participating in their programmes every year. Indian Value Engineering Society (INVEST), formed in New Delhi in 1977, has been disseminating this concept through their Seminars, Publications and National Conferences.

(5) The Government must make sure that the large number of productive enterprises, both in Government and Public Sector, should systematically and intensively practise the VM team-approach dovetailing it to their annual planning process.

The Committee on Public Undertakings emphasised, as far back as in 1967, that Value Management offered considerable scope for cost reduction and that all public enterprises should undertake it systematically. The Bureau of Public Enterprises, found in 1975, that this technique had *not* been adopted by most of the units in a systematic maner and 'felt' that it ought to be adopted by all public enterprises. 'For this purpose an inter - departmental Committee may be formed, who may draw upon an action plan and lay down priorities for organised Value Management, 'the Bureau recommended.

It is heartening to find that our Army, Navy and Air Force and some public sector enterprises such as SAIL, BHEL, BEL and ITI have been organising themselves systematically for Value Management efforts; much more intensive efforts are, however,

needed from our public enterprises for exploiting the VM team-approach fully.

(6) Last but not the least, employee - involvement is a critical factor in implementing Value Management changes quickly. A more - attractive Suggestion Award Scheme, combined with many other ingenious ways of involving employees such as employees' participation in Management, will dilute their resistance to change and consequently, accelerate VM gains.

The scope for VM gains in India is tremendous. In fact, less than 1% of its potential is now being realised ! Besides improved value and cost-effectiveness, the methodology is known to yield 'fringe benefits', more often than not, in parameters such as producibility, production hours, quality, reliability and maintainability. In many VM projects, the number of components are known to have been reduced by more than half; and 'with fewer parts fewer things could go wrong'![12],[13]

The organised VM team-approach, well supported by the Government and well dovetailed into contractors' incentive clauses and employees' suggestion schemes, can conserve our annual costs in India to the tune of Rs. 10,000 crores and thus accelerate the revitalisation of our economy. It should finally reflect in better products and services at lower costs for the consumer and the tax-payer.

In the '80's, when the costs are escalating even wifhin the same year, it is not only appropriate but is absolutely essential for our Government and other organisations to adopt the VM team-approach effectively, in order to get the best value out of every rupee spent. Can we expect that the Productivity Year 1982 will further accelerate the VM efforts and gains in India ?

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Resolving Food Problem Through Innovation

OJHA, T. P.

How innovations in agriculture system, utilisation of technology, irrigation and other measures, dairy management and food habits of the affluent can help to resolve the baffling food problem for our growing population.

Alike many developing countries of the world, India had faced famine in the past. But the dramatic increase in food production and the productivity during the last decade has made tremendous impact of the capabilities of the Indian scientists and agriculturists world over. The irrigated Indo-Gangetic plains of India have demonstrated that the productivity of wheat can be even higher than that in any developed nation. With effective management of the five resources (i.e. land, water, forests, sea and energy), India can produce the targeted crop yield of 250 M. Tonnes and milk yield of 60 M. Tonnes by 2000 AD.

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The Baffling Food Problem

Feeding the world's population has always been one of the greatest problems of mankind, and yet it has taken on even greater importance in recent years. Widespread famine is now a reality. The Bengal famine of 1943 has not been forgotten. During the period 1964-72, an average of 5.2 million tonnes of food grains were imported annually in our country. The worst year from this point of view was 1966 when food grain imports peaked at 10.4 million tonnes following the two drought years. In the global context, the year 1972 represented a turning point downwards, for the first time in the past 20 years. Worldwide production of cereal grains decreased, while the world population continued to increase at alarming rate. Even the vast surpluses of food grains of North America have declined now. About a decade ago, there was a worldwide reserve of four-month supply of grain. We have in hand today a reserve supply of grain sufficient for only three weeks. However, the situation of grain surplus in India is very happy one. According to the latest reports, India has food grain reserve of about 20 million tonnes stored in Government godowns and warehouses. This surplus got accumulated since 1975-76 and was partially exhausted in 1979 when a part of the country was under severe drought condition.

In an assessment prepared by F.A.O. for the world Food conference in 1974, it was estimated that the demand for cereals in the devoloping countries would reach 929 million tonnes by 1985. Yet the report predicted that the production would not rise over 853 million tonnes. The deficit of 76 million tonnes would be about 100 million tonnes if the exporting countries among them were excluded. Assuming that losses in the Post-Harvest period are not more than 10 per cent, which according to F.A.O. is rather low figure, this means 86 million tonnes will be lost per year by 1985 if no action is taken to prevent it.

According to the latest estimates, about 600 to 800 million people on the earth are existing in a perpetual state of chronic hunger and are suffering from malnutrition. It is also estimated that 15 to 20 million people die each year as a direct result of famine.

Tackling the Problem

Probably, the food shortage has to be tackled by increasing production through all five natural resources namely, Cultivated lands, Pasture lands, Forests lands, Salt affected lands and Ponds, Lakes & Oceans. Compared with the developed countries, in the crop yield per hectare and milk production per animal, the developing countries of Africa, Asia and Latin America are lagging far behind. There is a great scope to improve the conditions by adopting modern technology to achieve the much desired higher output. Huge statistical as well as research data are available to substantiate the above claims. Table (1a) represents the factual data of cereal production per hectare in few selected countries of the world. It is quite obvious that there is a great scope of increasing the productivity of cereal crops per hectare in India. Similarly, the milk production can also be tremendously increased by adopting cross breeding and better animal management programmes in the country.

Using Modern Agriculture System

The distinctive feature of modern agriculture is that it has augmented the food supply by increasing the rate at which nutrients flow through the energy cycle of plant. This has been accomplished by several methods, but by far the most common and one of the most important, consists in speeding the return of nutrients to the soil, where they can be obsorbed. Hence, in order to feed the human population, we must ensure the nutrition of an assortment of plants, animals and micro-organisms. The earth intercepts a vast amount of solar energy but only a little of it is available for biological purposes. The solar energy absorbed is employed by the plant to drive a complicated sequence of chemical reactions in the plant. Green plants capture solar energy with an efficiency from 15 to 22 percent, which exceeds the energy conversion in many industrial technologies. The annual production of fixed carbon by green plants on land and in the sea is about 150 million tonnes, whereas the human consumption is about 120 kg. per person. Thus, the energy captured by the plants far exceeds the human needs. If it could all be directed to human nutrition, it could support more than 250 times the present population. Hence, the food supply is not limited by scarcity of sunshine but due to inadequate supply of few other inputs, losses occurring in the system, etc.

In the mid of 19th Century, Justum Von Liebig formulated his law of the minimum, which states that plant growth is limited by the availability of whatever nutrient is the scarcest. Thus, it is of little benefit to irrigate a crop that is stunted for lack of nitrogen, and if the nitrogen, deficiency is corrected, some other nutrients will become the limiting factor. Therefore, the strategy of agriculture must be to provide all nutrients in adequate amounts and in optimum proportions. Nitrogen is commonly the limiting element. Because it is a constituent of all proteins and of many biological molecules, it is required in relatively large amounts. Furthermore, much nitrogen is removed from the soil by leaching and erosion, by the action of micro-organisms and by the plants themselves. This necessitates effective soil management programme.

Let us now compare the virtues of modern agriculture system with those of traditional one. Traditional agriculture system is characterised by a small energy application, low output and high overall efficiency. For everyone calorie of energy input, about 5 calorie worth of output is achieved. Animals consume excess feed, roughage and waste products. Wastes from the plant decay, and from the animals and people are utilized or recycled back to soil. Power requirements are met through the muscles of men, women and animals. Little is added to the system in fuel, machinery, fertilizer or pesticide. Properly managed, the system is at best self-sustaining. Mismanagement either by overgrazing or by cultivation practices that lead to excessive erosion destroys the system. Hence, it cannot support the ever increasing world population. The annual growth of world population is estimated at approximately 75 million people. According to U. N. medium projection, the world population should touch 6.3 billion figure at the end of 2000 A. D. as against 4.0 million now.

Modern agriculture system emphasizes high production and labour efficiency. The natural plant and animal cycles, the mainstay of traditional system, are modified to fit a technology in which a large energy input is possible. The energy input often takes the form of manufactured

goods machinery, petroleum, fertilizers, pesticides, improved seeds and irrigation water. These inputs have their independent as well as combined effects in improving the yields in agriculture.

Optimal Utilisation of Technology

The adoption of the new technology package including high yielding varieties, fertilizers, irrigation, multiple cropping and mechanization has resulted in high yield of food grain per net sown area. Harrington estimated that in Punjab, this increased by 224 per cent from 0.84 T/Ha in 1961 to the total of 1.88 T/HA in 1972. During the same period the nation as a whole had only a minor net improvement. The average yield of wheat on all India basis stands at about 1.38 T/Ha only. In spite of overall low average yield of wheat crop in India, the total yield of wheat has increased by 50 per cent during the last decade (Table 1a). This increase has been a spectacular one in the history of world agriculture even though the level of fertilizer and power inputs remained extremely low (Table 1b).

Land and more particularly land with an adequate water supply, is a major limiting factor in the total food production. India had 43 per cent of its land sown to crops in 1970. Much of this land is so marginal that it would not be used for crops in other countries. Punjab, the state that supplies the most of food for the remainder of the country, had 81 per cent of its land sown to crops in 1972. Wheat and other crops yields remained essentially stagnant in India prior to 1961. Wheat, yield in Punjab essentially doubled between 1961 and 1973 and now exceeds those of the U.S. (Table 1b). Pubjab's dramatic yield increased by the introduction of Maxican Dwarf wheat. These wheat varieties were capable of full utilizing considerably larger amounts of fertilizer. Average fertilizer consumption in punjab increased tenfold during this priod, and stood at 58 kg of actual nutrients for each hectare of crop land in 1972 (Table 1 b).

Table 1 (b)

Resources Used in Food Production : 1972

Item	Countries				
	World	USA	W. Germany	Japan	india (Punjab)
Cereal/Capita (Tonnes)	0 34	1 09	0 34	0.15	0.19
Cereal Production (Mill Tons)	1275	228	20	16	108
Cereal Yields T/ha	1.83	3.90	3.82	5.50	1.2 (1.90)
Rice yield T/ha	2.25	5.25	—	5.85	1.62
Wheat yield T/Ha	1.63	2.20	4.06	2.31	1.38 (2.25)
Tractor hp/ha	—	1.1	5.2	5.0	0.03 (0.24)
Fertilizer use	50	120	410	350	16 (58)

Table 1 (a)

Wheat production In different countries in Million Tonnes

Country	Year				
	1961	1967	1970	1975	1979 (expected)
World	255	299	319	356	412
USA	33.0	41.0	36.8	58.1	57.2
CANADA	15.3	16.1	9.0	17.1	—
INDIA	11.2	11.4	20.1	24.1	30
PAKISTAN	4.1	4.3	7.3	7.6	—
U K	3.5	3.9	4.2	4.5	—

Irrigation And Other Measures

Irrigation is extremely important to wheat production in India because of the monsoon rains fall entirely outside the wheat growing season with little rainfall coming during wheat production. Punjab increased its crops receiving irrigation from 56 to 77 per cent during this period (1961-1973). The nation as a whole increased their percentage from 18 per cent to 24 per cent only. Indian farmers have endorsed the increased production potential of assured water by investing more money in irrrigation pumpsets than other forms of mechanization combined. Tube wells with pumpsets grew from 26,000 in 1960 to over 180,000 in 1973 and now supply over half of Punjab's irrigated hectares. The number of pumpsets in whole of the country is around 6 million. It is estimated that those pumpsets contribute about 4 per cent of India's food grain production through increased yield and an additional 2 per cent through growing a second crop each year. Additional food produced by the use of pumpsets in India each year exceeds the average food imports for the past 10 years between 1966 and 1976. Irrigation makes it practical to grow a second crop each year in India during the season of inadequate rainfall. This had led Punjabi farmers to buy tractors rapidly especially since 1966. One farmer in 10 in Punjab now owns a tractor while for the country as a whole it is only one in 150. Tractor power has provided the Punjabi farmer with more rapid tillage and permitted him to plant his second crop on time. Tractors implements can improve the quality of work as well as quantity. In some instances yields have increased by better seedbed preparation and timely operation. A variety of tests have shown that the use of grain drills has increased wheat yields 10 to 15 per cent over traditional seeding. Effect of energy treatments and timeliness of field operations in the rice growing belt of Eastern region of India is presented in Table 2. It is noted that the timely transplanting of paddy crop can give 10 to 40 per cent extra yield keeping all other inputs constant. The energy mode has also its own effect in increasing total yield. Among the various treatments, the rotopuddling gave the best results (61.4 Q/ha.) Threshers and combines have reduced losses of the crops already grown. Generally, adoption of threshers and combines reduces grain losses from exposure to rains, fire, rats, birds, cattle and pilferage.

The current level of yield per hectare for cereals, oil seeds and pulses is extremely low (Table 3). The target for 2000 AD to be achieved has been fixed at the figures quoted in the same table, if we wish to provide sufficient quantity of food to the population likely to grow by that time. It is estimated 'that the total cropped area may get reduced by the turn of the century. But overall food grain production will improve by adapting improved crop and water management techniques, supplying adequate quantities of inputs, and controlling post harvest losses.

Table 2

Effect of Energy Treatments and Timeliness of Field Operations on Paddy Yield

Sl. No.	Source of Power	Details and No. of Operations		Yield, Qlt./ha Early Transplanting	Yield, Qlt./ha Late Transplanting
1.	Bullocks with Improved Implements	M. B. Ploughing	One	57.30	44.61
		Puddling	Two		
		Planking	Two		
2.	-do-	M. B. Ploughing	One	48.00	44.32
		Puddling	Three		
		Planking	Two		
3.	Power Tiller (8HP)	Rotopuddling	Two	61.40	48.86
4.	-do-	-do-	Three	57.80	44.91
5.	35HP Tractor	Puddling by Paddy disc harrow	Two	49.38	43.24
6.	-do-	-do-	Three	56.34	41.67

Post-harvest measures

It is estimated that about 10 per cent of the total yield obtained after the harvest is lost in the postharvest operations, namely, threshing, transportation, storage, processing, etc. (Table 5). Khan

has estimated that if not managed properly, the harvest losses of paddy crops can be as high as about 60 per cent (Table 4). Most of the farmers are either ignorant or careless even to think of controlling these losses due to various reasons. Loss of yield due to unfavourable weather during the harvest can be avoided by employing simple and economical grain drying systems. Grain losses in storage can be effectively controlled by using improved storage structures and fumigants. Valluri has tried to compare the equivalent of energy that is required for subsistence type of agriculture, energy intensive agriculture, and medium energy intensive agriculture. To achieve the target of 250 million tonnes of food grain production by 2000 AD, the above three types of agricultural systems will need 400×10^6 ha, 44×10^6 ha and 167×10^5 ha of cropped land respectively as against 150×10^6 ha under cultivation today in India. Oil equivalent of energy for each of these systems works out to be 6.5×10^6 Tonnes, 65×10^6 Tonnes and 16×10^6 tonnes respectively. Hence the solution lies in larger use of energy utilization only.

The white revolution :

Let us now examine the possibilities of increased food production through animals. The white revolution in few pockets of India has become reality mainly due to good supports from agricultural production as well as genetic upgrading of the cows and buffaloes owned by the farmers. The steady increase of total milk production in India as shown in (Table 6) offers a great promise to provide more

Table 3

Current Average Crop Yields and Targets of Food Grain Crop for 2000 AD.

Drop	Area, M-ha		Yield' T/Ha	
	Present	2000 AD	Present	2000 AD
Wheat	18.01	17.55	1.30	3.64
Rice	37.54	32.00	1.13	3.04
Jowar	17.59	17.00	0.49	1.20
Bajra	12.39	12.00	0.50	1.25
Pulses	22.35	25.00	0.60	1.50
Total	123.27	123.05	—	—

Table 4

Pre-and Post-Harvest Losses of Paddy Crop.

Harvesting Period	Per cent, Loss
One Week Before Maturity	0.77
Right At Maturity	3.55
One Week After Maturity	5.63
Two Weeks After Maturity	8.64
Three Weeks After Maturity	40.70
Four Weeks After Maturity	60.46

Table 5

G.O.I. Post Harvest (Committee Assessment)

(1)	Threshing Losses	=	2.5 Per cent
(2)	Processing Losses	=	2.0 Per cent
(3)	Transportation Losses	=	0.9 Per cent

Table 6

Milk Production in India in Million tonnes

Year/ Animal Type	1951	1956	1961	1966	1974	1985	2000AD
Cows	7.7	8.2	8.8	6.9	—	—	—
Buffaloes	9.2	11.0	11.1	11.9	—	—	—
Goats	0.5	0.6	0.5	0.6	—	—	—
Total	17.4	19.8	20.4	19.4	23.2	40	65

food for babies, pregnant and lactating mothers and the young and old citizens of the country. The target of 40 million tonnes of milk production by 1985 and 60 million tonnes by 2000 AD can be safely achieved by improving the milk producing capacity of the cows. Table-7 indicates the great potentiality that lies in improving the milk yield by cross breeding programme in India. Of course, the desired targets can be achieved only by consorted efforts in improving the genetic inheritance of about 20 million cows in next 10 years or so. Sundaresan is quite optimistic that 20 million cross-bred having either 1/2 exotic inheritance or 1/4 exotic inheritance in all could produce 35 million tonnes of milk per year. The remaining Indian cows left untouched and essentially kept for raising bullocks would continue to give about 5 million tonnes of milk a year. Thus, the target of 40 million tonnes a year as fixed for 1985 could be achieved easily through effective dairy management.

Table 7

Milk yield Influenced by Genetic Factors (4)

Milk Yield/ Animal type	Hilly Cow	Hilly Cow x 1/2 Sindhi	Hilly Cow x 1/2 Jersey	Hilly Cow x 3/4 Jersey	1/2 Haryana 1/2 Jersey
Per Lactation (300 days) Lit.	298	636	1258	1477	2200
Av. Yield (Daily) Lit.	1.00	2.12	4.20	4.92	7.33
Peak yield (Daily) Lit.	—	—	10.9	11.3	14
Milk Fat	3.96	4.2	4.2	4.4	4.5

The fat share of the Affluent

Another long term food availability factor that is now being felt is the growing affluence of the developed nations. While wheat and rice are the basic foods of most of the world's population, the well to do folks of North America, Europe, Russia and Japan eat more and more meat. According to Janes, the problem with heavy meat consumption, apart from the increased risk of heart disease, is the amount of the grain required to fatten the animals. Lester R. Brown says that 'in the poor countries, the annual availability of grain per person averages only about 180 kg. per year (nearly all of it consumed directly). In the USA and Canada per capita grain utilization is currently approaching 900 kg. Of this total, only about 68kg are consumed directly (in the form of bread, cereals etc.). The remainder is eaten in the form of meat, milk eggs and variety of processed foods.

In the world where the key nutritional problems are a shortage of grain and protein deficiency, eating meat is a terribly inefficient way to consume that grain and produce that protein. Dr. Onio Feliciotti made the startling observation that "a steer would have to eat 180 kg of protein in the form of vegetables to yield 450 gm of dressed beef. The total amount of grain that cattle must consume to put on a kg of weight is 7kg. Every steak North American eats, uses up enough grain to feed the average Indian for a week".

As Brown calculates, if American substituted grains, vegetable protein and other foods for 1/3rd of their meat and poultry consumption, there would be a net annual saving of about 35 million tonnes of grain now used to feed 600 million Indians for half a year.

A concluding note

If millions of people of the poor nations are to be fed, the food will have to come from their soil, their resources and their farm economics. For Indian condition, the choice has to be made between medium energy inputs in the existing cropped lands or high energy inputs with reduced cropped area, the surplus area being diverted for production of fodder and fast growing species of timber. The surplus production of a few exporting countries can serve on occasions as buffer stock for bad weather or other calamities, nature or man made. Of course, a part of the solution also lies in reduction of meat eating by North Americans and other affluent countries of the world. There is

no doubt that a hectare of land can support more vegetarians than the non-vegetarians in the world.

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LETTER TO THE SUBSCRIBERS

Dear Sir,

We in the NPC are keen to bring about qualitative improvements in the 'PRODUCTIVITY' journal. This is possible only with the active support and cooperation of our readers. We shall, therefore, appreciate it if you kindly complete the accompanying 'opinion survey questionnairs' and mail it to me at your earliest to enable us to provide you our best possible services.

Yours faithfully,
(DR R. S. DWIVEDI)
DIRECTOR-CUM-EDITOR

OPINION SURVEY QUESTIONNAIRE

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   (a) Expectations _____
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   _____
   _____

Search For Knowledge

Abstracts of Books and articles on empirical studies, practices, concepts and theories providing useful knowledge in capsule form on productivity system

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1. Vaidyanathan, A.

"Indian Economic Performance and Prospects"

Economic Bulletin for Asia and the pacific, 21(1), 1980, 1-19

The analysis of India's economic prospects and problems involves the following contentions :

1. It seems that the possibilities of accelerating overall growth, even to the extent indicated in the long-term estimates embodied in the fifth plan, are remote in view of several barriers to stepping up the growth rates of agriculture and export.

2. While the barriers to agriculture are largely institutional and partly technological, those to export are related to fundamental tenets including political and current development policy necessitating changes in these respects to accomplish a markedly outward-oriented growth.

3. Without removal of the above barriers, continued investment programmes in terms of both level and composition, is likely to result in inflation and wasteful application of limited investible resources.

4. In the face of a modest rate of growth, redistributive measures are likely to play a crucial role in improving the conditions of the poor because of reduced possibilities of obtaining jobs and maintaining the real wages.

5. The possibilities of a wide-spread anti-poverty programme embracing employment generating growth, reinforced through infrastructural and productive agricultural projects launched in the poor areas, cannot be denied provided that the fiscal management efficiency contains the consumption of the rich and enough care is taken in identifying areas and planning and implementing the projects.

6. The development of effective institutions forms a prerequisite to anti-poverty and agricultural programmes.

2. Hope K. R.

"Improving public enterprise management in developing countries"

Journal of General Management, 7(3), 1982, 72-82.

Public enterprises are of utmost significance in developing countries. Indeed, they form instruments of government intervention and structural change. However, they have several weaknesses such as ambiguous planning frameworks, excessive amount of bureaucratisation and paucity of skilled managers. The measures to improve management in these enterprises include improved manpower planning and training, a political leadership conducive to more efficient and responsible administration and effective decentralisation and communication systems. These measures are likely to minimise the huge amounts of red tape in public enterprises stemming, in part, from the over concentration of power, authority and resources at the top management level.

3. Thaha, M. and D. Shanthudu

"Cluster plan for production and employment (Sindhnur cluster, Raichur district)

—an evaluative study" *Journal of Rural Development*, 1(4), 1982, 565-610.

The study purports to : (1) evaluate the current level of growth in agriculture and industry and determine the extent of availability of basic infra-structure and social facilities in the cluster, (2) locate the gaps between the targets fixed or anticipated by the National Institute of Rural Develoment (NIRD) and the attainments in various sectors, (3) diagnose the causes for any gap between targets and attainments (4) provide a comparison of the projected production and employment targets of the cluster with the attainment levels and(5) formulate a follow-up plan for the forthcoming stage (i. e. 1982-86) in order to reduce the gaps between targets and physical attainments. To accomplish these objectives, Sindhnur Cluster, comprising 108 settlements with a total population of 120, 109 was selected for the study. Both primary and secondary data were collected for the analysis. The researchers draw several conclusions relating to agriculture, industry, social facilities and roads in the cluster.

4. Maheshwari, B. L.

"Decision styles and organisational effectiveness" *ICSSR Research Abstracts Quarterly*, 9(1 & 2), 1980

The study focuses on decision styles, frequently used by business managers in India. The data relating to decision styles and organisational effectiveness measures was collected from both managers (n=804) and organisations (n=12). Decision styles were analysed in terms of two dimensions-participation and entrepreneurship. The organisational effectiveness measures included : (1) perceived effectiveness aspects including quality of products, productivity of people, morale of workers and managers, rate of growth, and utilisation of resources, (ii) profits (iii) growth. The former measures were obtained through administration of a questionnaire and personal interviews, while the later two measures from published records. The following are the findings of the study :

(1). Public and private sectors do not differ in terms of strategy of diversification and structure; however, these sectors are substantially dissimilar vis-a-vis other variables including age, technology, size and environment.

(2) The decision styles are the outcome of a complex interaction of several factors such as the context and characteristics of the organisation, the nature of decisions and the characteristics and preferences of decision makers. There is positive relationship between participative and entrepreneurial styles. Culturally, the Indian organisations are neither authoritarian nor extremely bureaucratic. Indeed, there seems to prevail a mixed pattern and largely, the organisations are in the process of evolving decision styles.

(3) Notwithstanding significant inter-organisational variations, the organisations are neither authoritarian nor highly participative. They use consultation on job related decisions and limited participation on selected issues. There does not exist joint decision making and group participation on crucial issues; the managers have also moderate preference for participation.

(4) As the overall entrepreneurial style score is also moderate, it seems that the Indian business organisations are neither marked by highly bureaucratic or highly entrepreneurial style. They have departed from the bureaucratic style but are long behind the entrepreneurial style; the public sector managers are less bureaucratic in their orientations to rules and regulations than their counterparts in the private sector.

(5) While participating in the decision-making process, the managers seek to influence decisions and share power with their seniors and other peers.

(6) Profit effectiveness scale (with stress on resource utilisation) has moderately positive relationship with both perceived effectiveness (with stress on productivity and morale) and growth effectiveness (with stress on resource mobilisation). There does not exist any definite relationship between the perceived effectiveness and growth effectiveness.

(7) There does not exist a high positive relationship between participative style and organisational effectiveness as revealed by the analysis of objective data on performance. Comparatively, the entrepreneurial style correlated more strongly and significantly, with organisational effectiveness. Neither of these styles appeared to be related with growth effectiveness. There is no relationship between a participative style of strategic decision making and organisational effectiveness. Effective organisationshave favourable externl environment-market and government policies.

There are several implications of the above findings for organisational policy.

Note : The entrepreneurial style is characterised by high amount of anticipation and awareness of problems, lesser stress on rules and precedents, faster response to emergencies, effective problem solving and concern for excellent performance at different levels in the organisation.

5. Brown, C.

"Estimating the determinants of employee performance"

The Journal of Human Resources, 17(2), 1982, 178-94.

Do factors used by managers in personnel selection really enable them to procure the most qualified individuals ? As the performance measures of individuals not selected, are not available, there arises sample selection bias problem in validating employee selection criteria. The problems of sample selection can be tackled by using, with slight modifications, the recently evolved techniques. The researcher analyses data on applicants for first-line supervisory positions and on the job ratjngs of the selected individuals (n= 161) in a moderately large plant manufacturing non-durable goods. A comparison is made between ordinary least squares estimates of the determinants of performance and maximum-possible estimates which correct for selection bias. There arise changes in the expected direction in some variables' coefficients as a result of the correction for selection bias. Of course, the corrected estimates remain insignificant at conventional levels. The characteristics of the applicants available at the time of selection decisions do not have significant relationships with subsequent on-the-job performance. However, 'years in the supervisory position' has strong relationship with performance.

6. Maheshwari, B. L.

"Formal training, skill development and job performance".

ASCI Journal of Management, 11(1), 1981, 28-37

The paper determines the extent to which formal training programmes contribute to the development of job-related skills among managers and improve managerial effectiveness. It provides an analysis of some issues relating to the development of managers from development banking institutions in India and raises some significant questions pertaining to the relationship between formal training and skill development for effective job performance. The data was collected through a structured questionnaire and available responses of 999 managers (out of 2000 managers whom questionnaire was mailed) were processed. The analysis shows some amount of dissatisfaction with the formal training experience and a rather week relationship between training and skill development. Training programmes are considered less effective by managers in respect to their contribution to job performance; however, the usefulness of formal training for future is recognised. Thus, formal training is only one of the sources and cannot compensate for organisational or personnel inadequacies which hamper job performance. Finally, it is recognised that managers must be inclined to and be encouraged to convert the knowledge acquired into practice. Without these measures, even an excellent training programme is least likely to have significant effect on job performance.

7. Bansal, P. C.

"Some Correlates of Managerial Performance"

Unpublished Ph.D Thesis Department of Humanities and Social Sciences, Indian Institute of Technology, Delhi, 1982.

The study purports to analyse to contribution of 32 independent variables embracing six areas (i.e. organisational climate, ability, personality, motivation, personal values and demographic characteristics) accounting for the performance of managers in terms of three dependent variables including professional ability, managerial ability and personal qualities as assessed by their superiors. The sample consists of 61 middle-level managers and 131 lower-level managers drawn from one electronic and one electric company in the public sector and one electric company in the private sector located in South India. Data was collected through a series of tests including organisational climate questionnaire, self-description inventory, personal value questionnaire and personal information blank. The managers' performance ratings have been provided on performance appraisal form by their superiors. In addition, some managers were also interviewed. The statistical analysis include regression-analysis and analysis of variance.

Attempts are made to test eight hypotheses relating to relationships of managerial performance with (a) organisational climate, (b) ability, (c) personality, (d) motivation, (e) personal values and (f) demographic characteristics, (g) middle level managers scoring higher on test scores in comparison to lower level managers and (h) effect of the combined linear combination of organisational climate and personal variables on managerial performance. On the basis of the analysis of results, the following conclusions are drawn :

1 The managers desire smooth communication, better coordination, more say in decision making and responsibility alongwith authority.

2 The common factors contributing to three dependent variables among lower level managers are decision-centralisation, conflict, intelligence, masculinity-famininity, need for power over others, need for occupational achievement, age and experience. At middle management level, the contributors include responsibility, decision-centralisation and decisiveness.

3 The independent variables account for 29% to 38% of the variance in the three dependent variables for the two groups of managers.

8. Subrahmanyam, G.

"A production model with two labour inputs for the cement industry"

The Indian Journal of Economics, April 1982, 557-63

The study relates to the theoretical derivation and empirical estimate of the direct partial elasticities of substitution between two imperfectly substitutable labour inputs (production and non-production workers), and capital. As production function implies, all the three partial elasticities reveal marked change over time. This raises doubt about the applicability of simple two factor production models involving a homogeneous labour input. Moreover, it is suspected that, over the sample period, there has not taken place any significant improvement in Hicks neutral technical change. Notwithstanding its small sample, the study has provided significant tentative results indicating the empirical usefulness of production function.

9. Rao, V. L.

"Industrial entrepreneurship and productivity in Andhra Pradesh (structure, growth and performance of the small and large scale manufacturing sectors" (Andhra University), 1977.

Indian Dissertation Abstracts, 9 (1&2), 1980, 180-83.

The study involves both small and large manufacturing sectors in Andhra Pradesh. In small scale sector, the industrial estate programmes benefit largely those with better family background and higher level of education. There does not exist systematic relationship between socio-cultural factors and efficiency measures. Entrepreneurship is found to be of the 'imitative' type. While

the estate enterpreneurs face the only problem of raw materials' procurement, those in the sample also face the problem of raising working capital. In large scale sector, both labour and human resources productivities, substantially increased in the latter half of the sixties as a consequence of increased capital intensity. However, capital and total factor productivities decreased indicating a decline in the efficiency. The growth in managerial resources appears to play a negative role. There are positive relationships between productivity and employment movements and movements in output. Several policy suggestions have been made based on the findings of the study.

10. Sarup, S. and R. K. Pandey

"Assessment of factors affecting rice productivity in Madhya Pradesh"

Margin, 14 (4), 1982, 50-57

The study seeks to analyse factors responsible for the low productivity of rice in Madhya Pradesh. It uses data on resource endowments, crucial input use in rice production and the productivity of rice on a per-hectare basis for the year 1978-79 at the district level. The following are the findings of the study :

1. Eleven districts covering nearly 55 per cent of the total area under rice in the state are in the higher productivity group. In the other districts, the yield rate of the crop is lower than the state average.
2. The higher percentage of the high yielding varieties and irrigated areas and smaller holding size contribute significantly to the higher productivity.
3. The use of nutrient use is marginally a determinant of rice productivity; the level of nutrients use in the state is far from satisfactory.
4. The availability of different inputs varies widely among various districts of the state and this has strongly influenced the rice productivity.

Several suggestions have been made to improve rice productivity in the state.

For Your Bookshelf

All About Good Health

BERNARD C., C. N. PARKINSON
&
M. K. RUSTOMJI

What the medical practitioners advise to remain in normal good health

Bombay : IBH Publishing Company, 1982, 187 pp
Price : Rs. 22.50

Reviewed by Dr. R. S. Dwivedi, NPC, New Delhi

The book lucidly examines several issues related to health classified in six categories—sex, psychology, food, exercise, physiology and general. Specifically, attempt has been made to describe contributions of sexual behaviour and exercise to health, suggest measures to overcome tension and stress, insomania, constipation, food poisoning, and infections, heart diseases and strokes, backaches and slipped discs, cancer, diabetes, ulcers, liver trouble, hernia, headaches, colds and coughs and allied health problems and indicate some popular medical myths and frauds, necessity of periodical medical check-ups, use of the unconscious or subconscious mind, causes of suicide, common sense about food and eating, causes of bad breath, effects of alcohol, smoking, noise and climate on health and the significance of saunas, massages, hot springs, sun-bathing and sea-swimming.

The book can form a very useful reading for busy business executives and all those interested in health problems informing them the latest thinking on physical, psychological and psychosomatic illnesses which have become a common problem in modern civilisation.

Export Promotion Of Selected Small Industry Products

ASIAN EXPERIENCE
JAITLE, T. N.

What role small industries can play in promoting exports of six APO member countries in the ESCAP region and what prospects can be of increasing trade and co-operation between developing countries and Japan

Tokyo : Asian Productivity Organisation, 1981, 115 pp

Reviewed by Prof. B. C. Tandon, Faculty of Management Studies, University of Delhi, Delhi.

Export promotion of products of small scale industry has been accorded importance in recent years in India and other developing countries. The development of such industries in electronics, electrical machinery and autoparts, etc. has opened a new era as they have helped underdeveloped countries in increasing their national income, employment and export trade. The present study throws light on developments that have taken place in Japan and five other South and South-East Asian countries including Korea, Hong Kong, the Phillippines, Singapore and India.

Ten years ago, the Oshnikawa Fellowship was instituted with a view to providing annually an opportunity to a selected fellow to deepen his study in the field of small industry in the Asian Productivity Organisation (APO) member countries, and it was thought that such a study would serve as a possible input for national as well as regional development. The present report is one of those printed in the series.

The small enterprises are put to great disadvantage in the field of export marketing due to their size, restricted market and limited resources. These limitations can be over-come through efforts at different levels-enterprise, industry, national governments and international organisations.

Although the efforts which have been made in different countries are discussed in this book, the discussion is incomplete and the subject needs further study and investigation.

Chapter 1 deals with the changing pattern of industrialisation and trade in developing countries and the main theme is based on the role of Japan and validity of its experience. Chapter 2 enlightens the readers with the role of small industries in overall economy and exports, and critically evaluates the position of these industries in all the six countries. The report (Chapter 3) mainly deals with the role of electronics and autoparts for export, and it is suggested that other small industries producing and exporting a number of other items may also be included in the study by researchers in the coming years. Chapter 4 studies export promotion measures in Japan, India and other countries and critically examines the financial and fiscal measures and institutional assistance provided by the governments of these countries. Chapter 5 is a useful section of the book as it deals with trade possibilities and economic cooperation with Japan and measures to be taken by developing countries.

Such a study could become even more useful if it is published early. Delay in preparing the final report reduces its practical usefulness. It has, however, an academic utility and it will be found interesting by those who are engaged in the study of small industries in India, Japan and other small countries of Asia.

Dictionary Of Instrument Science

RAMALINGOM, T.

What terms the field of Instrument Science covers

New Delhi : Wiley Eastern Ltd., 1982. 588 pp
Price : Rs. 110.00

Reviewed by Mr. Ajay Pandit, Lecturer, Faculty Management Studies, University of Delhi, Delhi.

Instrumentation covers "designing, manufacturing and using physical instruments or instrument systems for detection, observation, measurement, automatic control, automatic computation, data processing, etc." This is how the book under review explains the meaning of the word 'Instrumentation'. In fact, rapid advances in the field of instrument science has brought with it countless new terms and new applications of established terms, and most of which are not found in the recent unabridged dictionaries. The author, who is an instrument science specialist, has done a commendable job of compiling over 6000 terms which cover almost every aspect of the broad field of instrument science. The dictionary, unique in itself, will be of immense utility to the scientists and engineers as well as to the students of physics and engineering. Simple explanations of the terms will enable even non-technical readers to understand the definitions without much difficulty.

The author has referred to many standard works on instrumentation and allied subjects in compiling this dictionary. A selected bibliography in the areas of General Instrumentation-Electrical and Electronics-Control systems-Optical and Analytical Instrumentation-Computer and Data Processing and Telemetering and Remote sensing is given at the end. A glossary of acronyms that appear in the book is given in the appendix.

Economic Development

MAHAJAN, V. S.

What factors are of particular relevance for developing countries to accomplish economic development

New Delhi : Kalyani Publishers, 1982, 144 pp
Price : Rs. 30.00

Reviewed by Dr (Mrs) V. Raghavachari, Miranda House, University of Delhi, Delhi

Economic development of any country is the result of the interaction between various factors, both economic and non-economic. The developing country, although it can benefit from the experience of the already developed, has to take into account its own uniqueness as regards its resources and institutions, existing as well as potential. A successful policy for development, therefore, is an interdisciplinary matter, skilfully organizing the

economy and society so as to promote rapidly, growth and development. This necessarily requires the integration of theory, history, institutions and policy, supported by empirical findings.

Mahajan's book attempts to discuss some of these complex issues, of particular relevance to the developing economies.

After surveying the interest in the subject in recent years in Section 1, the author goes on to define under-development in Section II. Development of ideas regarding economic growth as enunciated by some Western writers is then discussed with a useful speculation about their utility to the developing economies in Section III. Thereafter, in the next six sections, specific issues are highlighted which form the problem areas in the poor countries. These issues include agriculture and industry, population and its consequences, trade and transport, technique and technology and the significance of a global approach in the transformation of a developing economy.

This is a very heavy matter for a small-sized book (144 pages) and if one also feels the absence of a clear link between the chapters, it is perhaps because of the fact that most of the material included in the book is taken from the author's articles published in various journals. However, the book introduces the reader to the basic and associated problems which one can expect to encounter in the development process and makes some policy suggestions, supported by theory and historical experience.

The first problem discussed by the author is the exact meaning of the term 'underdevelopment' (Sec. II). Is it to be defined with reference to per capita income or output or with reference to the utilisation of the key factors of development, i.e., natural resources, human resources, capital and technology ? Having discussed the concept of 'underdevelopment' in relation to the above factors of development, Ihe author arrives at the conclusion that the term is elusive and "does not lend itself to any fruitful meaning" (p. 18). Somehow, in the discussion, the author has missed out the distinction between economic growth and economic development-while the former refers to increases over time in a country's real output of goods and services or real output per capita, the latter (i.e., "economic development") is more comprehensive, including as it does, growth, accompanied by structural changes embracing social and political. The terms 'developing countries' and 'less developed countries' are commonly used in development literature currently to describe countries which could do both growth and development.

Section III, which provides the theoretical background, discusses the classical and other models of development. The author examines the models of the classical school, Schumpeter, Marx and Harrod. He feels that the classical model throws light on the current problems of the developing countries (p. 28) and so by implication can guide in policy. Schumpeterian model is discarded as not relevant because it does not visualise governmental intervention in a positive manner. Marx is rejected as "Marxian theory of growth is confused and suffers from its own contradictions". (p. 43). Harrod's model too is considered unsuitable as "growth cannot be reduced to a particular variable or variables" (p. 49). The discusssion preceding the conclusions is very inadequate and does not bring out the details of the models which could warrant such conclusions. In any case, it is now agreed that there can be no general growth model suitable to all countries just as we can no longer have one diagnosis of the causes of underdevelopment.

Next, the author tackles some of the important issues in economic development including agriculture and industry, trade and transport, population, choice of techniques and technology and the need for global intervention. While the author has brought out the importance of appropriate technology, suitable industrial and agricultural policy and shown the need for international awareness, one wishes that the discussion would be more comprehensive and adequate, filling in, where only floatings of thoughts are there. Certain other very important issues such as the distributional aspects of income distribution, employment and financing, etc. are not brought in at all.

But economic development is such a complex issue that perhaps it is not possible to be exhaustive. Mahajan's book serves to whet the appetite, creating interest in the problems of developing countries and the reader is led on thence into the development debate and other development literature.

NPC CALENDAR OF EVENTS

JANUARY—DECEMBER 1983

INTERNATIONAL PROGRAMMES

Sl. No.	TITLE	DATES	VENUE	FOR DETAILS CONTACT
1.	Management Development Seminar	Jan. 26-Feb. 10	Madras Singapore	HQ DG
2.	Modern Management Concepts	Nov. 20-25	Kathmandu	HQ DG
	ILO MODULAR TRAINING FOR TRAINERS IN SUPERVISORY DEVELOPMENT			
3.	7th Programme	March 21-25	Bombay	HQ DG
4.	8th Programme	April 4-9	Ooty	HQ DG
5.	9th Programme	May 16-21	Darjeeling	HQ DG
6.	10th Programme	July 25-30	Srinagar	HQ DG
7.	11th Programme	Aug. 22-27	Hyderabad	HQ DG
8.	Workshop on ILO Modular Programme	Oct. 17-21	Kathmandu	HQ DG
9.	ILO Programme for Energy Sector	Jan. 17-21	Delhi	HQ DG
10.	ILO Programme for Hotel & Catering Sector	(To be announced)	Bombay	HQ DG

TRAINING PROGRAMMES

A. Management Services

S. No.	TITLE	DATES	VENUE	PARTICIPATION	FOR DETAILS CONTACT
	GENERAL MANAGEMENT & PRODUCTIVITY				
1.	Management Development Programme	Jan 17-22	Jorhat	Chief Executives & Senior Managers from Industries, Service Organisations & Utilities	RD Gauhati
2.	Managerial Effectiveness for Women Executives	March 15-19	Bombay	Women Executives from first and middle level management	RD Bombay

Sl. No,	TITLE	DATES	VENUE	PARTICIPATION	FOR DETAILS CONTACT
3.	Productivity Measurement & Monitoring	April 27-29	Madras	Senior Executives from all functional departments of Private & Public Sector Organizations	RD Madras
4.	Productivity Measurement & Monitoring	June 14-16	Bangalore	Senior Executives from all functional departments of Private & Public Sector Organizations	RD Bangalore
5.	Public Relations & Corporate Management	June 20-25	Srinagar	Senior Executives from Industries, Service Organisations & Public Utilities	RD Chandigarh
6.	Effective Management by Systems	Aug. 20-23	Puri	Senior Executives from Industries, Banks, Govt. and Service Organisations	RD Calcutta
7.	Managerial Leadership for Higher Productivity	Aug. 23-26	Jaipur	Senior Executives	RO Jaipur
8.	Programme on Advancement of Management & Productivity	Sept. 13-24	Srinagar	Senior Executives from Industries, Banks, Govt. and Service Organisations	RD Chandigarh
9.	Management for Higher Productivity	Dec. 6-10	Goa	General Managers, others who can introduce changes in the organisations	RD Delhi
	FINANCIAL MANAGEMENT				
10.	Advanced Financial Management	April 12-15	Darjeeling	Senior Finance Executives from Public/Private Sectors, Govt., Administration and Banks	RD Calcutta
11.	Finance for Non-Financial Executives	June 27 - July 4	Srinagar	Executives	RD Chandigarh
12.	Working Capital Management	Sept. 6-9	Bombay	Executives concerned with Policy Making & Financial Planning & Control	RD Bombay
13.	Performance Budgeting	Oct. 28 - Nov. 3	Nainital	Senior Finance Executives from Public/Private Sectors, Govt., Administration and Banks	RD Kanpur
	ORGANISATIONAL BEHAVIOUR AND PERSONNEL MANAGEMENT				
14.	Selection & Interviewing Techniques	Sept. 13-17	Madras	Senior Executives from Staff & Line Positions	RD Madras
15.	Executive Effectiveness	Oct. 18-24	Srinagar	Senior Executives from Industries, Govt. Undertakings and other Institutions	RD Chandigarh

EDITORIAL

The Year 1983 marks the beginning of the 'Silver Jubilee Year' of National Productivity Council of India. Since its inception in February 1958, NPC has made significant contribution towards the national goals of improved productivity and standard of living by creating productivity consciousness in all sectors of the economy, rendering specialist services to different sectors to augment their operational, managerial and organisational effectiveness and disseminating relevant productivity information both nationally and internationally. To accomplish these goals effectively, over 200 full time specialists of the Council are engaged in multi-dimensional, professional activities ranging from training, consultancy and promotional to international services through 11 regional directorates, 3 regional offices and 2 sub-regional offices and its training Institute in Productivity and Industrial Engineering and a network of 48 local productivity councils. It has published over 10 dozen guides, monographs, manuals and research reports on varied themes of management and productivity. It is bringing out 5 periodicals including the PRODUCTIVITY.

This issue of PRODUCTIVITY forms an extension of the preceding one which embodied topics of specific interest for research and executive action in different delineated areas of the productivity system : problems and prospects, determinants, measures to improve, sectoral analysis, relationship with other systems, management and innovations. At the very outset, "Marketing problems of small scale industries" (Kapoor, T.N., et.al.) have been presented. Specifically, these problems relate to raw material and accessories, storage, packaging and transport, price fixation and promotion and distribution demanding application of several specified governmental measures to effectively resolve them. In addition to this exploratory discussion on problems of growing concern, attempt has been made to provide a global assessment of the export performance and prospects of our economy in A.K. Sengupta's article "Analysing India's Export size and Composition". The author indicates emergence of some sectors which apparently seem insignificant, as major contributors to the export and cautions the economic planners that they must consider the implication of change in the context of the magnitude and the composition of export to avoid any breakdown in our economy in future.

The ideas for action are sound both to withstand the criteria of practicality and overcome the resistance to change. They emphatically indicate application of PMT systems in certain delineated areas in our industry to increase productivity identifying the barriers and measures to overcome them (L.M. Sukhatanker; "Productivity Improvement Through PMT Systems"), evolution of result-oriented incentives linked to productivity, peculiar to chemical and process industries, as an effective alternative to harness human motivation (D. Chakrabarti: "Here is the need for Productivity Linked Incentives") and upsurge of innovations in methods and techniques from the shopfloor of a leading public sector organisation to accomplish significant gains in productivity ("Operating Cases on Productivity Improvement").

The planning process forms a pre-requisite to long-term success of an enterprise. As a determinant of productivity, it has been lucidly addressed in J. Stanislao's article "Planning for Productivity". Once you develop organisational objectives, you will require a systematic planning to facilitate coordination of efforts and improve organisational efficiency. In a more sharp analysis of a manufacturing plant, Y.P. Kedia explores the causes of under-utilisation of capacity and suggests action oriented measures to actualise the maximum potential in response to a rising challenge of the day ("Improving Capacity Utilisation"). The next two articles deeply penetrate into the issue of organisational vitality in specific settings. If you are working with railways or otherwise have interest in the effectiveness of this sector, R.C. Acharya's article on "Resurrecting a Railway Corporation" will attract you most. You are likely to appreciate as to how formation of a task force, transfer of technology and allied timely action research measures go a long way to check organisational crisis and breakdown and restore effectiveness of the corporation in Nigeria. Likewise,

as an executive manning iron and steel or cement industry, you will be keen to look into the causes of setback in the profitability of your own system and there exists every possibility that you become illuminated with specific measures to improve its profitability as a result of your own search into the forces responsible for profitability trends in 15 other industries in India (Rede, L.A.: "Towards Profitability of Manufacturing Industries). Write to us your reactions and experiences in this regard.

In conjunction with several other disciplines, ergonomics, industrial engineering and psychometry contribute towards the understanding and improvement of productivity system. While ergonomics can be applied as a significant managerial tool to enhance human effectiveness by providing an understanding into the complexity of psycho-physical characteristics of human system (J. Banerjee : "The Ergonomics has Proved Itself"), industrial engineering provides several measures for production planning and control including the multiple-product solution procedures to deal effectively with the problems of lot sizing and sequencing on one common facility (R.P. Mohanty and R. Natarajan : "Tapping Three-Product Heuristic Solution Procedure"). Finally, psychometric methods and techniques, if properly used, can prove to be effective predictors of human performance and thus, form useful devices for selection and placement decisions as evidenced in the study reported by S. Chatterjee and M. Mukerjee ("How to select Trainee Pilots").

The management of productivity system involves a plethora of effective practices and tested theories. S.K. Agrawal and P. Vrat present an empirical analysis of waste management practices indicating agriculture and industry as the most critical sectors necessitating immediate action. They pose a challenge to the managers engaged in these sectors for unfolding the immense potentialities for waste reduction and recycling ("Where Do Our Waste Management Practices Stand?"). More than this, there exists a veritable challenge to managers and trade union leaders in different sectors of economy to accomplish organisational and their own effectiveness through the application of trust-based systems. Management by Trust (MBT) training, evolved by R.S. Dwivedi, provides new opportunities to attain effective results through optimisation of organisational structure and processes, assimilation of conflicts and integration of goals by trust ("MBT Training Has Made Great Strides").

Innovations in the field of technology and engineering can be used to accomplish excellence in different sectors of the economy including agriculture. P.K. Srivastava proposes a new approach to innovate tobacco cultivation as a measure to improve the productivity of this significant commercial commodity ("Now is the Time for Innovating Tobacco Cultivation"). Will our cultivators overcome the vast resistance to change and come forward to adapt this approach ?

In addition to the above varied articles, the issue embodies "For your Bookshelf" presenting analytical and descriptive reviews of five books on management of human resources and productivity. If you are keen to understand significant methods and techniques found effective in managing people at work, R.S. Dwivedi's *Manpower Management* is likely to attract you most. Specifically, if you are an administrator in a government department or otherwise have interest in it, there is a great deal for you to learn what motivates people in bureaucracy (M.A. Aleen: *Personnel Management in Government*. As you know, productivity has received enough attention among interdisciplinary researchers. Three of these several efforts relate to socio-economic dimensions of *Labour Productivity* (J.P. Srivastava), comparative trends and prospects in *Productivity of Electrical Machinery Industry* (K. Rajalakshmi) and problems stemming from *Linking Bonus with Productivity* and measures to resolve them (G.K. Suri).

The column "Of Productivity Thinking" provides a classification and an index of articles, book reviews and bibliographies and abstracts, published in our twenty-third volume of the PRODUCTIVITY, which may be of particular relevance for researchers in related areas. It also generates interest of our practitioners into the complex productivity system raising a myriad of ideas for their decisions and actions. We hope knowledge and ideas obtained from this volume will be disseminated through our numerous readers in thousands of centres in India and abroad inspiring the productivity movement.

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Linking Bonus With Productivity (Edited by Suri, G.K.)

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PRODUCTIVITY

Notice to Contributors

Productivity, an official journal of the National Productivity Council of India, is published quarterly in April, July, October and January. It disseminates knowledge on productivity systems to facilitate economic growth, provides a forum for interdisciplinary discussions and forms a bridge between scholars and practitioners. It is being restructured to publish manuscripts reporting results of empirical research on productivity system and application of research results to the solution of problems in business, industry and government with experience based, reflective articles distilling basic truths philosophies and thoughts. To serve its dual readers, the practising executives and the scholars, manuscripts need to be prepared to meet the criteria of technical soundness, readability and practicability. The manuscripts should relate to the following areas:

(a) Productivity System : Problems and Prospects
(b) Determinants of Productivity System
(c) Improving Productivity System
(d) Productivity Systenm by Settings
(e) Productivitiy in relation to other Systems
(f) Managing Productivity System
(g) Innovations in Productivity System

With exceptions, the length of manuscript should be restricted to around 5000 words. Two copies of the manuscript should be submitted, double spaced and typed on one side of the paper. A cover page embodying abstract of the manuscript, bio-data of the author(s) and a declaration that it is an original contribution and has neither been published nor submitted for publication elsewhere, should be attached. Reference and notes should be in double space separately in the order of their citation in the text of the manuscript and must be complete in all respects for the publisher, place of publication, year and page number(s) (for style refer to the latest issue). Graphs and designs should be drawn in ink only. Tables should be typed on separate pages at the end. Contributors will receive a nominal honorarium and 25 copies of the reprints of their papers after publication.

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

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Growing Concerns

Topics of specific relevance for owners and managers of small undertakings

MARKETING PROBLEMS OF SMALL INDUSTRIES

Kapoor, T.N.
Bidhi Chand and
S.K. Kapoor

What the central and state governments should do to effectively resolve the baffling marketing problems of small scale industries including stiff competition in general and those related to raw material and accessories, storage, packaging and transport, price fixation and promotion and distribution systems in particular

The problems of small scale industries vary from time to time in their magnitude and dimensions. Historically, these problems have ranged from non-availability of material and finance to a stiff competition in the market. The central and state governments provide help to these units in different forms. An empirical study conducted by the authors in 1978 indicates that raw material and accessories, storage, packaging and transport, price fixation, and promotion and distribution emerged as major problem areas at Chandigarh and Mohali industrial units. Despite these problems, small scale entrepreneurs have little awareness of the government assistance and even where such awareness exists, there is reluctance to use it for varied reasons. Based on their analysis, the authors make the following suggestions : (a) bigger units should purchase goods produced by the small units and sell them under their own brand names, (b) an organisation should be established to buy the goods from small units and market the same, through a network of shops, (c) assistance should be provided for performing certain marketing tasks, (d) attempt should be made to increase the awareness and utilisation of marketing assistance, (e) government rules, regulations and procedures should be simplified, etc. Although the findings of the study are limited to the two settings, they have relevance for policy design at macro-level.

Dr. T.N. Kapoor is Professor and Dean, and Dr. Bidhi Chand and Mr. S.K. Kapoor are faculty members with the Department of Commerce and Business Management, Panjab University, Chandigarh.

The Industrial Policy Framework

A modern small scale industry in India is distinguished from a large scale industry if its fixed capital investment in plant and machinery does not exceed Rs. 10 lakhs. This limit is Rs. 15 lakhs in respect of small scale ancillaries. Small scale industries involve a shorter gestation period, depend to a less extent on imported equipment and raw materials help large industries by meeting their requirements of parts and components and stimulate faster growth of capital, skills and managerial and entrepreneurial talents. Because of these and several other advantages that small scale industries offer, they have been given an important place in the industrial policy of the country. On the role of cottage, village as well as the modern small scale industries, the Industrial Policy Resolution of 1956 had observed : "—Further, heavy industry in the public sector may obtain some of their requirements of lighter components from the private sector, while the private sector in turn would rely for many of its needs on the public sector. The same principle would apply with even greater force to the relationship between large scale and small scale industries." It will be noted that, among other things, the Policy Resolution laid special stress on development of small scale industries as ancillaries to large scale industries. The industrial policy statement (December 1977) emphasises effective promotion of cottage and small industries, widely dispersed in rural areas and small towns. Stress has been laid down on the point that whatever can be produced by small and cottage industries must only be

so produced. For this purpose, an exhaustive analysis of industrial products has been made to identify those items which are capable of being produced or expanded in the small scale sector. This policy pays special attention to units in the "tiny sector", namely those with investment in machinery up to Rs. one lakh and situated in towns with a population of less than 50,000 according to 1971 census. It rightly pinpoints that growth of small scale and cottage industries sectors has been tardy mainly for want of satisfactory marketing arrangements for their products. The policy calls for special attention to be paid on marketing of goods of these sectors with its concomitant of product standardization, quality control and marketing surveys.

The Emergence of Marketing Problems

A number of industrialists and academicians have expressed themselves on the problems of the small scale units. Over the years these problems have undergone a significant change in their magnitude and dimensions. It is pointed out that a few years back the major problems which these units faced related to raw materials and finance. There are still some difficulties of specific raw material shortages and non-availability of capital. But, by and large, it is said that now the position is much better. The greatest problem which these units face for some years now is in the area of marketing. The units face stiff competition not only from other small units but also from large units.

Because of limited financial resources and inability to hire professional managerial personnel, small scale units lack specialization in different functional areas. The execution of various policies relating to the functional areas, such as the development of products, procurement of raw materials, production control, marketing, administration of personnel etc. have to be done by the proprietors, partners or directors of the firm themselves. Therefore, the owner-manager has to be proficient in several areas. Not only he lacks managerial resources there is also absence of motivation. There is a resistance in accepting and learning new ideas and methods. In view of these constraints the units are not able to take care of the peculiar marketing problems requiring professional expertise. Very few units have been able to create a 'Brand' image of their own and thus others have been deprived of consumer acceptance and awareness. Also small units have to rely on sales agents and distributors if they do not have one or two large customers. These middlemen do not give adequate attention to the products of the small scale sector. On the contrary they have some expectations from the small manufacturer. For example, dealers expect credit from him. But due to the paucity of funds, the small manufacturer cannot provide these facilities. It is also not possible for these entrepreneurs to undertake systematic marketing research, product development and designing, promotion and distribution.

The Governments Render Support

The Small Industries Service Institutes generally help the entrepreneur in the selection of industries, suitable raw materials, distribution aid surveys, enlisting the units for participation in the Central Government Stores Purchase programme, etc. They also provide technical guidance in production of goods according to prescribed standards, competency certificates to the units receiving government orders. Tender sets and specifications such as ISI and IR are supplied free of charge to registered small scale units through NSIC.

With the object of encouraging increased participation by small scale sector DGSD, has reserved some items to be purchased from the small units only. For some other products DGSD allows a price preference to small scale industries up to a maximum of 15% over the accepted quotation of the large scale units.

The State Small Industries Corporations supply raw materials against quotas. These Corporations also manage emporias, where products from small scale sector are sold.

The State Industries Departments provide financial help, 'focal point' facilities, and quality mark to small industries.

Excise Duty exemption is also provided for certain products.

Other agencies which help the small scale sector include Indian Standards Institutions, Council of Scientific and Industrial Research.

However, it is our view that if the new industrial policy emphasising the role of small scale industries is to be made a success, the details of the scheme of assistance and programmes for their development should be formulated not just on the basis of a general understanding of their problems but by obtaining a thorough assessment of their specific problems and constraints. The role played by the Government assistance available to them at present will also have to be carefully evaluated.

An Empirical Study

The present study is limited in scope and covers only two centres—Chandigarh and S.A.S. Nagar (Mohali) in Punjab. The study seeks to identify the marketing problems faced by the small scale industries and their awareness and extent of utilization of Government assistance for marketing. The questionnaire covered a representative sample of 26 units. Interviews were also held with industrialists with a view to eliciting their views and obtaining their comments and suggestions. Data collection and interviews were done by the authors themselves and all the findings reported here are based on them.

A Profile of Characteristics

As will be seen from Table I & II, which give basic information about the units surveyed, the form of ownership was mostly partnership. In S.A.S. Nagar (Mohali) majority of the units were established after 1974 while in Chandigarh they were established before 1970. Much bigger units exist in S.A.S. Nagar (Mohali) on the basis of capital investment and employment. The range of products varied from engineering items to soaps, detergents, fertilizers, electronics, paper packing, plastics, and boats.

It may also be mentioned that out of the units surveyed about 20% units in Chandigarh and 50% in S.A.S. Nagar (Mohali) are supplying their goods to other areas besides Punjab and the local market.

Table I : Background Information about Small Scale Industrial Units at Chandigarh

Number of units surveyed : *15*

Form of Organization	*Sole Proprietorship*		*Partnership*		*Private Limited Company*	
	4		10		1	
	(26.6)		(66.5)		(6.65)	
Year of Establishment	*1970*	*1971*	*1972*	*1973*	*1974*	*1975*
	7	—	1	2	3	2
	(46.5)	—	(6.65)	(13.3)	(20)	(13.3)
Capital Investment (in Rupees)	*Up to Rs. 10,000*	*10 to 50 Thousand*	*50 Thousand to 1 Lakhs*	*1 to 2 Lakhs*	*2 to 5 Lakhs*	*Over 5 Lakhs*
	—	6	3	3	3	—
	—	(4.0)	(20)	(20)	(20)	—
Employment	*Up to 5*	*5 to 10*	*Over 10*			
	2	10	3			
	(13.3)	(6.65)	(20)			
Main Products	*Engineering*	*Beats*	*Soap, detergents*	*Fertilizer*	*Paper Packing*	
	10	1	1	1	2	
	(66.5)	(6.65)	(6.65)	(6.65)	(13.3)	
Production (in Rupees)	*Up to 1 Lakh*	*1 to 5 Lakhs*	*5 to 10 Lakhs*	*Over 10 Lakhs*		
	9	2	2	2		
	(10)	(13.3)	(13.3)	(13.3)		

Figures in brackets indicate percentage of the total units surveyed.

Table II : Background Information about Small Scale Industrial Units at S.A.S. Nagar (Mohali)

Number of units surveyed : 11

Form of Organization	*Sole Proprietorship*		*Partnership*	*Private Limited Company*		*Joint Sector*
	3		6	1		1
	(27.3)		(54.5)	(9.1)		(9.1)
Year of establishment	*Till 1970*	*1971*	*1972*	*1973*	*1974*	*1975*
	—	—	—	2	6	3
	—	—	—	(18.2)	(54.6)	(27.3)
Capital Investment (in Rupees)	*Up to 10,000*	*10-50 Thousand*	*50 Thousand to 1 Lakhs*	*1-2 Lakhs*	*2-5 Lakhs*	*Over 5 Lakhs*
	—	1	3	1	4	2
		(9.1)	(27.3)	(9.1)	(36.4)	18.2)
Employment	*Up to 5*	*5-10*	*Over 10*			
		4	7			
		(36.4)	(63.6)			
Main Products	*Engineering*	*Private/Public*	*Paper Packing*	*Electrical/Electronics*		
	6	1	1	3		
	(54.6)	(9.1)	(9.1)	(27.3)		
Production (in Rupees)	*Up to 1 Lakh*	*1-5 Lakhs*	*5-10 Lakhs*	*Over 10 Lakhs*		
	1	4	4	2		
	(9.1)	(36.4)	(36.4)	(18.2)		

Figures in brackets indicate the percentage of the total units surveyed.

The type of channels used by Chandigarh units vary from door-to-door selling, agents, and distributors. In the local market the goods are sold directly to the customers. Export Houses are used for exports.

In S.A.S. Nagar (Mohali) also the pattern is the same. Locally, the units sell directly. For sales to other parts of India, agents and distributors are employed. Some units appoint their own dealers.

The promotion of the products by the small scale units is generally not on any scientific basis. There are just random insertions in the newspapers. Some also advertise through weeklies and monthlies. Many units approach their customers through brochures and pamphlets. Two units offered incentives to their dealers, and also offered good 'after sales service.'

Table III : Responses Regarding Marketing Problems of Small Scale Industrial Units At Chandigarh

Number of Units : 15

Problem Areas	*Number responding*		*Percentage of No. responding*	
	Yes	*No*	*Yes*	*No*
1. Raw Material and accessories	9	6	60	40
2. Quality Control	1	14	6.7	93.3
3. Packaging	5	10	33.3	66.7
4. Price Fixation	4	11	26.7	73.3
5. Selling	3	12	20	80
6. Promotion	1	14	6.7	93.3
7. Distribution methods	2	13	13.3	86.7
8. Transport	5	10	33.3	66.7
9. Storage	9	6	60	40

Identifying Marketnig Problems

Table III gives responses regarding marketing problems faced by the sample units at Chandigarh. The most important problems relate to raw material and accessories, and storage, each of which were indicated by 60% of the units. Packaging and transport, (each reported by 33.3% of the units) are the problem

areas next in order of importance, in which small scale industrialists at Chandigarh face difficulties. Selling as a problem area has been mentioned only by 20% of the units covered, problems in distribution methods by 13.3% and problems in promotion area only by 6.7%. This indicates that promotion and actual selling are not the important problems faced by the units. Availability of raw materials and space for storage followed by packaging and transport are the major problem areas. The nature and character of these problems have been indicated in Table IV. Available details about the availability of raw meterials and accessories have been given in Table V.

Table IV : Nature and Extent of Marketing Problems faced by Small Scale Industrial Units at Chandigarh

Problem Areas	*Details*
Packaging	(a) Based on trial and error, no idea of a good package.
	(b) Packaging facilities not available in Chandigarh; mostly have to be got from Ludhiana.
Price Fixation	(a) Difficult to fix a price for end-product, because of fluctuations in raw material prices.
	(b) Price fixed by large units for small-unit products without any idea of the cost structure of the small units.
	(c) Compelled to follow the prevailing price in the market
Selling	(a) Seasonal products in the off-season need storage facilities
	(b) Cannot afford a marketing organization; hence have to sell personally or against orders.
Distribution Channels	(a) Middlemen expect credit, which small-units can ill-afford
	(b) Payment by middlemen not on time.
Transport	(a) Inadequate wagon supply, heavy freight charges
	(b) Inadequate road transport service to important towns of India. Service also not reliable.
Storage	(a) High cost of storage; rented space
	(b) No proper storage facilities for fertilizers.
Marketing Information	(a) No information about potential products
	(b) Scanty information about existing products, mostly through middlemen.
Other Problems	(a) Non-availability and high interest rate for working capital
	(b) Multiplicity of service organizations
	(c) Cheap labour not available
	(d) Too many visits/inspections by Inspectors.
	(e) Excise duty rates deterrent to growth
	(f) Spurious manufacturers
	(g) Over emphasis by govt., on specifications for the building, leading to high investment.

Table V : Availability of Raw Materials and Accessories to Small Scale Industrial Units At Chandigarh

No. of Units : 15

	Number of units responding		*Percentage of units responding*	
	Yes	*No*	*Yes*	*No*
1. Regularly	8	7	53.3	46.7
2. At competitive and stable price	6	9	40.0	60.0
3. Of assured quality	11	4	73.4	26.6
4. In the required quantities	13	2	86.5	13.5
5. From the best considered sources	13	2	86.5	13.5

It is worth pointing out that a majority of the sample units indicated non-availability of funds for working capital as their major problem. They found it difficult to get funds from banks and other sources. Some industrialists talked about the harassment by the Government fuctionaries whom they were required to please for every small thing they wanted to get done by the Government. Other problems at Chandigarh relate to non-availability of cheap labour, non-availability of information about potential products, multiplicity of service agencies located at different places, faulty pattern of excise duty rates, and over emphasis by the Government on building specifications.

The position of units facing marketing problems at S.A.S. Nagar (Mohali) has been shown in Table VI. The biggest problem of units studied at S.A.S. Nagar (Mohali), is price fixation, faced by 91.1% of the units surveyed. These units face fluctuations in the raw material prices leading to fluctuation in the price of

Table VI : Responses regarding Marketing Problems faced by Small Scale Industrial Units At S.A.S. Nagar (Mohali)

No. of Units : 11

Problem Areas	*Number of units responding*		*Percentage of units responding*	
	Yes	*No*	*Yes*	*No*
1. Availability of raw materials and accessories	5	6	45.5	54.5
2. Quality control	3	8	27.3	73.7
3. Packaging	1	10	9.3	91.1
4. Price Fixation	10	1	91.1	8.9
5. Selling	4	7	36.4	63.6
6. Promotion	5	6	45.5	54.5
7. Distribution methods	5	6	45.5	54.5
8. Transport	4	7	36.4	63.6
9. Storage	1	10	8.9	91.1

their finished product. The units are also compelled to fix the prices as desired by the buyers of their products which happen to be big manufacturers. Thus, the price gets fixed without any relation to the cost structure of manufacturers. A number of units (45.5%) face problems with regard to availability of raw materials and accessories, promotion and distribution methods. Selling and transport problems were faced by 36.4% of the units. Table VII gives the nature and character of these problems. The details about the availability of raw materials and accessories have been provided in Table VIII.

Table VII : Nature and Extent of Marketing Problems faced by Small Scale Industrial Units at S.A.S. Nagar (Mohali)

Problem Areas	*Details*
Packaging	(a) Package selection through intution, experience, etc. no idea of good packaging companies.
	(b) Packaging and printing on the packaging is of poor quality. Because of this, cannot compete with large manufacturers who offer attractive packs.
Price Fixation	(a) Because of fluctuations in the raw material prices, units find it difficult to revise their end-product prices.
	(b) Compelled to follow a particular price fixed by big manufacturers; this price is fixed without any idea about the cost structure of the small units.
Price control	(a) Difficulty in modifying the product, for the desired price range.
Selling	(a) Because of competition, units are forced to sell at unremunerative prices.
	(b) Difficulty in understanding tender conditions.
	(c) Cannot afford a marketing organization, hence have to sell personally or against orders.
Promotion	(a) Cost of advertising high; limited resources for promotion.
	(b) No experience and know-how in promotion.
Distribution Channels	(a) Lack of awareness of genuine distributors
	(b) Problem in payment; middlemen expect credit facilities.
Transport	(a) Rail link is not available.
	(b) Inadequate road transport facilities for important towns of India; sometimes the service is not reliable.
Storage	(a) No storage problem.
Market Information	(a) Market information about existing products provided by Industries Department is not comprehensive and is outdated. Information collected by units themselves.
	(b) Scanty information for taking new product decisions.
Marketing Planning and Strategy	(a) Not possible to prepare a marketing plan because of lack of information about frequent changes in the market conditions.
	(b) Difficult to implement a plan.
Other Problems	(a) Working capitial requirements not being fulfilled.
	(b) Excise duty structure constraint to growth in some industries.
	(c) Problem of competing with Chandigarh units, where there is no sales tax.
	(d) Lot of time wasted in procedures and formalities.
	(e) Units have to deal with many inspectors, whose integrity is not above board sometimes.
	(f) Multiplicity of agencies for getting incentives and services.
	(g) Problem in fulfilling bulk orders for exports.

Table VIII : Availability of Raw Material and Accessories to Small Scale Industrial Units at S.A.S. Nagar (Mohali)

No. of Units: 11

	Number of units responding		*Percentage of units responding*	
	Yes	*No*	*Yes*	*No*
1. Regularly	6	5	54.6	45.4
2. At the competitive and stable price	9	2	81.6	18.4
3. Of assured quality	9	2	81.6	18.4
4. In the required quantities	9	2	81.6	18.4
5. From the best considered sources	8	3	72.8	27.2

It may be observed that units surveyed both at Chandigarh and S.A.S Nagar (Mohali) complained of non-availability of funds for working capital. They were also equally critical of the time-consuming Government procedures and formalities. The units at S.A.S. Nagar (Mohali) also stated that they faced tough competition from Chandigarh industrial units where there is no sales tax.* Excise duty structure was considered by most to be a great deterrent to their growth.

It would be seen that whereas storage and raw material problems are prominent with Chandigarh industrial units, price fixation gets the top place at Mohali. It is followed by raw material. At S.A.S. Nagar (Mohali) promotion and distribution are also the problem areas, which by and large are not faced by the units.

Not Utilising Government Assistance

Enquiries made about the awareness of Government assistance indicate a very poor awareness by the units. The reply mostly was that no assistance was available. The units showed some awareness of assistance with regard to raw materials, and quality control. Replies received indicate that of those who showed such awareness, some knew about Central Government assistance as well as the assistance provided by Chandigarh Small Scale Industries Corporation. But their number was not significant. It is, however, important to note that even out of those who knew about the government assistance, many did not prefer to avail of it as it proved to be very bothersome to get the same. The benefit available was hardly worth the trouble which the process involved. Government procedures and rules were so cumbersome and time consuming that small entrepreneurs did not find it worthwhile to try for the assistance. In the process of getting assistance so many persons had to be pleased in different ways that the net assistance available got considerably reduced. It was pointed out that in the case of small scale units it was "Inspector *Raj*" and no unit could operate peacefully unless the inspectors were pleased.

At S.A.S. Nagar (Mohali) 63.6% of the sample units are aware of the Government assistance provided with regard to raw materials and accessories, and quality control. Some of the sample units (27.3%) also showed awareness with regard to Government assistance for selling the products. It may be observed that many sample units as S.A.S. Nagar (Mohali) also indicated that they did not like to obtain Government assistance as the procedure of getting the same was very cumbersome and many persons had to be pleased before anything was available. This reduced the net quantum of the assistance. Entrepreneurs were critical of the 'Inspector *Raj*' and were of the view that the greatest service that the Government could do to them was to save them from the 'Inspector *Raj*'.

It is obvious that the entrepreneurs at S.A.S. Nagar (Mohali) are more aware of the Government assistance than those at Chandigarh. At Mohali Central Government assistance is also better known.

The Policy Implications and Guidelines

It is worth mentioning that the basic philosophy of the small industrial units at both these centres, as perhaps at others also, seems to be to keep themselves in the safe zone and avoid risk. They prefer to be the suppliers of certain items to some comparatively bigger unit(s). This assures them the market for their goods. Their expectations run on these lines. They desire that the type of relationship that has developed between different units at Ludhiana or in Japan under which

*Sales tax has since been introduced in Chandigarh w.e.f. 8th March 1978.

bigger units buy goods manufactured by the smaller units and sell them under their own brand names should develop at places like Chandigarh and S.A.S. Nagar (Mohali) also. Such an arrangement is considered ideal for the growth of small scale industries in the region, and needs to be encouraged consciously.

State Governments may also consider the possibility of setting up an organisation which may buy goods from the small scale and tiny industrial units and market the same. For this purpose a net-work of shops may be set up under the proposed sales organisation. This and the preceding suggestion may be pursued simultaneously also.

Alternatively, the net-work of shops to deal with the goods of small scale industries may be promoted in the private sector. Such shops may be given some incentives related to the quantum of sales of the goods of these industries. The incentives may be in the form of reduction in various taxes to be paid by these shops, or even in the form of cash incentives.

The small scale industrialists need help in the performance of certain marketing tasks also. These include: publicity of their goods through radio net-work at concessional rates or even free of cost in selected cases, holding of industrial fairs and exhibitions to promote their goods; provision for regular supply of marketing information; fixation of fair and remunerative prices for their goods; and price preference for goods of these industries in their purchases by State Government.

Steps should also be taken to increase the awareness and extent of utilisation of marketing assistance extended by the Government. Programmes, conferences, meetings and seminars ensuring participation of maximum number of small scale industrialists should be periodically organized. A bulletin giving the latest information about various assistance and facilities and other matters of interest may also be published in regional languages and regularly supplied to small scale industrialists apart from using the radio net-work for publicising it. A Guidance Bureau to guide the industrialists in various matters may be set up in each district or at industrial focal points.

A simplification of Government rules, regulations, procedures and the end of 'Inspector *Raj*' are also called for, if the small scale industries are to be boosted.

Various suggestions made by the small scale industrialists for the development of these industries (Tables IX and X) also need to be carefully examined by the Government with the help of a small working group.

Table IX : Suggestions by Small Scale Industrial Units at Chandigarh

Areas	*Details*
Raw Materials	(a) Raw materials against quota should be available to the units, irrespective of the size of the order.
	(b) Government should control price-fluctuations in raw materials.
	(c) Raw material supply where possible should be through the Corporation, rather than the dealers (e.g. supply of zinc ash from Hindustan Copper).
	(d) Procedures and paper work be reduced for getting quotas.
Quality Control	(a) Quality Marketing Centres should be provided, spurious products should not be allowed.
Packaging	(a) Information about package design and 'right' package should be provided.
Selling	(a) More purchase by the Government agencies from small units.
	(b) More information be provided about NSIC and DGSD.
Transportation	(a) Ensure more reliable and adequate road transport facility.
	(b) Freight rebate should be provided.
Storage	(a) Storage space to be provided by assessing the requirements of small units.
	(b) Temperature controlled storage facilities.
Other suggestions	(a) Guidance Bureau for helping units in assessing new product idea, technical matters, distributors selection, and information about export markets and procedure.
	(b) Finance at a lower rate of interest.

(c) 'Package' help regarding all service facilities and incentives should be given by the Corporation.

(d) Sales Tax facility should not be removed.

(e) Cheap housing provided to labour.

(f) Excise duty exemption limit should be raised. This was set a long time back when prices of end-products were low.

(g) 'Focal point' facilities for Chandigarh.

(h) Power connections should be provided without delay.

Table X : Suggestions by Small Scale Industrial Units at S.A.S. Nagar (Mohali)

Areas	*Details*
Raw materials and accessories	(a) PSSIC should assess raw material requirements.
	(b) Government should earmark units in local market like Gobindgarh for supply of quality raw material.
	(c) Create awareness about import procedure.
	(d) Adequate stocks of canalized items should be maintained.
Quality Control	(a) Tool room and testing facilities at S.A.S. Nagar (Mohali) be provided.
	(b) Subsidy to entrepreneurs for setting up testing laboratories, should be available to a group of industrialists from the same industry. Government should identify such groups.
Packaging	(a) Packaging education to be intensified.
	(b) Facilities for attractive designs and printing.
	(c) Government should identify reliable packaging units.
Price Fixation	(a) Large units in fixing the purchase price of goods from the small units, should be so on the basis of the cost structure of the small units. This should not be arbitrarily fixed but through negotiations with small units.
	(b) Price preference should be given by State Government in purchases from small units.
	(c) Where possible, State Government should only purchase from the small scale units in Punjab.
Selling	(a) Less commission by State Emporia. The Emporia should take greater interest in Marketing.
	(b) PSSIC should actively search for enquiries and tenders for products which are produced by small units, rather than just pass on the tenders received from NSIC.
	(c) Greater awareness should be created by the government for DGSD and NSIC Schemes.
	(d) PSSIC should explain tender conditions and technical details to small units.
	(e) State Marketing organization be created with the following functions: (i) Purchase of small units products and sale under a common 'Brand' name (ii) The marketing organization can establish the complete marketing network and take up promotion.
	(f) Consortium approach should be adopted by the Government. The Government should bring together units with allied products. Joint publicity, requirements of information, quality control, supply of raw material would be the functions of each Consortium group. The Consortium group can help in exports also.
Promotion	(a) Industrial Fairs and Exhibitions should be set up locally.
	(b) Should fix limit on advertising based on licensed capacity (T.V. manufacturers).
Transportation	(a) More road transport facilities to important cities of India.
Market Information	(a) Regular journal of the Industries Department, which should provide tender information, list of distributors, market conditions, export information.
Other suggestions	(a) For getting financial assistance, procedure should be streamlined. Unnecessary paperwork avoided.
	(b) Interest subsidy for non-engineers.
	(c) Excise duty exemption limit should be raised, as this was fixed a long time back.
	(d) 'Focal point' benefits should be made available to rented sheds.
	(e) Prompt payment should be provided by large units to the small units, rather than after 90 days.

Similarly it would be in the interest of small scale industrialist that he should adopt the marketing concept. If he wants to really benefit from the help and facilities offered by the various Government agencies, he should modernise his marketing methods. This means that he

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PRODUCTIVITY IMPROVEMENT THROUGH PMT SYSTEMS

Sukhatankar, L.M.

If PMT systems have been effectively used to increase productivity in certain indentified areas abroad, what hampers Indian managers to import these systems and what measures can be taken to implement them for increasing productivity in those areas in our industrial settings

Predetermined Motion Time (PMT) systems have been widely used in industrially developed countries such as West Germany, USA and Sweden. Methods Time Measurement (MTM) is one of the most popularly used PMT systems in many countries. The paper brings out how and in what areas this system has been found useful in improving man-machine productivity in wide range of industries in these countries.

Based on a survey of Indian industries, the author identifies reasons for lack of extensive MTM application in India. He brings out the potential and stresses the need for unit level application of this system in manufacturing industries particularly in those organisations where large quantities or mass production is undertaken. Based on his experience, a methodology has been explained by the author to improve unit level productivity by MTM appreciation and application training.

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Predetermined Motion Time (PMT) Systems have been developed from 1920 onwards as Systems for measurement of work and evolution of work methods for improvements where human motions are involved. Segur, pioneer of Basic Motion Times (BMT) states : "Within practical limits, the time required for all experts to perform true fundamental motions are constant and hence Basic Motion Times developed in the context of one basic task can be applied in cycles of different tasks and thus they are additive." These assumptions have been found sufficiently valid for most applications and hence PMT systems have been widely used.

Based on the above assumptions, many consultants in USA developed their own PMT Systems and defined basic human motions. They have clearly specified what each basic motion constitutes, what parameters affect each basic motion time and quantatively determined time values for all human motions which commonly occur in Industrial Situations.

Out of the many PMT Systems such as Basic Motion Time (BMT) developed by Segur (1926), Work Factor (WF) developed by Quick (1938), Methods Time Measurement (MTM) developed by Maynard and associates (1948), the most popular and widely used PMT System all over the world (by more than 22 countries) is MTM.

MTM has been widely used in USA/Canada, West Germany, Sweden UK who are considered industrially advanced and economically developed countries.

Surveying the MTM activities

It is worthwhile to note the findings of the survey carried out by International MTM Directorate (IMD) in the year 1978. The survey data was collected through the National MTM Associations of member countries of IMD. The main objective of the survey was to know the scope and overall activities and membership structure of National Associations and its member organisations.

It may be noted that these national bodies are independent of labour/employer and political policies of the country, largely recognised by labour unions and employers in these countries. The National Associations have good support for their activities through their member Companies by active role played by them in organising, training conferences and development projects in MTM. Table 1 shows how MTM has been used and for what purpose by the industrially advanced countries as indicated from the activities of National MTM associations in these countries collected through International MTM directorate :

of technology. For labour intensive and mass production jobs like electronic industry MTM is useful.

Status of MTM in USA and Canada

In USA and Canada MTM has been in diverse fields of industry such as manufacturing industry, services, commerce, maintenance, Government, Warehousing, Insurance etc. In the survey carried out by American Institution of Industrial Engineering on Methods of Work Measurement used by companies doing Industrial Engineering work, it was found that 2/3 rd of the companies surveyed use PMT systems in one from or the other. Incidentally Canada uses PMT systems more than USA. Among the manufacturing industries, textile, automobile industry, industries manufacturing and assembling electric and electronic products, even foundries and heavy industries and decorating furniture industries are using MTM with advantage.

Experience of Industrial Engineers in the above mentioned countries about practical use of MTM can be summarised as follows :

Table 1 : Application of MTM iu Industrially Advanced Countries

	US/ Canada	Germany	Sweden	UK	Switzerland	Norway	Japan	Belgium	Finland	Israel
MTM for Production	70	70	40	95	85	9	100	75	35	10
MTM for Clerical Work	25	20	20	5	15	1	—	15	—	70
Fields other than MTM	5	10	40	—	—	90	—	10	65	20

Figures are for percentage of time spent for the activities by the National MTM Associations in these countries

A glance at the figures in Table 1 indicates that MTM is increasingly being used for production operations. This is understandable because production methods are more specific and MTM can be used for Methods Planning and Methods Improvement and Standard data development. MTM has been exclusively devoted to production activities in Japan. This is probably because their industries are largely either labour-oriented or almost automatic, the two extremes

(1) MTM helps supervisors to think thoroughly, systematically about methods they use.
(2) MTM analysis gives better methods for assembly Line and reliable data in a very short time.
(3) Layouts standards developed with the implementation of MTM are more productive.
(4) MTM data can be used to establish time standards and standard data for machining, subassembly and assembly operations

(5) MTM time standard data is more consistent to be used to establish incentive schemes.

Popularity of MTM in Sweden

In 1976, Sweden had 3.3 million persons gainfully employed. Out of which 1.2 million were in Industry and Mining. There were 20,000 trained MTM technicians, 550 qualified MTM teachers and 2 lakh employees overall informed about MTM and about 50,000 workers were covered by MTM—Methods and Standards under the Companies using MTM. These figures speak for themselves as to the extent of use and popularity of MTM in Sweden.

Introduction and use of MTM in Sweden started from 1950s and has been of much significance in giving a new dimension to Methods—Work Measurement endeavours. They have begun to understand Motions and Motion Times, this is important because even in highly advanced Swedish industries manual motions still play a predominant role and will continue to do so in many years to come.

MTM application in Sweden have spread all over the country from big mines in the north through the chemical and paper mills in mid Sweden, the steel works, metal industry, electronics, foundries, machine tools, civil engineering and construction industry so on down to the rubber industry in the South. It is also used in different dimensions. MTM for example, has been used to help physically handicapped. The system in application has broader range of industry and administrative environment including hospitals, Government Offices, banks, etc.

Areas of MTM Applications in West Germany

About 18,000 trained MTM Personnel and about 12,000 MTM standard data trained personnel and 748 licensed MTM Instructors use MTM in Germany. Number of employees of the Companies as members of MTM Association are 2,20,000. MTM is used centrally in all branches of Industry namely electrical and electronic Industry, private and heavy vehicle industry, needle trades, shoe manufacturing shipyards, etc.

MTM is also used in maintenance, administrative area, banks, insurance companies. The National MTM Association in Germany has specially developed MTM standard data training manuals.

West German MTM Association undertakes specific Company Development, Training and consulting assignments.

The MTM Family

From the original basic motions of MTM and their time values called as MTM-1 System, researches in the above countries have led to development of simplified systems called MTM-2, MTM-3 and others called as MTM family Systems.

A further look at MTM Association statistics of 1966-78 tells us that MTM-1 is successfully applied technique compared to MTM-2 and MTM-3. Second preference is given to MTM-2 which has gradually picked up importance from the years. In fact, it has become more popular than MTM-1 in some countries like Switzerland, Finland, Sweden, UK and France, particularly for Work Measurement and related extensions namely standard data development, etc.

Poor Response to PMT Systems in Indian Environment

Application of PMT systems is still in the foetus stage as far as Indian Industry is concerned. The reasons for this can be attributed to the following :

(1) Senior executives and managers are not adequately aware of these techniques and the resultant cost-reduction and cost control potential by application of PMTs in Indian Industries.

(2) Many professional industrial engineers also feel that for Indian industries much less sophisticated techniques of work measurement like Time Study, Activity Sampling, etc. are enough for application. National Council of Indian Institution of Industrial Engineering (IIIE) in December, 1974 observed:

MTM formed a highly sophisticated technique which was used sparingly only by a handful of industries in India and IIIE was not in favour of supporting formation of Chapter of International MTM directorate in India due to variety of reasons. However, it was noted by IIIE Council that any individual member was free to pursue and promote any discipline or technique and institution would appreciate the endeavour.

Even now in 1983, reasons for MTM applications not catching up in India can be attributed to the following :

(i) Lack of awareness and orientation for PMT systems among industrial engineers.

(ii) Industrial Engineers (IE) who have awareness of PMT system, feel that its application may be too much of effort.

(iii) It is felt by IES that necessary support may not be given by line engineers and managers for PMT systems application to inprove ongoing methods on the shop floor and affect changes in the various factors of production.

(iv) Fear of possible resistance from workers and their unions for PMT systems application.

An Exploratory Study

A survey was conducted by the Author to find out the extent of application of PMT system in public and private sectors in India. A questionnaire was sent to some 60 organisations. These organisations were chosen because of the fact that they had sponsored participants for PMT systems courses conducted by NITIE and the chances of application of these systems in them were very high.

About 15 organisations out of 60 have responded to the survey and it is noted that only four organisations have used MTM, that too to a limited extent.

(1) One of the main reasons for these organisations using MTM was that their collaborators who are from among advanced Western countries have used this technique with advantage.

(2) Executives from collaborators' organisations coming as top executives in the Indian companies have initiated and supported initial applications of MTM in India. Making use of collaborators experiences and getting some of the Indian Engineers trained with their collaborators, these companies have benefited.

(3) These companies have created companywide awareness and appreciation about MTM and hence there is co-operation and involvement of engineers and supervisors in taking advantage of MTM to improve man-machine productivity.

However, from the above survey it is clear that even among the manufacturing industries where large batch production or mass production is undertaken and where MTM could be used with considerable benefits, very limited application of MTM has been made.

Potential Areas for Application

In view of the above findings, following questions arise—In which industries and with what advantage can MTM be used in India ? What can we learn from the experience of developed countries ? Following are some thoughts and guidelines.

(a) Automobile Manufacturing and its Ancillary Units : (Manufacturing cars, scooters, vehicles and their components and spares)

Sweden's Volvo-Pentavarken—largest automobiles manufacturers of Sweden achieved significant productivity improvement by application of MTM in foundry, Engine Plant, various manufacturing departments where man hours per unit of production were reduced to 1/3rd.

One production man-machine semi automatic Centre was saved by spending $1400 on Methods Study through MTM, compared with $10,000 spent on new machines and new

equipments reducing some extent of man-machine time. It is worthwhile to note that high proportion of rationalisation of work through MTM application was done during project engineering stage while planning for new plants and expansion of units. MTM made detailed division of assignment in each work situation possible, enabling more accurate line balancing. MTM was used for reducing the training time of workers due to detailed methods description.

MTM was used to provide special methods and for giving all pertinent methods for tool room work, reducing tool making man-machine time by 40-50%.

Universal Maintenance Standard (UMS), a functional MTM system, was used with greatest success as a base for planning and control in maintenance work and this resulted in substantial increase in maintenance capacity.

Approximately 75% of total work force of these factories in Sweden could be covered by MTM, rest operation being process controlled, so MTM is not used.

Why could Indian industries not benefit in the above areas ?

(b) Engineering units manufacturing electrical, electronic and light engineering products :

Wherever in such class of industries large batch size or mass production is undertaken, scope exists for application for PMT Systems in various manufacturing departments such as machine shop, press shop, brazing, injection and other methods of moulding, spot welding, sub-assembly, assembly packing operations.

The planning of work methods, work place design and facilities at work place can be examined in detail by using MTM.

Applications of PMTS ystems in these types of industries have been made in all the developed countries and there is no reason why this can not be undertaken in the organisations manufacturing similar units in India.

(c) Pharmaceutical and Food Products Industry, Textile, chemical and light engineering industries :

In such class of industries, large number of manual operations are carried out in processing, packing and related handling. The activities could be examined and MTM can have substantial scope for application to reduce labour and overhead cost per unit output in a growing organisation. What can be the plan of action and future course for use of MTM in organisations which desire to do so in India ?

A Guide for Action

Though each plant has different emphasis for various manufacturing operations due to cost, criticality and product-volumes considerations, use of MTM will depend on top management view-point and labour union and supervisory personnel attitude about MTM usage.

It is necessary for successful application of MTM that the top management, supervisory staff as well as selected skilled workers from the shops are given good appreciation. Illustrations could be through sample studies carried out at pre-training stage from the same organisation showing how man-machine productivity could be improved. Such a course could precede by work carried out by MTM specialist and sample survey done for improving manufacturing operations and potential area identification where MTM can result in saving of man-machine time. Keeping this in mind such seminars shall dwell on motion economy, micro motion analysis, introduction to PMT Systems and MTM application examples. The contents of the course should also include improvement of methods at pre-production stage, tool planning, assembly and manufacturing operations, work place layout planning, etc. Engineers, Supervisory personnel and workers from each department should be grouped in a batch of

around 20 and relevant case example shown and discussed while on such a programme. Middle and top level management can give necessary encouragement and support by their involvement. One of the companies where such programmes are conducted by the Author is a large light engineering industrial unit in Bombay.

Besides the above orientation/appreciation programmes and seminars, intensive inplant or organisation based programme of long duration need to be conducted for selected engineers from various departments such as product design, production engineering, tool design, pre-planning, Industrial Engineering and Operations management (shop floor operations engineers).

Success of plantwide use of MTM technique depends on how workers are involved in its application and implementation. In doing this, every organisation should give training to selected workers in the regional language in the areas of Motion Economy, work place Layout and appreciation of PMT systems. The important lessons that can be drawn from the successful use of MTM is that in Sweden right from the very beginning of MTM application, detailed MTM appreciation is given to workers. Each operation is started by an operator by receiving 4 hours of MTM information about the operation he is supposed to perform. Some representatives of union have received complete training of MTM. Meetings with union leaders were held every week during MTM application. Training and consultations were the important measures used by engineers and managers to get workers' acceptance of the importance of these systems. In India, we have lot to emulate from what was done in Sweden and other developed countries.

It is for industrial engineers and line managers to give the lead to improve productivity in wide range of industries using PMT systems and MTM with the support of top management.

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should take up product manufacture, product changes, packaging, promotion and pricing keeping the customers' need in mind.

Marketing knowledge has advanced substantially in recent years and if the small industrialist has to follow the marketing concept, he should study the trends in the market. However, the small unit cannot take up surveys and elaborate projects. But there is no dearth of secondary data, both internal and external which the small unit can use to formulate a sound marketing strategy.

A Concluding Note

The study diagnoses the problems of small scale industries in two centres in late seventies and suggests accordingly, some remedial measures to overcome them. Since then some of the government policies have changed and it is also possible that the nature and extent of marketing problems have altered in these centres in early eighties. However, this does not minimise the relevance of findings of this study. Indeed, it provides an analysis of interaction of small industrial units with their environmental dynamics which has implications for a broader horizon. Despite lack of generalisation the illustrative case examples of the two units at Chandigarh and Mohali pinpoint some marketing constraints which are also likely to be encountered in varying amounts in different units at different times. Explicitly, these constraints must be taken into account in designing macro-level policy for the development of small scale industries at national level.

HERE IS THE NEED FOR PRODUCTIVITY LINKED INCENTIVES

Chemical and process industries need to evolve results-oriented incentives linked to productivity quite different from other industries to effectively harness human resource motivation—a major determinant of productivity

Chakrabarti, D.

Design of an incentive scheme is a very professional job because a badly designed scheme could produce negative results. While the conventional principles can be applied successfully to increase productivity for the predominantly manual jobs, it is not so easy to find dependable yardsticks to accurately measure productivity of the continuous plant operations and maintenance jobs where the main intention is to act on exceptions. A model has been evolved for a results-oriented incentive scheme linked to productivity suitable for chemical and process industries. This is basically a multifactor type of scheme based on definable and measurable parameters for objective assessment of productivity. The model is an integrated one suitable for foctory level but can be easily tailored down to suit sectional level also. This model has been presented in the article along with the necessary conditions for its design, operation and performance audit.

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The key factor in any production system is the human element. The main purpose of an incentive scheme will, therefore, be to motivate the human element in the enterprise to improve his performance. Thus, the basic requirement of an incentive scheme will be that the contribution of the worker towards productivity should be identifiable and finite.

A chemical and process industry today is generally an agglomeration of activities ranging from manual work to operation of highly sophisticated continuous systems. The performance of an individual worker here depends on a combination of 'efforts' and 'skill' in varying degrees depending on the requirements of his job. While 'effort' is measurable and has been a popular yardstick in the conventional incentive schemes, 'skill' varies with individuals and is difficult to account for in an incentive scheme. Also, in continuous plant and maintenance operations, output is not much related to the effort put in by the workers and the role of the worker here is more to act on exceptions.

Emphasis on Linkage with Overall Performance

Having decided for an incentive scheme, the choice will be between a comprehensive scheme for the whole factory with an objective to improve company performance as a whole, or for sectional or individual schemes where the impact of incentive is more, or for combinations thereof. A system with individual or sectional schemes will be complex to operate and difficult to coordinate with overall company performance. The choice of parameters is also wide, ranging from individual's rate of working to ratio of value added to employment costs and so on. The principle adopted in the present model has been a global scheme linked to

overall performance of a factory with built-in factors linked to sectional and individual performance. It will be possible to escalate this scheme to suit the requirements of a multiproduct unit and also to tailor it down to suit sectional levels, if necessary.

The different steps involved in design, implementation and maintenance of a successful incentive scheme will be:

- ☐ to identify the key factors which will improve company performance,
- ☐ to identify these among the key factors which can be influenced by employees and are within their control,
- ☐ to isolate key pattern of employee behaviour which will improve company performance,
- ☐ to define skeletal outline of the most appropriate scheme,
- ☐ to define basis of measurement of improved performance,
- ☐ to keep adequate provision for future changes,
- ☐ to obtain acceptance from workforce for active participation,
- ☐ to institute a system for audit, monitoring and control.

The Ingredients in the Incentive Design

The incentive scheme presented here is basically a multifactor scheme having 4 components, one each related to the unit as a whole, department, section and individual. Each component can be divided into a number of sub-components for further refinements depending on requirement. The weightage for the various components will vary from concern to concern depending on individual priorities and necessities. A skeletal outline of the model is described below and a schematic presentation of this is given in the Annexure.

1. Factory Level—Productivity Index—Weightage 40 (say)

   This will be a measure of productivity for the factory as a whole and will be expressed as a ratio of total production to total manpower unit input for the production. For a multiproduct unit suitable weightages based on workload or any other relevant parameter may be used to derive a total equivalent production. Manpower input should include all labour input including overtime expressed as equivalent normal time and secondary deployment in the form of temporary, casual or contract labour. The standard productivity index will be derived based on accepted industrial engineering techniques. The creditable points for incentive for a particular period will depend on the ratio of actual Productivity Index to standard for the period.

2. Departmental Level—Efficiency—Weightage 30 (say)

   Suitable factors for this component will be key raw material efficiency, capacity utilisation, equipment availability, maintenance effectiveness, wastage reduction, cost effectiveness or any other such relevant factors which are identifiable, definable and measurable. Incentive will be linked to the ratio of actual efficiency during a period to standard efficiency.

3. Sectional Level—Manpower Utilisation—Weightage 20 (say)

   Manpower Utilisation will be a ratio of standard manhours to actual manhours as deployed at departmental or sectional level. This will be expressed as a percentage of optimum manpower utilisation and points will be credited depending on performance. The basis for deriving the standard manhours and optimum utilisation will be the accepted industrial engineering principles.

4. Individual Level—Attendance—Weightage 10 (say)

   The performance against this factor will be judged from actual attendance over a period expressed as percentage of working days during the period, excluding Sundays and holidays. The other individual factors could be rate of working, late attendance, degree of commitment, time wasting, etc.

At the end of the specified period, say a month, the respective performance ratios will be computed, the

corresponding creditable points will be derived and added to find out the total points. The maximum payable incentive will correspond to 100 points. The quantum of incentive in a month can thus be derived from the points obtained in the month as percentage of the incentive at 100 points.

A Differential Rate

The workforce in a chemical and process industry can be broadly classified into three distinct categories—

direct —process control operators who are directly linked to production

semidirect—maintenance and services operators who provide supporting services to production

indirect —whose efforts are not related to production fluctuations and who are mainly deployed on the basis of allocational requirements like Security and Fire personnel.

A reasonable basis for sharing of incentive by the various categories will be full incentive as obtained from performance ratios for the month for direct workers, reduced share (say 70% of direct workers' earning) for the semidirect workers and further reduced share (say 40% of direct workers' earning) for the indirect workers. The relative shares will be local decisions based on accepted practices and judgement.

The Prerequisites

The industrial worker today is conscious of his rights and power, resists changes and modernisation, demands his share of benefits arising out of any uprating or debottlenecking, endeavours to delink productivity from incentive and demands incentive even for below level performances. It is therefore imperative that in design of an effective scheme productivity is given primary recognition, factors which are definable and measurable are only adopted and all factors for which performance has to be assessed on a subjective basis are avoided. It is also essential that the specific aspects of employee behaviour in the organisation that need to be improved are identified and dealt with rightly.

On the part of the management, for a successful incentive scheme, proper evaluation of how a scheme is going to influence the overall performance of the organisation should be undertaken before it is accepted and a system of effective motivation should be instituted which will consist of an accomplishment centered approach from a fair and firm management.

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THE ANNEXURE

Structural Framework of a Model for Incentive Scheme for Process and Chemical Industries

Structural Frame Work		*Factor*	*Weightage*	*Share of Incentive*		
Level	*Index*			*Category-1 Direct (process Control) workers*	*Category-2 Semidirect (Maint, Engg. Services, Warehouses, etc.) workers*	*Category-3 Indirect (Fire, Security, etc.) workers*
Factory	Productivity Index	*A. Factory* : Productivity Index—Ratio of total equivalent output to total labour deployment (say to/manday) expressed as %age of standard.	40	For Ratio actual to std.-1.00-points-40 ,, ,, -0.75- ,, -Nil straight proportional in between		
Departmental	Efficiency/Capacity/ Equip. Availability/ Cost, Effectiveness etc.	*B. Departmental* Efficiency—(Raw Materials, Capacity Utilisation, Maint, effectiveness, wastage reduction, etc.) — Ratio of actual output to rated output (or ratio of efficiency in month to std. efficiency and so on)	30	For Ratio actual to std.-1.00-points-30 ,, ,, -0.75- ,, -Nil straight proportional in between	.....% of direct workers	.....% of direct workers
Sectional	Manpower Utilisation	*C. Sectional* : Manpower Utilisation—Ratio of standard hours to actual hours expressed as %age of optimum.	20	For Ratio actual to opt.-1.00-points-20 ,, ,, -0.75- ,, -Nil straight proportional in between		
Individual	Attendance	*D. Individual* : Attendance—No. of days attended as %age of working days.	10	Attd -100%-points-10 ,, - 95%- ,, - 5 ,, - 90%- ,, -Nil	Same as Category-1	Same as Category-1

Note : 1. Condition for Eligibility: Ratio of Actual Productivity Index to Standard=0.76 or more.

2. Calculation and payment of Incentive—Monthly.

3. In calculation of Productivity Index, OT hrs will be taken as equivalent normal time and secondary labour engaged will be added to normal hrs. to derive total labour deployment.

4. The figures given above for weightages, allocation of points against performance ratios, share of incentive to the different categories of workers, etc. are arbitrary and will vary from enterprise to entreprise depending on nature of industry, priorities, workload, etc.

OPERATING CASES ON PRODUCTIVITY IMPROVEMENT

Innovation in methods and techniques has immense to offer towards significant productivity gains

Six short case studies from different divisions of Bharat Heavy Electricals Limited have been cited to show productivity improvement through

- ☐ *simple method improvement (Hardwar)*
- ☐ *improved method of moulding (Bangalore)*
- ☐ *design improvement of fan blades through value engineering (Bhopal)*
- ☐ *pneumatic tube bending equipment for H.G. Thrust Bearing and Guide Bearing Oil Coolers (Hardwar)*
- ☐ *improved cutting plan (Hyderabad)*
- ☐ *introduction of castellated beams in structural areas (Tiruchirapalli)*

These cases have been reproduced from Productivity Movement in BHEL, *1(1), August, 1982.*

1. Simple process improvements can lead to increase in productivity—a case in point is a particular machining operation at Hardwar Division on a planing machine. Coupling/guiding pieces for condensers were machined previously one at a time on a planer by clamping the job on planer table and the cutting tool in the side tool holder. A new fixture and tool holder has been developed by a task force on which two jobs and cutting tools can be mounted simultaneously. Thus, two coupling/guiding pieces can be machined at a time on the same planing machine which has doubled the productivity of machining operation leading to an annual saving of Rs. 1,43,350.

2. This case study relates to improvements in productivity in moulding shop of the Electro-Procelain at Bangalore Division, foundry through simple changes in methods of work. The method improvement has helped in raising the productivity two-fold. By making the mould of 11 K cap simultaneously in upper and lower part of the mould box, output is doubled in the same pouring of the molten material. This change in method enables 12 caps to be made per box instead of 6. Apart from doubling the output, it also makes savings in floor space and consumption of sand. Steps are underway to extend the improved method to 22A and 22D types caps also.

—C. Longanathan, Artisan (A-2), EPD, Bangalore.

3. This case from Bhopal Division shows that Design improvement of fan blades through value engineering improves productivity. Fans are used in Hydrogenerators to create flow of cold air to hot areas of the machine in order to dissipate the heat generated due to losses. The axial fan assembly consists of fabricated fan housing and sheet steel or cast aero foil blades. The fan blade is made from steel sheets 8 mm thick in IS 226. The profile of the blade is flame

cut and formed to suitable shape as per the design requirement. These blades are then welded to the steel fan housing.

In few cases, failures of these sheet steel metal type of fan blades have been encountered. Failure of axial fan blades causes heavy damage to over-hang portion of winding and stator core resulting in long shutdowns followed by costly repairs. The cost to each fan blade is also quite high. In light of these two factors, it was decided to take up the value engg. of fan blades as a project.

Through a functional and creative phase, it was seen that maximum number of ideas generated were pertaining to change in material of fan blade. The comparative costs of the present material and the alternative selected are as follows :

Existing method :

Cost of each fan (Material-cast steel)	Rs. 200
Die cost (for mfg. the fan)	Rs. 45000

Alternative method :

Cost of alternative material	
Cotton field thermo setting	
Phenolic resin	
Textile filled thermo setting	
Phenolic resin	Rs. 40
Glass filled nylon thermo setting	
Phenolic resin	
Mineral filled polyster resin	
Die cost	Nil

It was decided by management to go for the modified design for the forthcoming projects. It was also agreed to order one set of fan blade and watch their performance during shop testing of one of the Hydrogenerator. The result of this value engineering exercise has been very encouraging and beneficial to the company. The annual saving through the material substitution works out to be Rs. 4 lacs as detailed below :

No. of blades on one m/c	= 200
No. of m/cs per year	= 10
Total cost saving	
Material saving	= Rs. (200−40) × 200 × 10
	= 3,20,000
Saving in cost of die	= Rs. 45,000
	= Rs. 3,65,000

—S. Lomash, Sr. Design Engineer, HPE Bhopal

4. This case from Hardwar Division demonstrates that pheumatic tube bending equipment for H.G. Thrust bearing and guide bearing oil coolers improves productivity. Large number of double 'U' bend brass tubes are used in HG Thrust Bearing and Guide Bearing Oil coolers. Previously straight tubes were bent manually from both ends by two workers simultaneously to produce the 'U' shape.

Now, the same operation is done on a locally developed pneumatic tube bending equipment using one operator only. This equipment developed by Shri Mukhai Ram, Fitter, has increased the productivity four folds. Being automatic process, fatigue is reduced and better qualitative consistancy ensured.

The comparison of old and the new methods is as under:

Description	*Before*	*After*
1. No. of brass tubes bent per shift	400 (by two operators)	800 (by one operator)
2. Output per operator	200	800
3. Ease of work	Hard	Much, less strenuous
4. Types of Process	Manual	Semi-automatic
5. Approx. cost of the bending (on annual requirement of 9,800 tubes)	Rs. 18,424	Rs. 4,606
Recurring saving annum = Rs. 18,424—Rs. 4,606 = Rs. 13,818		

5. This case from Hyderabad Division shows that improved cutting plan leads to increased material

productivity. Around 60% of production cost is attributed to cost of materials consumed. Also bulk of the materials being imported, drainage of valuable foreign exchange can be minimised if reduction in material cost is possible.

Imported Silicon steel sheets are used for stator laminations of all types of Turbo-Generators. On observing the scrap generated out of 0.5 × 914 × 1800 54 1800 mm and 10 × 1000 × 2000 mm. Silicon steel sheet and 0.2 × 650 × 1160 HGL sheet being high, various studies were conducted to explore the possibility of improving utilisation of these imported materials.

Stator lamination of 0.5 × 914 × 1800 mm Silicon steel sheet:

As per the then existing cutting plan, Silicon sheets of dimension 0.5 × 914, 1800 mm were first sheared into two equal halves. From each piece, a lamination of the required dimension was blanked leaving remaining as scrap (64%). By suitably modifying the lay out of cutting, the balance material available from each sheet was utilised as two blankes required for 1.5 MW sets. The improved cutting plan has resulted into saving of Rs. 86,275/- per set of 60 MW Turbo-Generator.

Stator lamination of 1.0 × 1000 × 2000 mm Silicon sheet:

As per the existing method, 1.0 × 1000 × 2000 mm Silicon sheets are sheared to shape. The improved cutting plan of this material has resulted into a net saving of Rs. 3,764/- per set.

Stator lamination of 0.2 × 650 × 1150 mm HCL sheet:

As per the existing method, one insulation segment is punched from each sheet, leaving remaining as scrap. In the proposed method, the material dimension of this sheet is altered to suit punching of 2 laminations, resulting into material savings amounting to Rs. 12,000/- per set of 1100 MW.

Taking into consideration, production of an average 2 sets of 60 MW and 2 sets of 110 MW, a net saving of Rs. 2.04 lakhs per annum has been effected.

—M.S. Rao, Industrial Engineer
Ch. Venkateswarlu, Technician Industrial Engg.

6. This case from Tiruchirapalli Division shows that introduction of Castellated Beams in structural areas improves productivity.

Introduction

In developed countries, the castellated beams are widely used, thus reducing the weight of the structural members. Inspired by this, a new design concept known as expanded beams was developed; this envisages the use of expanded beams in the buckstay design and other structural areas with a saving in material and cost to the tune of approximately 40%.

Expanded Beams

Expanding of beams means the fabricating of a bigger size beam with openings in the web out of a smaller size beam. This fabrication process is as follows:

The smaller size beam is marked on the web in a zigzag pattern, symmetrical to the centre line. The beam is carefully flame cut along the marked zigzag line to separate the beam into two pieces. The gascut portion are deburred and one of the beams is turned and to end and matched with the other section and held in position for welding. The but ends are welded together and the result is a bigger beam, stronger than the original.

Cost Savings

For an I beam 600 size substituted by expanding ISMB 400, the cost saving in percentage will be around 54 while for size 450 substituted by expanding ISM B350 will be 35%. Assuming 15 Boilers per year the total saving works out to Rs. 52.5 lakhs.

To start with, this concept is being introduced in boilers for PARICHA and TANDA Projects (110 MW) and will be subsequently incorporated in future boilers. This project was the result of collective working by the Product Engineering Group of Boilers and co-ordinated by the Value engineering cell.