Increasing of Productivity Through Simulated Decision Making

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This paper intends to show that both in formal business education and in executive development programmes, a well designed general management simulation offers a special opportunity to provide a dynamic business setting in which participants actively manage rather than assume consulting roles as they do in case analyses.

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Productivity Growth and Management

The world-wide economic slow-down at the turn of the 1980's both puzzled and alerted economists, business executives, politicians and the population at large. It appeared that the term "recession" may not be a permanent replacement for the frightening word, "depression". The problems and the search for remedies were widely discussed and analysed in the international literature. Szendrovits[1] gives a comprehensive summary of this, pointing out that improving productivity is a primary prerequisite for economic development and that it must be a central objective for every level of management.

A collection of papers by Kendrick[2] illustrates that studying productivity trends of either the aggregate economy of a nation or a sector of the economy requires complex analysis. There is no improvement in productivity or real economic growth if production output is increased by using proportionally more of the necessary input factors. Productivity only increases when a given level of production is achieved with less input of resources than before. While there is much to learn from specific studies of productivity in different countries, experience is not easily transferable because the importance of various inputs for productivity differs substantially among nations.

Is there then a common denominator influencing productivity growth ? Ross[3] advocates that, since

management pools and coordinates a diversity of resources for production (or service), nobody could meet the challenge of improving productivity better than managers in both micro and macro-economic structures. This idea is gaining wide acceptance in the literature. Thus, improved management practices can be identified as a unique source of increasing productivity.

Policy-making, formulating objectives, making strategic and tactical decisions, as well as implementing all decisions, strongly influence productivity. Although not all managers make or participate in high level policy decisions, their direct or indirect input is vital for the decision of the chief executive officer and the board of directors of the organization. The quality of their input obviously depends on how well they know their role in the organization and how well they understand the role of others. Experience shows that managers often act in splendid isolation, not knowing the web and the interactive nature of the complex system within which they operate. It takes years of experience to discover the dynamics and intricacies of that system and learn how the jobs of various managers dovetail in the process. It is axiomatic then that if managerial effectiveness can be accelerated by experiential learning, the overall productivity of management will increase.

The Need to Portray Management Dynamics

There is a strong possibility that some part of the twentieth century will go down in history as the "management revolution". The emergence of various fields of management gave birth to the professional manager. The three organic functions of industrial management, Marketing, Production and Finance, rely heavily on the knowledge of Human and Industrial Relations, Organizational Behaviour, Accounting and Quantitative Decision Analysis. These fields of management have become embodied in well defined business disciplines. Either by experience or by formal education managers need to acquire knowledge of their particular field. But, they cannot be effective without knowing the interaction of their field with most of the others.

Historically, Business Policy is perceived to integ-

rate management studies. The usual method of teaching, i.e., the analysis of practical cases, is undeniably quite effective in reflecting the concept of business policy. However, the evidence is anecdotal regarding the degree of integration achieved by diagnosing the cause of illness in various management functions. The problems remain : the recommended treatment cannot be tested, and the reaction of the dynamic system is separated into parts. Management falls more in the domain of the arts than sciences, as does medicine. Is pathology a substitute for therapy? Dissecting historical occurrences by case studies and illustrating alternatives for therapy by simulating a clinical environment are of equal importance in management education.

Since their inception just a few decades ago, management simulations, popularly labelled "business games", have been widely discussed in the literature. Much emphasis has been placed on comparing their educational effectiveness with that of case analyses, particularly in teaching the concepts of business policy. Wolfe's[4] experiment supports the notion that sufficiently complex business games convey conceptual and factual knowledge of business policy. Also, Neuhauser's[5] observation that business games appear to have failed as principal components of business education, seems valid. Perhaps this is because they were used as substitutes for, rather than complements to, case studies. However, in his dialogue with Wolfe, Neuhauser[6] admits that business games are excellent vehicles for certain types of learning, and that the future of such games is quite bright. Portraying management dynamics through simulation lends a unique significance to business games. Thus the fundamental issue is how to supplement traditional teaching methods with experiential learning from decision-making in a dynamic, real-time environment. Instead of comparing business games with other methods of teaching and learning, the focus of attention must shift towards defining their proper goal, content, complexity and application.

This study is limited to general management games, since they are most relevant to business policy. Szendrovits[7] shows that their primary goal is to present data in a well-designed information system in

order to understand organizational relationships and the interdependence of various management functions for the purposes of decision-making. With respect to their content, the objective is to reflect the dynamic forces underlying the management of an ongoing concern. Completeness rather than complexity is a crucial prerequisite for a model to be successful in teaching participants about the intricacies of the management process. All major facets of management planning and control must be included along with fairly detailed operational decisions concerning marketing strategy, production and inventory planning, material, labour and capacity utilization, as well as financing the entire operation from limited resources.

Characteristics of a Management Simulation

The simulation of a complex system, such as the operating system of a company, focuses on characteristics vital to the problem. Therefore, it is necessary to ignore less essential elements and details. In fact, the simulation contains some restrictions that would not prevail in reality. By its nature, the simulation is an artificial reproduction of a business environment. Nevertheless, the simulation presented in this paper is dsigned to incorporate the important features of the business system, and the model is sufficiently valid to teach users about managerial problems.

Szendrovits[8] describes the Master University Business Simulation which is much more complex than the "complex game" in Wolfe's[1] experiment. The three organic management functions, Finance, Marketing, and Production, are emphasized distinctly in this simultation with an appropriate restraint that preserves the General Management character of the exercise. The cause and effect relations of the business and the economy are represented by several mathematical models that simulate the major characteristics of the business environment. The model is somewhat general, but it is sensitive enough to reflect a real business situation.

The simulated environment consists of three to nine firms, all competing strenuously for their share of the market. Each management team requires at least five members. The participants act as managers of a company and make decisions involving the administration of funds and the selection of strategies that are appropriate under competitive circumstances. The simulated business environment reacts to these decisions, and the participants are presented with the results. Repetitive decisions, similar to those made in an actual business, are made for every quarter of a year, over a period of several years. To simulate the pressure under which managers usually operate, no more than two to three hours are allowed for each decision session.

Such simulations are known as business games. However, it must be recognized that beyond their entertaining character their objective is to reproduce a business environment for managerial decisions, thereby providing users with enduring insight into the nature and pitfalls of managerial actions. Their purpose is to serve as an effective teaching device so that participants can develop and practise skills in understanding, interpreting, analysing, defining, communication and ultimately coordinating information within a managerial group for the purpose of decision-making.

Business games are fun to play, but they are not played for fun. Participants soon learn that they have to organize their group for performing managerial tasks; they confront the problems of communication, the difficulties in analyzing and interpreting management information, the necessity of long-range planning, and the behavioral problems in group decision-making.

The decision network and information system model is illustrated by diagrams and explained in the following sections.

Marketing in a Competitive Economic Environment

Figure 1 illustrates the marketing environment. There are two product lines—an industrial and a consumer product—sold in Western and Eastern territories. The combination of products and territory gives four different markets, each having distinct characteristics : IW = Industrial West,
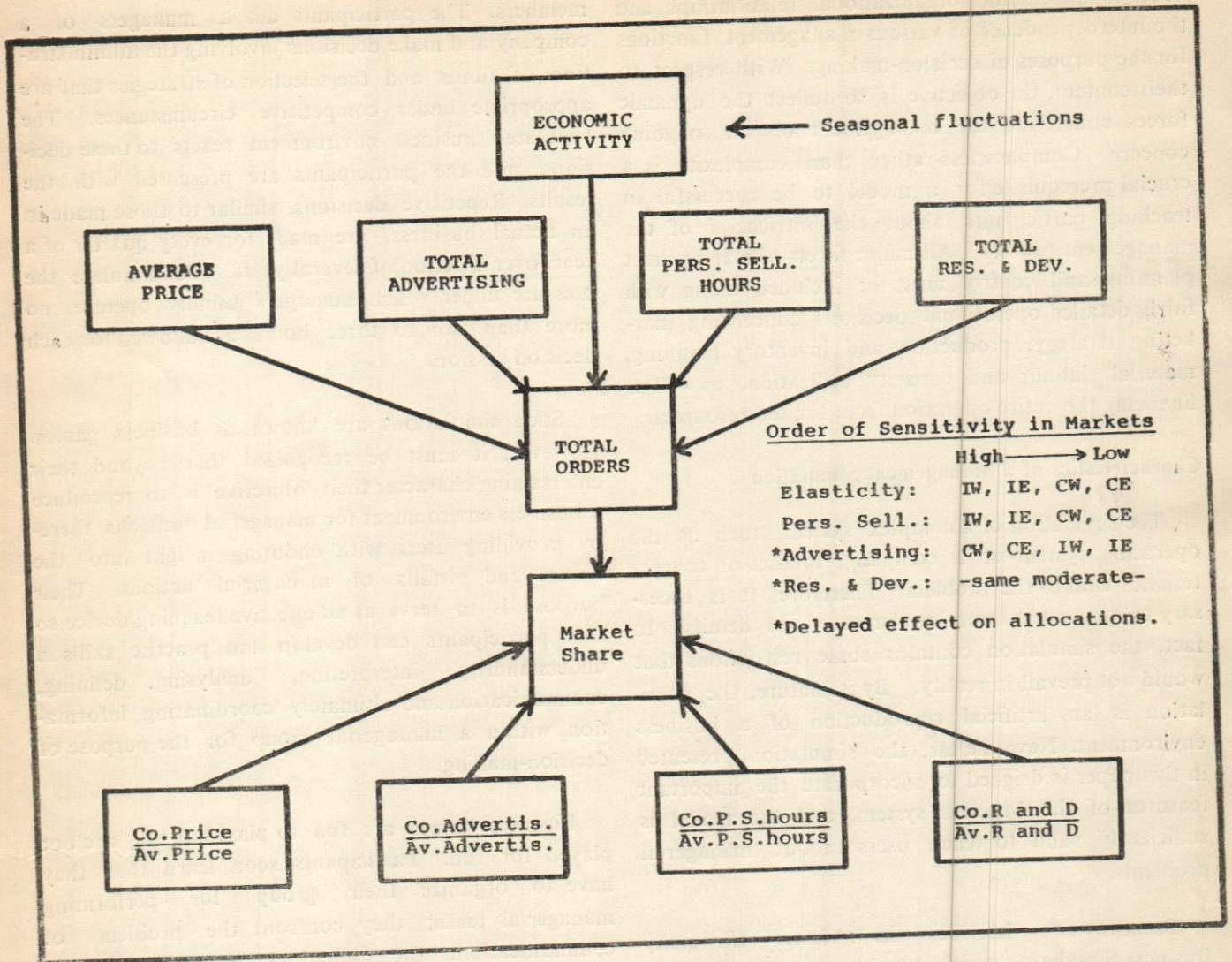
Fig. 1 The Marketing Environment

CW = Consumer West, IE = Induɛtrial East and CE = Consumer East Total orders in each market vary as a function of the average price, total advertising expenditures, and personal selling hours, as well as research and development funding by all companies. The market share depends on the ratio of the company's input to the average input adjusted by non-lineal sensitivity factors which are related to the particular market. In each market changes in price induce a more than proportional change in demand.

In other words, ihe price-demand relations are elastic in all markets. The ranking of sensitivities to various inputs is indicated in Figure 1. Also,

there is a delayed effect from some input factors.

Each market reflects the level of general economic activity derived from reports which are related to a decision period (one quarter of a year). Although participants do not know the particular year, they are informed of the key indices for the quarter preceding the decision period and the corresponding quarter of the past year. This is accompanied by an economic review and forecast which is based on the statistical information as well as on a contemporary official report.

To facilitate decision making on the basis of

rational analysis, random effects are avoided in the simulation. Nevertheless, the marketing decision of a particular management team influences the overall results and the decisions of all other teams. This interactive character of the model creates an environment of uncertainty which necessitates reliance on intuition and judgement.

Interaction Among Marketing Production Output and Inventory

Pricing strategy and promotional expenditures, as well as sensitivity characteristics of the particular market, determine the quantity of orders received. To avoid drastic effects of price differentials in the highly elastic industrial markets, prices can be adjusted by pre-assigned codes indicating the degree to which the lowest price will be matched.

Figure 2 shows the effects of marketing two product lines, both of which are manufactured from a common mould. The industrial product is the basic product' while the consumer product is built into a cabinet requiring a finishing cost which must be covered by its price. When industrial and consumer products are shipped from the plant located in the West to the
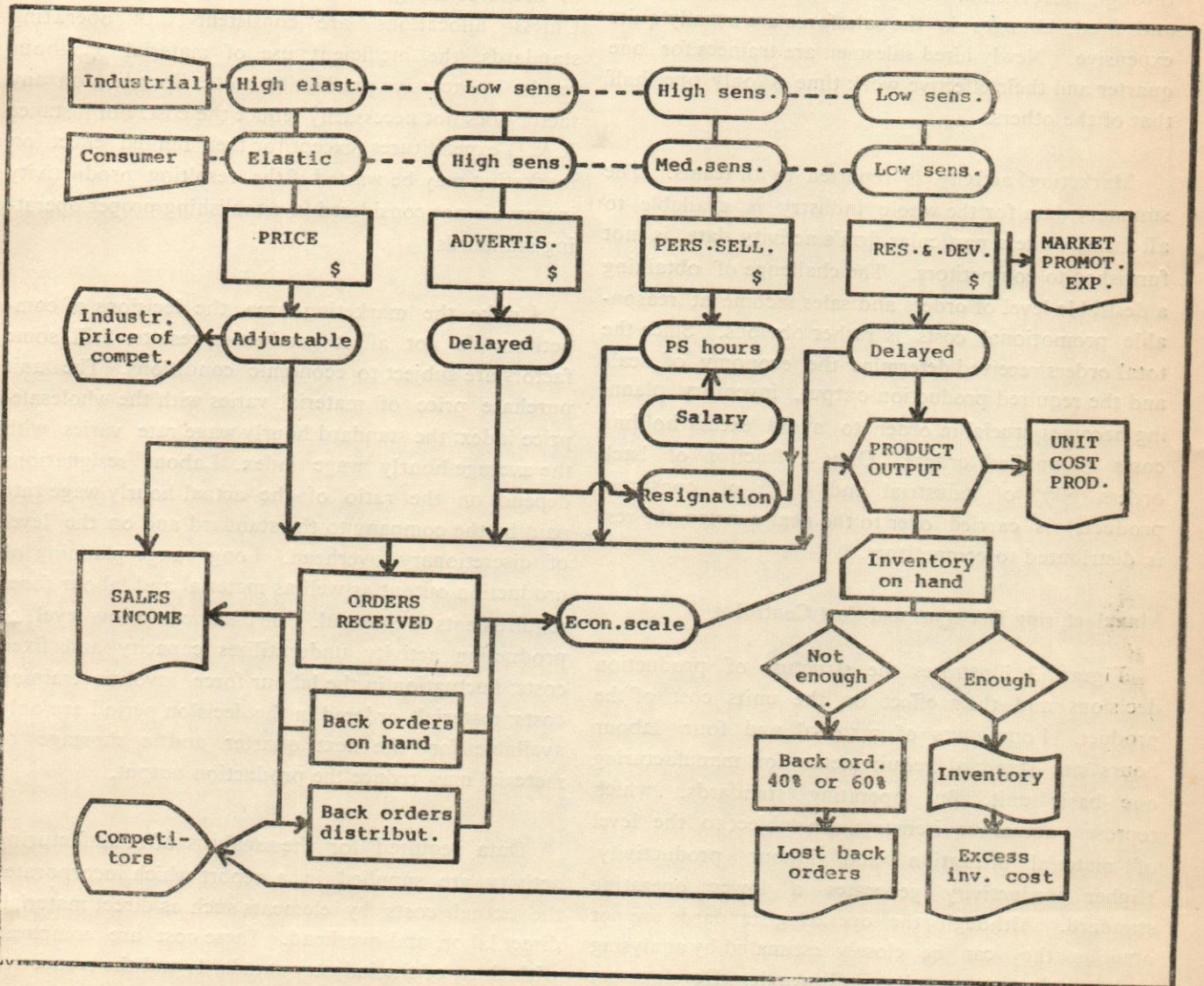

Fig. 2 The Effect of Marketing Decisions

Eastern territory, their prices should cover the additional transportation cost. Although only one basic product is being manufactured, each company markets four different products in terms of pricing decisions.

Monetary allocation for promotional expenses has only an indirect effect. The effectiveness of personal selling in getting orders depends on salesmen's hours. The salary level of salesmen does not influence their productivity; it only affects their loyalty and thereby their resignation rate. This rate is also influenced by the amount of pre-selling activity through advertising. While salesman can be hired and fired, changes in the salesforce are usually quite expensive. Newly hired salesmen are trainees for one quarter and their effective work time is only one half that of the others.

Marketing activity is reported to all teams. The summary data for the whole industry is available to all firms, while a particular firm's activity data is not furnished to competitors. The challenge of obtaining a desirable level of orders and sales income at reasonable promotional costs is rather obvious. Since the total orders received determine the economy of scale and the required production output, inventory planning becomes crucial in order to avoid excess holding costs or unfilled orders. Only a fraction of back orders (60% of industrial and 40% of consumer products) is carried over to the next quarter; the rest is distributed to competitors.

Manufacturing Decisions and Cost Control

Figure 3 illustrates the structure of production decisions and their effect on the units cost of the product. Four units of material and four labour hours are standard requirements for manufacturing one basic unit. But operating standards, which represent actual requirements, are subject to the level of material utilization and labour productivity. Higher productivity generates a lower operating standard. Although the operating standards are not obvious, they can be closely estimated by analysing past production results. Research Development expenditures which represent technological improve-

ments and the economy of scale regulate the level of both material and labour productivity. The latter is further influenced by spending on discretionary overhead (fringe benefits) to improve workers' morale.

Labour productivity also affects the plant capacity, the standard level of which is the basic capacity. This is derived from the value of the plant which depreciates. Thus, new investment is required in the quarter preceding the decision period to maintain or expand the basic capacity. Besides the plant capacity, the number of products ordered from the plant and the number of material units and labour hours allocated to manufacturing, constrain the production output. Unless allocations are consistent with operating standards, the inefficient use of material or labour results in excessive production costs. Spending on any factor does not necessarily reduce the cost. For instance R & D expenditures (except for their limited effect on marketing may be wasted if the resulting productivity increase is not considered in establishing proper operating standards.

Unlike the marketing area, the decisions of competitors do not affect production results. Still, some factors are subject to economic conditions. The unit purchase price of material varies with the wholesale-price index; the standard hourly wage rate varies with the average hourly wage index. Labour resignations depend on the ratio of the actual hourly wage rate paid by the company to the standard and on the level of discretionary overhead. Long range planning of production output as well as material and labour force requirements is essential. For instance : a low level of production activity underutilizes capacity and fixed costs; fluctuation in the labour force involves training costs; materials ordered in the decision period are only available for the next quarter and a shortage of material may reduce the production output.

Data required for the analysis of manufacturing activity are supplied in a report which incorporates the actual costs by elements such as direct material, direct labor, and overhead. These cost are compared with those of the industry standards and the respective variances are shown. A manpower report shows changes
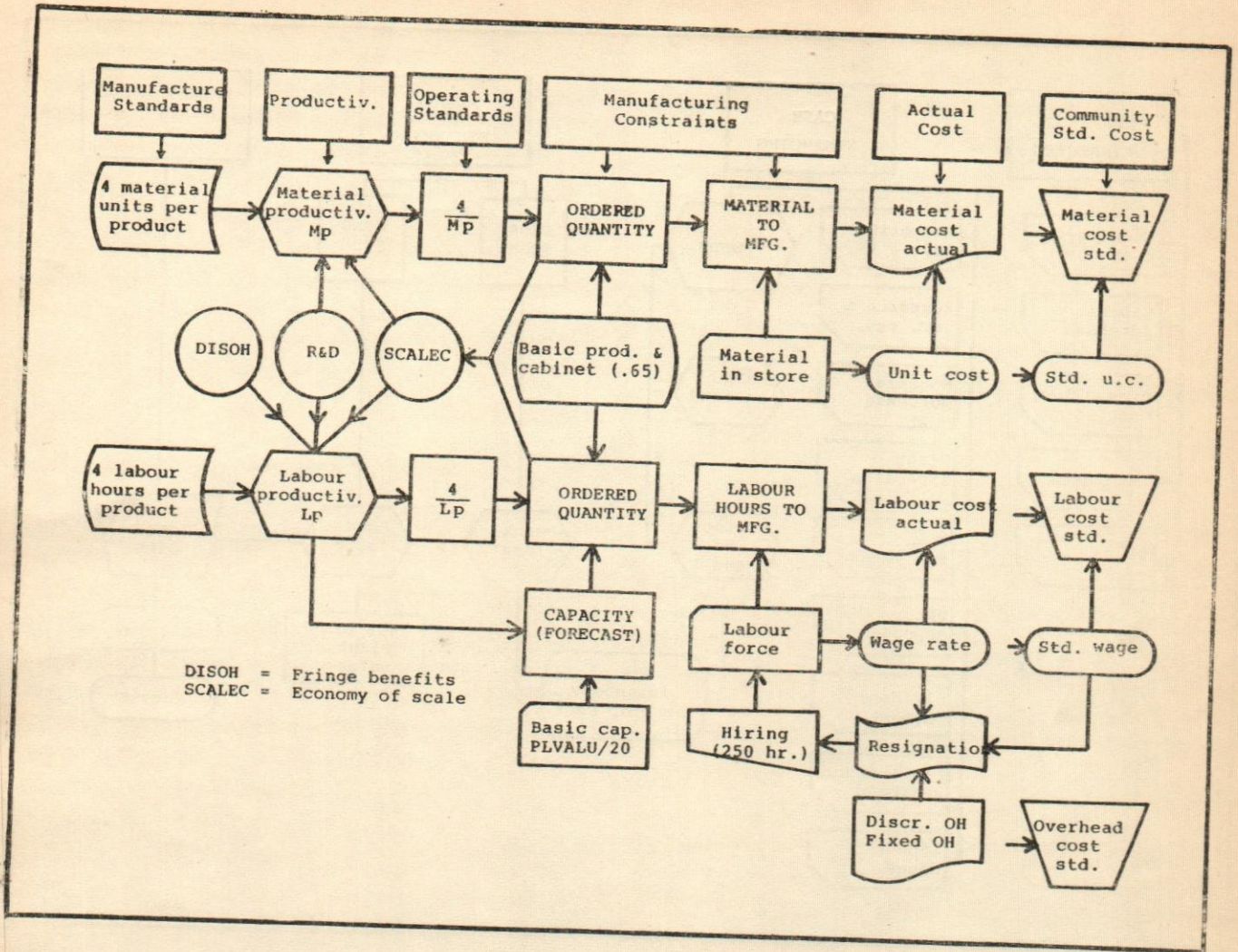
Fig. 3   The Structure of Production Decisions

in the employment of the labour force and sales personnel, the actual hourly wage rates paid by the firm, the comparable standards for the industry and the resignation rates. A warehousing report contains inventory data for raw materials, finished products and cabinets along with a comparison of their actual and industry standard cost. Usually there is no inventory of cabinets because they are purchased automatically at a set price for the sale of consumer products. If the company decides to make cabinets, they are handled as partial basic products. One cabinet is 0.65 of a basic product if an economic quantity is manufactured. However, the policy implication of a make-or-buy decision is far more complex than its technical accommodation.

Coping with Limited Financial Resources

Due to limited initial financial resources, a company can expand its operation beyond a certain limit only by building up its equity through efficient operations. Figure 4 shows the structure of financial decisions. Only the expenditures listed under "revenue financing" are paid automatically from the income generated in the decision period. All other expenditures for the decision period must be financed from available cash and bank loans.

The ceiling for bank loans is 75% of the standard cost of inventory (raw materials, basic products and cabinets). The maximum line of credit at the begin-
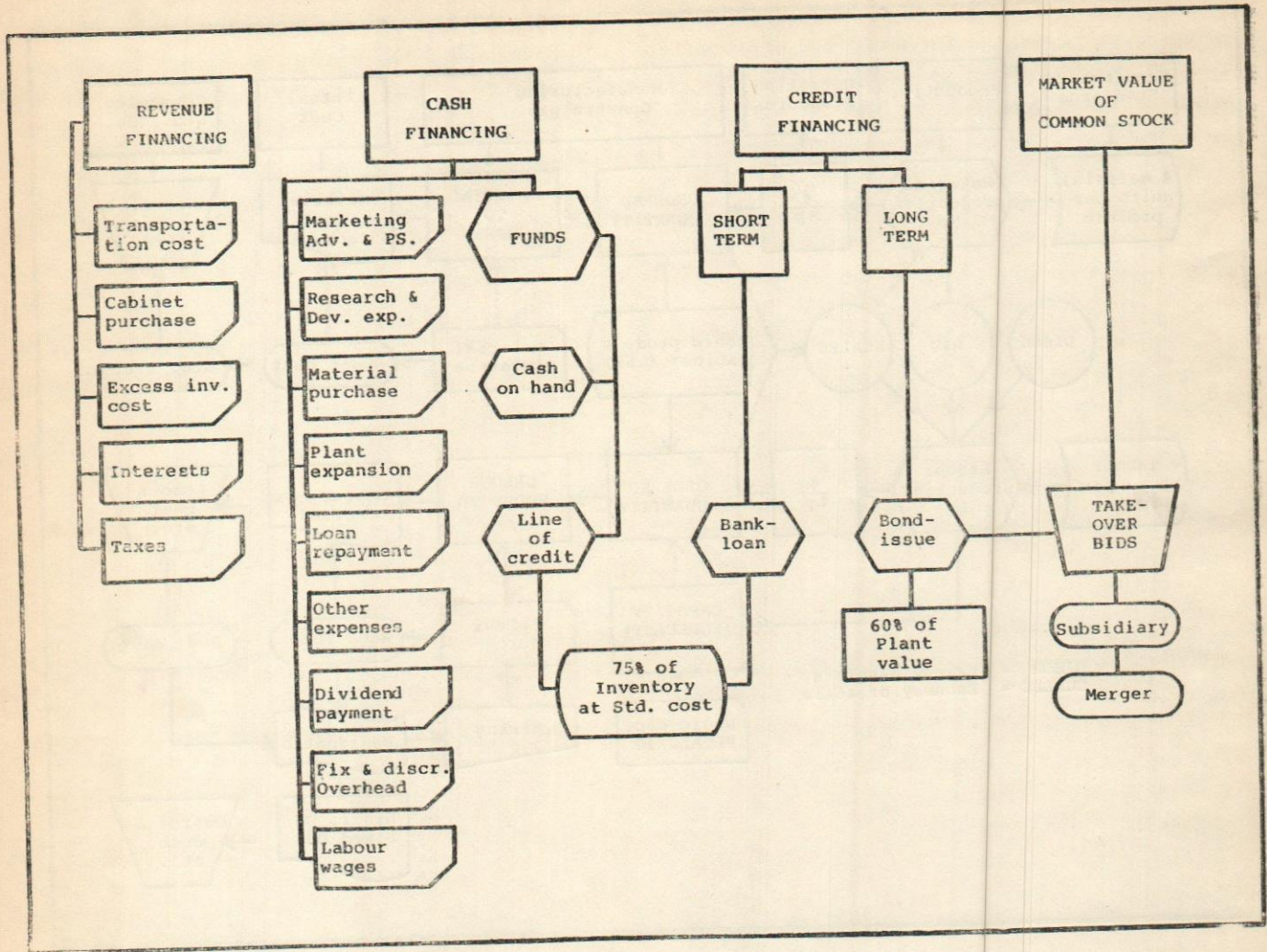
Fig. 4 The Structure of Financial Decisions

ning of each quarter is the difference between the credit ceiling and the existing bank loans. If a company does not have outstanding loans and wants to utilize its unexpended cash, it can purchase marketable securities. The same interest rate is received on securities as is paid for loans. Securities must be sold before loans can be acquired.

Bonds can be issued only when a takeover bid succeeds. There is a public market for the shares of the companies. The initial value of a common stock changes as a function of the rate of return on the net equity, the liquidity of assets, and the dividend policy of a particular company. Fifty per cent of the common

stocks must be obtained to control another company, either as a subsidiary or by merger. While other factors are also considered, the probability of success of a take-over bid increases with the premium offered above the market price of the shares to be acquired.

A profit and loss statement, a statement of funds and cash flow, and a balance sheet are supplied to each company. The financial report also includes the market value of common stock of the firm and of the competing firms. In addition, at each year end the total sales, total profit, total dividend paid, and a balance sheet of each firm are provided in comparative form.

Special Features for Enhancing the Simulation

The main features described above reflect how the general management character of this simulation exercise is preserved. Four management reports contain about 200 pieces of data as feedback on the decisions. While the initial conditions given in the first set of reports are identical for each company, they soon become markedly different as the game progresses. The general implications of making about 30-35 decisions in each period are obvious from the four diagrams.

To cope with the complexities of the decision-making process, most teams find it worthwhile to purchase additional reports. The usual uncertainty surrounding marketing decisions can be significantly reduced by buying a market research report. This report includes the actual marketing decision data of all competitors in a randomized form, within a ±5% or ±10% range, depending on the fee paid to the marketing consultant. In another report, actual sales and production data are analysed and compared with planned data which are reconstructed from the relevant decisions. This report reflects the plans of the company that are implied in the decisions.

A special feature of the model is that it accommodates strikes of different lengths of time (up to six weeks per quarter). When this feature is used, union and management negotiations reveal the differences between company and union-oriented arguments and often lead to an inquiry into labour law. By its nature, the game gives an excellent opportunity for role playing; collective bargaining is an example.

External interactions can close the gap between reality and the game. Interaction with a board of directors enhances the evaluation of management performance and tests the skill of participants in being able to defend their views and actions. Although it is not an easy task, every effort should be made to complement the game with this feature. Such interactions are vital and organic parts of a business simulation because the reaction of people to the opinions and behaviour of others cannot be reproduced by even the most effective mathematical model.

There are various ways the performance of teams can be evaluated. For a relatively objective evaluation a computer program is available. Three factors are computed using data retained from each period of play: equity growth rate, share price, and cost efficiency. The quarterly results of these factors are averaged over all periods played and teams are ranked accordingly. One should note here that it is not necessarily the team performing the best according to this measure that is the one having learned the most from the simulation.

Conclusion

While a business game model cannot be fully realistic, it must be sufficiently complex to portray managerial problems. Striking a balance between the emphasis on major facets with adequate depth and the temptation to expand the complexity of the information/decision system was one of the most challenging tasks in developing this model. All parameters in the mathematical models, except those influenced by the decisions of the management teams and the economic indices, are fixed to maintain a "fair game" without manipulating results in any way.

Perhaps a valid concern about business games is that participants learn more about the model than the management process. The application of business games determines their fate. As long as they are "played" in splendid isolation, the danger is that they may become a routine in which techniques dominate or replace theories and the concentration on sound management principles. For research in simulation and experiential learning, the obvious challenge is to find ways and means for effective educational use of business games. Should their role be to integrate management knowledge, or to condition novices by amazing them with the complexities and intricacies of management decisions—or perhaps both? These are certainly intriguing questions.

The integration of various business disciplines related to different management functions is a thorny problem. This paper intends to show that either in formal business curricula or in executive development programs, well-designed management simulations offer

unique opportunity to solve this problem. Some of their features which no other teaching method can match are : the competitive environment within which most managers operate; the need to understand, analyse and utilize ever-changing information; the coordination of all major aspects of general management; and the continuity of management whereby participants must live within limited resources and with the results of their decisions. Most importantly, they provide a dynamic business setting in which participants assume managing rather than consulting roles.

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Goal Programming for Product Mix Decisions

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INTRODUCTION

Goal Programming (GP) is receiving much attention as a powerful tool for analysing multi-objective decision-making problem. Charnes and Cooper,[3] Ignizio[4,5] and Lee[6] have contributed much in the recent development in goal programming and multiple-objective optimization. The main reason of the popularity of GP seems to be associated with the awareness of the management science techniques and very natural orientation towards multi-goal or multi-objective formulation and uses.

In the present paper we have developed and solved an example of actual problem faced by an Indian Company manufacturing shock absorbers. Presently the company attempts to achieve the following objectives while taking product-mix decisions.

(a) To achieve production targets set in view of sales commitments.
(b) To ensure proper utilization of available resources.

However, these goals are insufficient to economize the production operations and moreover these areas are not based on any scientific or analytical models but rather subjective decision. The short term perspective of meeting sales demands leads to revising production schedules on a day-to-day basis and there-

In the present paper the authors present a goal programming model as an alternative method for product mix decision for shock absorbers in an Indian company.

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fore the total concept of planned operations is lost. This implies that the Company must consider other important objectives also while scheduling its production programme. Other objectives may have cost and profit implications, which certainly are helpful to the long-term survival and growth of the Company. However, it is equally important to assign priorities to these objectives.

PROBLEM AND MODEL FORMULATION

Constraints

1. *Regular productive hours per year*

The regular production capacity of the plant for the year 1985 has been worked out as 4576 hours, i.e., 286 working days × 16 hours/day.

2. *Production capacity of the plant per hour*

Production capacity of the plant has been calculated on the basis of past production levels achieved during the last few years for different categories of shock absorbers. For simplicity a uniform rate of production has been assumed for one type of application.

The production capacity of the plant is given below :

Application	Production/hour
Light Comm. Vehicle	225
Cars	225
Three-wheelers	250
Scooters	250
Motors Cycles	250
Tractor driver seat	275
Mopeds	275
Jeeps	225

3. *Overtime constraint*

Maximum allowable overtime set by management is 40% of regular productive hours of the plant. Hence was cannot get beyond 1830 hours as overtime while formulating and solving the model.

4. *Original equipment and spare parts market constraint*

This constraint forces the model to produce at least the requirement of original equipment and spare parts market, even if it is not economic. This is done in order to maintain the presence of the company in all segments of the market.

5. *Sales constraint*

The projected demand for different types of shock absorbers puts a limiting constraint on the production. This shows the maximum quantity of shock absorbers that can be sold in the market.

Problem Formulation

While formulating the goal programming model for this problem we will take numbers of productive hours allocated for manufacture of different types of shock absorbers.

1. *Production Capacity Constraint*

$$L_1 + L_2 + L_3 + L_4 + L_5 + L_6 + L_7 + L_8 + L_9 + L_{10} + L_{11} + C_{12} + C_{13} + C_{14} + C_{15} + W_{16} + W_{17} + S_{18} + S_{19} + S_{20} + S_{21} + S_{22} + S_{23} + S_{24} + B_{25} + B_{26} + B_{27} + B_{28} + T_{29} + T_{30} + T_{31} + M_{32} + M_{33} + M_{34} + M_{35} + M_{36} + M_{37} + M_{38} + M_{39} + J_{40} + d_1^- - d_1^+ = 4576$$

where d_1^- = Amount of under utilization of available productive hours

d_1^+ = Amount of overtime allowed by the management and $L_1, L_2, \ldots L_{40}$ are the number of hours used for producing shock absorbers of type $L_1, L_2, L_3, \ldots J_{40}$, respectively.

2. Original Equipment and Spare Parts Market Constraint

$L_1 + d_2^- = 26.6$; $L_2 + d_3^- = 26.6$

$L_3 + d_4^- = 11.7$; $L_4 + d_5^- = 25.6$

$L_5 + d_6^- = 17.7$; $L_6 + d_7^- - d_7^+ = 97.7$

$L_7 + d_8^- - d_8^+ = 35.5$; $L_8 + d_9^- = 17.7$

$L_9 + d_{10}^- = 17.7$; $L_{10} + d_{11}^- = 44$

$L_{11} + d_{12}^- - d_{12}^+ = 17.7$; $C_{12} + d_{13}^- = 133.3$

$C_{13} + d_{14}^- - d_{14}^+ = 88.8$; $C_{14} + d_{15}^- = 8.8$

$C_{15} + d_{16}^- - d_{16}^+ = 44.4$; $W_{16} + d_{17}^- - d_{17}^+ = 16.0$

$W_{17} + d_{18}^- - d_{18}^+ = 40.0$; $S_{18} + d_{14}^- - d_{14}^+ = 60.0$

$S_{19} + d_{20}^- = 48.0$; $S_{20} + d_{21}^- = 24.0$

$S_{21} + d_{22}^- = 16.0$; $S_{22} + d_{23}^- - d_{23}^+ = 52.0$

$S_{23} + d_{24}^- - d_{24}^+ = 16.0$; $S_{24} + d_{25}^- = 28.0$

$B_{25} + d_{26}^- - d_{26}^+ = 16.62$; $B_{26} + d_{27}^- = 28.0$

$B_{27} + d_{28}^- = 48.0$; $B_{28} + d_{29}^- - d_{29}^+ = 96.0$

$T_{29} + d_{30}^- = 32.7$; $T_{30} + d_{31}^- = 58.2$

$T_{31} + d_{32}^- = 43.6$; $T_{32} + d_{33}^- - d_{33}^+ = 87.3$

$M_{33} + d_{34}^- = 47.3$; $M_{34} + d_{35}^- = 18.0$

$M_{35} + d_{36}^- - d_{36}^+ = 54.5$; $M_{36} + d_{37}^- = 29.0$

$M_{37} + d_{38}^- = 14.5$; $M_{38} + d_{39}^- - d_{39}^+ = 44.0$

$M_{39} + d_{40}^- = 29.0$; $J_{40} + d_{41}^- - d_{41}^+ = 173.3$

where $d_2^-, d_3^-, d_4^- \ldots d =$ amount of underachievement of original equipment and spare parts markets.

$d_7^+, d_8^+, d_{12}^+, d_{14}^+, d_{16}^+, d_{17}^+, d_{18}^+, d_{19}^+, d_{23}^+, d_{24}^+, d_{26}^+, d_{29}^+,$
$d_{33}^+, d_{36}^+, d_{39}^+, d_{41}^+ =$ amount of overachievement of original equipment and spare parts markets.

3. Overtime Constraints

$d_1^+ = d_{42}^- - d_{42}^+ = 1830$

or

$L_1 + L_2 + L_3 + L_4 + L_5 + L_6 + L_7 + L_8 +$

$L_9 + L_{10} + L_{11} + C_{12} + C_{13} + C_{14} + C_{15} +$
$W_{16} + W_{17} + S_{18} + S_{19} + S_{20} + S_{21} + S_{22} +$
$S_{23} + S_{24} + B_{26} + B_{27} + B_{28} + T_{29} + T_{30} +$
$T_{31} + M_{32} + M_{33} + M_{34} + M_{35} + M_{36} + M_{37} +$
$M_{38} + M_{39} + J_{40} + d_{42}^- - d_{42}^+ = 6406$

where $d_{42}^- =$ amount of hours shortfall between the actual overtime and allowed overtime. $d_{42}^+ =$ overtime in excess of allowed overtime.

4. Sales Constraint

$L_6 + d_{43}^- = 239.9$; $L_7 + d_{44}^- = 51.0$

$L_{11} + d_{45}^- = 24.3$; $C_{13} + d_{46}^- = 502.1$

$C_{15} + d_{47}^- = 231.0$; $W_{16} + d_{48}^- = 42.0$

$W_{17} + d_{49}^- = 132.0$; $S_{18} + d_{50}^- = 84.0$

$S_{22} + d_{51}^- = 988.0$; $S_{23} + d_{52}^- = 80.0$

$B_{25} + d_{53}^- = 1910.0$: $B_{28} + d_{54}^- = 212.0$

$M_{32} + d_{55}^- = 90.9$; $M_{35} + d_{56}^- = 58.1$

$M_{38} + d_{57}^- = 461.8$; $J_{40} = d_{58}^- = 300.5$

where $d_{43}^-, d_{44}^-, \ldots d_{58}^- =$ amount of underachievement of sales target.

5. Cost Constraint

$13500 L_1 + 13500 L_2 + 8943 L_3 + 9033 L_4 + 13500 L_5 + 9450 L_6 + 9810 L_7 + 9450 L_8 + 9038 L_9 + 8347 L_{10} + 14557 L_{11} + 8572 C_{12} + 10350 C_{13} + 12600 C_{14} + 8662 C_{15} + 7625 W_{16} + 10150 W_{17} + 18725 S_{18} + 18675 S_{19} + 16400 S_{20} + 16400 S_{21} + 7650 S_{22} + 18250 S_{23} + 16875 S_{24} + 6250 B_{25} + 20170 B_{26} + 16875 B_{27} + 15450 B_{28} + 6561 T_{29} + 5252 T_{30} + 5142 T_{31} + 12828 M_{32} + 10890 M_{33} + 11715 M_{34} + 12622 M_{35} + 12567 M_{36} + 15468 M_{37} + 10725 M_{38} + 9006 M_{39} + 9135 J_{40} + d_{59}^- - d_{59}^+ = 1000$ (a small value)

where $d_{59}^- =$ amount of underachievement of cost target

$d_{59}^+ =$ amount of overachievement of cost target

The goal priorities for the given problem are as follows :

P_1 : Avoid any under-utilization of regular production capacity of the plant.

P_2 : Meet the order demand of all original equipment and spare parts market.

P_3 : Avoid overtime operation of the plant beyond 40% of regular production capacity.

P_4 : Achieve the sales goal of total projected demand including original equipment, spare parts

demand and replacement market demand.

P_5 : Minimize the overtime operations of the plant as much as possible.

P_6 : Minimize cost as much as possible.

Data

The relevant data is given in Table 1, 2 and 3. Data regarding profit margins and manufacturing cost has been modified in order to retain secrecy for obvious reasons.

TABLE 1
Projected Demand

Sl. No.	Application	Identification Code	Projected Demand (No. of Shock Absorbers) for 1985			
			OE	SPD	OE+SPD	RM
1.	Light Comm. Vehicle	L_1	6000	—	6000	—
		L_2	6000	—	6000	—
		L_3	4000	—	4000	—
		L_4	4000	1000	5000	—
		L_5	4000	—	4000	—
		L_6	20000	2000	22000	32000
		L_7	8000	—	8000	3500
		L_8	4000	—	4000	—
		L_9	4000	—	4000	—
		L_{10}	1000	—	1000	—
		L_{11}	4000	—	4000	—
2.	Cars	C_{12}	30000	—	30000	—
		C_{13}	20000	—	20000	93000
		C_{14}	2000	—	2000	—
		C_{15}	10000	—	10000	42000
3.	Three Wheelers	W_{16}	4000	—	4000	6500
		W_{17}	10000	—	10000	23000
4.	Scooters	S_{18}	15000	—	15000	6000
		S_{19}	12000	—	12000	—
		S_{20}	60000	—	60000	—
		S_{21}	40000	—	40000	—
		S_{22}	130000	—	130000	117000
		S_{23}	4000	—	4000	16000
		S_{24}	7000	—	7000	—
5.	Motorcycles	B_{25}	390000	25500	415500	62000
		B_{26}	6000	1000	7000	—
		B_{27}	12000	—	12000	—
		B_{28}	24000	—	24000	29000
6.	Tractor Driver Seat	T_{29}	9000	—	9000	—
		T_{30}	1000	15000	16000	—
		T_{31}	12000	—	12000	—
7.	Mopeds	M_{32}	24000	—	24000	1000
		M_{33}	12000	1000	13000	—
		M_{34}	5000	—	5000	—
		M_{35}	15000	—	15000	1000
		M_{36}	8000	—	8000	—
8.	Jeeps	J_{40}	39000	—	39000	35000

TABLE 2

Number of Productive Hours Required

Sl. No.	Application	Code	Required No. of hours for Meeting Projected Demand		
			OE+SPD	RM	Total
1.	LCV	L_1	26.6	—	26.6
		L_2	26.6	—	26.6
		L_3	17.7	—	17.7
		L_4	22.5	—	22.5
		L_5	17.7	—	17.7
		L_6	97.7	142.2	239.9
		L_7	35.5	15.5	51.0
		L_8	17.7	--	17.7
		L_9	17.7	—	17.7
		L_{10}	4.4	—	4.4
		L_{11}	17.7	6.6	24.3
2.	Cars	C_{12}	133.3	—	133.3
		C_{13}	88.8	413.3	502.1
		C_{14}	8.8	—	8.8
		C_{15}	44.4	186.6	231.0
3.	Three Wheelers	W_{16}	16.0	26.0	42.0
		W_{17}	40.0	92.0	132.0
4.	Scooters	S_{18}	60.0	24.0	84.0
		S_{19}	48.0	—	48.0
		S_{20}	240.0	—	240 0
		S_{21}	160.0	—	160.0
		S_{22}	520.0	468.0	988.0
		S_{23}	16.0	64.0	80.0
		S_{24}	28.0	—	28.0
5.	Motorcycles	B_{25}	1662.0	248.0	1910.0
		B_{26}	28.0	—	28.0
		B_{27}	48.0	—	48 0
		B_{28}	96.0	116.0	221.0
6.	Tractor Driver Seats	T_{29}	32.7	—	32.7
		T_{30}	58.2	—	58.2
		T_{31}	43.6	—	43.6
7.	Mopeds	M_{32}	87.3	3.6	90.9
		M_{33}	47.3	—	47.3
		M_{34}	18.0	—	18.0
		M_{35}	54.5	3.6	58.1
		M_{36}	29.0	—	29.0
		M_{37}	14.5	—	14.5
		M_{38}	440.0	21.8	461.8
		M_{39}	29.0	—	29 0
8.	Jeeps	J_{40}	173.3	127.2	300.5

TABLE 3

Profit Contribution

Sl. No.	Code	Manufacturing Cost		Profit Contribution	
		Rs./Unit of Shock Abs	Rs./Hour of Plant Operation	Rs./Unit of S.A.	Rs./Hour of Plant Operation
1.	L_1	60.00	13500	20.00	4500
2.	L_2	60.00	13500	20.00	4500
3.	L_3	39.75	8943	13.25	2981
4.	L_4	40.15	9033	12.85	2891
5.	L_5	60.00	13500	20.00	4500
6.	L_6	42.00	9450	21.50	4837
7.	L_7	43.60	9810	11.65	2621
8.	L_8	42.00	9450	14.00	3150
9.	L_9	40.17	9038	14.08	3303
10.	L_{10}	37.10	8347	11.20	2520
11.	L_{11}	64.70	14557	25.30	5692
12.	C_{12}	38.10	8572	4.00	900
13.	C_{13}	46.00	10350	13.40	3015
14.	C_{14}	56.00	12600	17.50	3937
15.	C_{15}	38.50	8662	9.40	2115
16.	W_{16}	30.50	7625	28.50	7200
17.	W_{17}	40.60	10150	25.30	6325
18.	S_{18}	74.90	18725	9.14	2285
19.	S_{19}	74.70	18675	9.00	2250
20.	S_{20}	65.60	16400	25.40	6350
21.	S_{21}	65.60	16400	21.40	5350
22.	S_{22}	30.60	7650	20.50	5125
23.	S_{23}	73.00	18250	10.00	2500
24.	S_{24}	67.50	16875	25.50	5625
25.	B_{25}	25.00	6250	18.10	4525
26.	B_{26}	80 68	20170	41.90	10475
27.	B_{27}	67.50	16875	22.50	5625
28.	B_{28}	61.80	15450	7.50	1875
29.	T_{29}	23.86	6561	33.20	9130
30.	T_{30}	19.10	5252	32.90	9047
31.	T_{31}	18.70	5142	38.30	10532
32.	M_{32}	46.65	12828	5.35	1471
33.	M_{33}	39.60	10890	13.90	3833
34.	M_{34}	42.60	11715	11.40	3135
35.	M_{35}	45.90	12622	4.00	1100
36.	M_{36}	45.70	12567	7.30	2007
37.	M_{37}	56.25	15468	18.70	5142
38.	M_{38}	39.00	10725	12.25	3308
39.	M_{39}	32.75	9006	10 25	2818
40.	J_{40}	40.60	9135	14.25	3195

ASSUMPTIONS

The goal programming model so formulated has certain limitations in form of assumptions. Some of these assumptions are as stated below :

(i) It has been assumed that the production schedule as indicated by the model will not get upset because of non-availability of raw material like steel, shock absorber oil and other finished and semi-finished O.S.P. components.

(ii) Work-in-Progress inventories have not been taken into consideration. It has been assumed that we are starting and finishing with zero inventories at the beginning and ending of Calender year.

(iii) The model does not take into account the loss of production time due to unforeseen circumstances, such as labour strikes, etc.

(iv) Shock Absorbers of similar features have been clubbed together to the extent possible for keeping number of rows in our problem formulation less than or equal to sixty. This has been done to suit the goal programming package available with Delhi University Computer Centre.

(v) Production capacity of the plant has been calculated based on the various operations required to be done on different types of Shock Absorbers. This in itself is a big exercise. Hence few approximation and generalisations have been made in this context.

(vi) Heavy duty Shock Absorbers, required for Railways, Army tanks and heavy commercial vehicles are produced in different shops and have not been included in the scope of this study.

(vii) The time-horizon taken into account in this study is of one year. Since single period approach treats each time period as an isolated unit, it is valid only if decisions are independent of one another over a span of time.

Moreover, the manufacturing costs and profit margins have been taken constraint throughout the time frame of one year. In practice manufacturing costs and selling prices fluctuate, almost on daily basis.

The above limitations may be overcome by combining goal programming with other techniques of operations research and by a more realistic formulation of the constraints and objectives. But this, may/will make the model more complicated and difficult to solve and hence costlier. Therefore, a compromise is needed between the cost of providing perfect information and benefit arising out of getting this information.

ANALYSIS OF RESULTS

After a computer run "using IBM/41 system, the optimal solution to the goal programming formulation was found in 64 iterations. The results of the model in terms of the final product/mix schedule and the goal attainments are given in Table 4.

It is observed that product mix given in the solution suggests that all the products except for Motor Cycle (Code-B28), Moped (Code M32 & M35) should be produced as per the maximum limit of projected sales demand.

On analysing the slack analysis table we find that deviational variables $\bar{d}_{54}$, $\bar{d}_{55}$ and $\bar{d}_{56}$ are showing negative slack of the amount 112.6 hours, 3.9 hours and 4.1 hours, respectively. This recommends that production of these type of shock absorbers should be reduced.

Application	Code	Proj. Sales Demand	Production Recomm.	Short-fall
Motorcycle	B_{28}	53,000	24850	28,150
Moped	M_{32}	25.000	23925	1,075
Moped	M_{35}	16,000	14850	1,150
Total		94,000	63625	30,375

TABLE 4

Final Product-mix Schedule

Variable	Code	Nos. of Hrs. Allocated	Qty. of Shockers to be Produced
1.	L_1	26.6	6000
2.	L_2	26.6	6000
3.	L_3	17.7	4000
4.	L_4	22.5	5000
5.	L_5	17.7	4000
6.	L_6	239 9	56000
7.	L_7	51.0	11500
8.	L_8	17.7	4000
9.	L_9	17.7	4000
10.	L_{10}	4.4	1000
11.	L_{11}	24.0	5500
12.	C_{12}	133.0	30000
13.	C_{13}	502.1	11300
14.	C_{14}	8.8	2000
15.	C_{15}	23.0	52000
16.	W_{16}	42.0	10500
17.	W_{17}	132.0	33000
18.	S_{18}	84.0	21000
19.	S_{19}	48.0	12000
20.	S_{20}	240.0	60000
21.	S_{21}	160.0	40000
22.	S_{22}	988.0	247000
23.	S_{23}	80.0	20000
24.	S_{24}	28.0	7000
25.	B_{25}	1910.0	477500
26.	B_{26}	28.0	7000
27.	B_{27}	48.0	12000
28.	B_{28}	99.4	24850
29.	T_{29}	32.7	9000
30.	T_{30}	58.2	16000
31.	T_{31}	43.6	12000
32.	M_{32}	87.0	23925
33.	M_{33}	47.3	13000
34.	M_{34}	18.0	5000
35.	M_{35}	54.0	14850
36.	M_{36}	29.0	8000
37.	M_{37}	14.5	4000
38.	M_{38}	461.8	127000
39.	M_{39}	29.0	8000
40.	J_{40}	300.5	67500
Total :			1482425

All other types of shock absorbers are to be produced to meet the projected sales demand for the year 1985.

The above table gives the value goals for the goals. These values represent the under attained portion of goals. The artificial priority will also be printed out if the model required assignment of the arrificial priority. Our Model does not assume any artificial priority for solution.

The priorities No. 1, 2 and 3 have been completely attained. This means that (i) the regular productive capacity of the plant have been totally utilised; (ii) with this mix, goal of meeting original equipment market and spare parts market have been achieved; (iii) the overtime operation of the plant has not exceeded the allowable limit of 40% of regular hours.

As far as priority No. 4 is concerned, it is related to non-availability of the productive hours of the plant. The value of 102442.50 is a weighted unit of under achievement of this priority goal which is equivalent of productive time required for meeting the short-falls in B_{28}, M_{32} & M_{35} type of shock absorbers.

Priority No. 5 shows that goal of minimising overtime is under-achieved by 1910 hours.

The last goal of priority No. 6 of minimising the manufacturing cost has also not been achieved, as expected. Because we have used a very small value of Rs. 1000.00/hour on cost constraint, it was bound to be under-achieved. The under achievement of Rs. 60093374.40 per year indicates that minimum manufacturing cost for this product mix is Rs. 6009337.40 + Rs. 1000.00 that is Rs. 60,10,337.40 for the year 1985.

CONCLUSION

The goal programming model formulation developed provides the firm's management with a decision aid in determining its various product mix in the light of many potentially incompatible and or in commensurable economic, business and operational goals facing the firm. Since the output of the model

provides easily discernable measures of the over and under achievement of each goal, the firm's decision maker can develop an understanding of the trade-off relationship that increase the achievement level of certain goals at the expense of other goals. Various forms of sensitivity analysis (such as varying goal levels, priority structures etc.) can give insight to the decision makers in terms of the impact such changes in the model would have on the blending of the products and the associated measures of performance. This may especially be important for organisations which may not be absolutely clear regarding its priority structure and may like to experiment before arriving at the final structure.

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Changing International Economy and Trade

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In this paper the author throws light on the changing scene of the national economy and suggests strategies for the development of international trade.

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There have been significant changes in the international economy over the last ten years. The pivotal role of primary commodities/minerals has tended to decline with the increasing shift to synthetics and substitutes. This has resulted in an overhang of supplies and greatly depressed prices. The spread of automation and robotisation has tended to erode the competitive advantage of lower labour costs and rising protectionist barriers. The extreme volatility of currencies has led to capital movements on an unprecedented scale which have compounded developing countries' efforts to maintain their Exports.

The problem of protectionism has been a major focus of inter-governmental discussion for more than a decade. Despite general advocacy by Governments of an improved, strengthened and expanding liberal trade regime and further liberalization efforts, protectionism and other forms of trade intervention have tended to increase in recent years. There has been a considerable build up in pressures for trade intervention and demands for the tightening up of legal restrictive provisions. Protectionism involves diversified types of restrictions, tariff and non-tariff, many of them giving rise to semi-permanent patterns of sectoral protection, intensifying structural rigidities in the national economies and encouraging trends towards managed trade and need to increase the transparency of trade policies and actions.

The analysis of long-term trends in all factors important to the structural adjustment process, such, as technological development, demand and international trade, and to factors of production in particular labour and capital brings out that efficiency and equity considerations in the international context would both dictate that market access in so-called traditional markets should not be obstructed for trading partners, and especially for developing countries. Emerging contradiction between the increasing export needs of developing countries and the mounting reluctance of some developed countries to pursue expansionary policies and to accommodate expanded exports from developing countries calls for a reassessment of the developing countries export potential and its underlying structural factors. Structural change may be brought about by underlying trends in productivity, technological innovation, demand patterns or trade flows.

International trading environment has been characterized by uncertainty and frictions reflecting the slow growth of world output, the continued imbalances in bilateral trade and the debt crisis in developing countries.

USSR has proceeded with reforms in their general economic and foreign trade regimes designed to enhance the role of market oriented instruments and to increase the number of economic agents responsible for carrying out foreign trade operations. China has maintained its liberalisation policy. Voluntary export restraints (VERs) and orderly marketing arrangements (OMAs), have extended to trade in such products as semi-conductors and machine tools in new manufacturing sectors, as also in steel, tubes, textiles, footwear, chemicals and agricultural products. DMECs as a group have made no progress in rolling back protectionist actions. Standstill has been seriously endangered by the introduction of new restrictions on certain additional products under the renewed multi-fibre Arrangement. The use of NTMs in developing countries has been pervasive in all sectors, with little sectoral bias.

In 1985-86, anti-dumping investigations initiated against imports from developing countries grew. Where the anti-dumping investigations did not result in duties, they were frequently replaced by other means such as VERs and price-undertakings.

The trade weighted average applied tariff rates by developed market-economy countries in 1986 against imports from developing countries of all food items, chemicals and manufactures (including leather, textile yarn and fabrics, clothing and footwears) were higher than those against imports from all countries. The developing countries' major export item receiving GSP treatment were labour-intensive products, which faced unusually high tariffs, even after taking account of GSP. It tended to concentrate on products such as textiles and clothing.

There is need for a coherent approach to the liberalization of trade in the areas of export interest to developing countries where substantial growth in export earnings is expected in the event of such liberalization. This approach should take into account macro-economic costs and imbalances which sectoral protective actions, cause both to domestic and international economic adjustment processes. Trade restrictions, both tariff and non-tariff, have been intensive in agriculture, textiles/clothing and iron and steel. Subsidies and new forms of barriers such as VERs in these sectors have reduced competition, constrained employment creation and discouraged efficient industries. Subsidies and VERs have created distortions in the operation of the market mechanism, both in importing and exporting countries.

Further liberalization efforts, the fulfilment of developed market-economy countries commitments on standstill and roll-back, and the provision of differential and more favourable treatment for developing countries, as well as positive structural adjustment need to be accompanied by measures to assist developing countries in promoting and diversifying their trade capitalizing on the trade liberalization process and improving access to competitive technological and services inputs in the process of intra-industry specialization.

A considerable part of the reduction in the inflation in the 'eighties was due to the extremely low

commodity prices'. The developing countries' terms of trade remained very low in historic terms.

The major DMECs largely achieved the objective of realigning their currencies at more realistic rates, but this has failed to have a major impact on reciprocal trade balances. Though nominal interest rates have been reduced considerably, but have remained high in real terms. Pressures for protectionist legislation and action have remained strong, especially in the United States, where the trade deficit has increased. Solutions to trade problems continued to be worked out principally on a bilateral basis often by arrangements which provide support for expanded market access or guarantee a minimum market share for a specific trading partner.

Agricultural products have remained a major source of friction. Tariff reductions by DMECs tended to concentrate on products traded principally between DMECs. Some relaxation of non-tariff measures took place in certain DMECs but were too modest. DMECs as a group made no progress in rolling back protectionist actions, although there were some signs of a standstill. The new Multi-Fibre Arrangement (MFA), which extended its coverage to new fibres such as silk and vegetable fibres (ramie, linen and jute), will expand the production of developing countries' exports facing NTMs.

Launching of a new round of multi-lateral trade negotiations (the Uruguay Round), was accompanied by renewed 'standstill' and 'roll back' commitments. Japan eliminated import duties on 1848 agricultural or industrial products, effective 1 January, 1986 and reduced or eliminated import duties on 88 industrial products. Canada reduced tariffs on certain items. A number of developing countries reduced tariffs. Tariffs on 373 products, representing 16 per cent of the value of 1985 imports, were bound at rates lower than 50 per cent. Newzealand eliminated customs and other fiscal charges on a large number of products.

Efforts continued to be made under the GSP to improve beneficiary lists, product coverage and tariff cuts but such improvements were modest. Some

developing countries and China increased duties on specific products. Actions undertaken by DMECs did not result in a net liberalization of international trade.

Japan reduced certain quantitative import restrictions. Quotas on leather and leather footwear imports were converted into tariff quotas. Norway eliminated licensing requirements and bilateral quotas on a large number of articles. Newzealand continued its process of reducing quantitative restrictions dismantling its licensing system. Greece terminated many of its residual national import restrictions. Import deposits imposed for balance-of-payments reasons—on a large number of products in 1985, were terminated for a number of products. France converted national quantitative restrictions on a number of items into "import restrictions without any limitation of quantity". The Federal Republic of Germany eliminated non-automatic licensing requirements on certain products imported from socialist countries. The United Kingdom terminated certain 'voluntary' export restraint agreements. Colombia, Egypt and Nigeria substantially increased the number of products for which import licences are to be granted automatically. The Republic of Korea and Senegal also liberalized imports of a large number of products. Mexico converted the ban on imports of a list of some 300 principally luxury products into a regime of prior import permits. It also exempted some 100 products (products and automobile parts) from the import permit requirement.

The United States renegotiated an extension of the product coverage of a 'voluntary' export restraint agreement on steel products negotiated with EEC in 1982. EEC introduced Community Surveillance on imports of a series of agricultural products originally in the United States, Steel products imported from the Democratic People's Republic of Korea and Video recorders originating in the Republic of Korea. Retrospective surveillance on footwear imports was renewed. New bilateral textile agreement with the United States had been concluded previous to the renewal of the MFA with Hong Kong, the Republic of Korea and Taiwan Province of China and included extension of coverage to silk blends and vegetable

fibre products. The new bilateral textile agreements signed with Hong Kong, the Republic of Korea, Taiwan Province of China and Japan which took effect retrospectively from 1 January. 1986, sharply reduced growth rates. EEC improved certain flexibility provisions in its bilateral agreements under the MFA.

The United States announced the imposition of a number of import fees and taxes, the conformity of which with GATT rules was contested by certain trading partners.

In 1984-85 certain DMECs (principally Australia, the EEC countries, the United States and Canada) and some developing countries (Chile, Argentine and Republic of Korea) imposed anti-dumping and countervailing duties on alleged dumped or subsidized imports. Anti-dumping actions are frequently replaced by other trade measures, principally VERs. Anti-dumping investigations, involving developing countries increased, mainly as a result of an increase of actions initiated in the United States. The developing countries and territories most frequently affected by anti-dumping investigations were—Brazil, China, Mexico, Republic of Korea, Taiwan Province of China, Yugoslavia and India. Provisional duties were imposed in 106 cases and definitive duties in 77 cases, while price undertakings were agreed to in 18 cases. Argentine, Brazil, Mexico, Peru, the Republic of Korea and Taiwan Province of China were most frequently involved in countervailing duty investigations, concerning mainly steel, tubes, textiles and chemical products. Provisional measures were taken in 32 cases, definite duties were applied in 18 cases, and price undertakings were agreed to in 5 cases. At the end of the period there were 88 outstanding countervailing duty actions. The Chinese external sector faced severe difficulties in 1986. The trade coverage ratio indicates the percentage share of the value of imports covered by selected NTMs.

In absolute terms there were some 120 thousand trade flows subject to NTM out of a total of almost 700 thousand. Trade flows affected by "all" NTMs accounted for 20.3 per cent of the value of imports, or 22.7 per cent of the value of non-fuel imports.

The "subgroup" of NTMs and quantitative restrictions affected 15.2 and 13.9 per cent of non-fuel imports, respectively in 1986. For 'all' NTMs, very high levels of trade interventions are shown in clothing, food and live animals, textiles and iron and steel.

Trade intervention has increased significantly between 1981 and 1986. The trade coverage of the "subgroup" of NTMs increased 10.1 per cent, while quantitative restrictions increased 13.9 per cent. An important increase in trade coverage took place from 1981 and 1982. An important increase was observed from 1984 to 1985. Trade coverage ratio remained practically unchanged in 1986.

The developing countries, many of which have established basic iron and steel industries, have a substantial interest in securing trade liberalization in this sector. Liberalization of tariffs and NTMs on a most favoured nation—basis in this sector would benefit developing countries through an expansion of their exports by more than $700 million. By contrast with the developed countries, the use of NTMs is not strongly biased in favour of particular sectors. The food sector is the second most affected by measures. The highest figures are those for developing Africa and C. America.

In a number of developed market economy countries the treatment of the developing countries as a whole is less favourable than that afforded to the other developed countries. In areas of manufactures where the developing countries are trying to expand and diversify their production base, rates of duty are particularly high and there are many product areas where the applicability of NTMs is much higher against developing countries.

The highest rates in the major markets are in the areas of textiles, clothing and footwear, with averages of 7.9 per cent, 11.9 per cent and 9.0 per cent respectively. The average tariff of 5.5 per cent on food products coming from preference-receiving countries is also marginally higher than the overall average of 5.3 per cent.

As a result of the application of the GSP, imports

in 1983 by preference-granting countries from preference-receiving countries may have been around $6 billion (2 per cent) higher than they would otherwise have been. Over 40 per cent of the benefits went to only three beneficiaries, namely, Hong Kong, the Republic of Korea and Taiwan Province of China. The key products which benefit from GSP treatment are some of the major export items of the developing countries perambulators, toys and sporting goods, telecommunications apparatus, footwear and so on. These products face unusually high tariffs, even taking account of GSP.

For non-fuel imports as a whole, there is discrimination against the developing countries, as measured by the percentage of imports covered by NTMs.

VERs represent a challenge to the GATT system. VERs have been the most rapidly increasing form of protectionist actions in the 1980s. The number of VERs increased from about 60 in 1981 to over 80 in 1986. The amount of trade covered by VERs increased from 3.0 per cent in 1981 to 4.8 per cent in 1986 on the basis of 1981 trade flows. The value of trade affected by VERs increased by 62 per cent between 1981 and 1986.

VERs are imposed principally by the United States, EEC and Canada. They are heavily concentrated in steel and automobiles, affecting respectively 45 and 30 per cent of the value of all corresponding imports into selected DMECs in 1986. VERs are also directed against some developing countries, principally the Republic of Korea and Brazil. The VER concerning exports of manioc to the EEC affects a relatively large share of Thailand's exports to DMECs.

The tariff rates as they appear in customs schedules and as they are negotiated in the course of international trade negotiations—may give very little idea of the protection that is afforded to the activity or process of transforming raw materials into semi-finished goods or components, for example. The 'effective protection' for the industry is the combined effect of tariffs on the outputs, even where the duties on both inputs to a production process and outputs of the process are simultaneously reduced. Examples of

production chains where escalation of intervention can be observed are meat, oil seeds/vegetable oils, leather, wool, cotton, jute, iron and steel and phosphates.

It is unlikely that there will be any rapid dismantling of trade intervention, especially in respect of restrictions on imports, although domestic budgetary considerations (rather than international agreement) may yet prove to be decisive in respect of the continued large-scale subsidized exportation of surpluses. There is now generally much greater reliance on subsidies and other non-tariff barriers. There are also quite divergent attitudes among the major trading countries towards the use of subsidies, reflecting in part attitudes towards interventionism in general. Subsidies form an integral part of the policy environment of most countries in agriculture and the conversion of the associated border controls (quotas, variable levies, etc.) into ad-valorem tariffs.

Developing countries are likely to make substantial gains if trade barriers on products such as tobacco, roasted-coffee, instant coffee, coffee extracts, cocoa derivatives, oil seeds and vegetable oil were lowered or removed and tropical products in any liberalization effort which is to be beneficial to developing countries as a whole. Liberalization of trade in cereals could have initial detrimental effects for food importers, it may well be that the associated price increases, which are expected to follow liberalization of trade in such products could provide a stimulus to the development of production of food-grains in those countries, so that the longer-term balances could be quite different from those predicted by current modelling exercises.

The MFA was originally intended to provide a period in which the uncompetitive lines of production in the textile and clothing sector in certain developed market economies could be phased out without excessive adjustment problems. The developing countries were to be provided with expanding market opportunities. Under the MFA and its extensions, trade in textiles and clothing has become progressively more restricted. Over time the annual growth rates have rarely achieved the six per cent target. The developing countries sought continued assurance of

liberal and stable access through the tightening of safeguard measures and continued provision for small suppliers, new entrants and cotton and wool-based exporters.

Tariff protection in the clothing sector is the highest of any sector in DMEC markets. In the textiles and clothing sector the percentage of DMEC imports of clothing from developing countries subject to NTMs is two to three times the incidence of measures facing other DMECs. The achievement of trade liberalization in this sector is of enormous importance to the developing countries. Liberalization of tariff and non-tariff barriers by the major developed conntries in this sector would lead to an increase in imports from the developing countries of the order of $ 14.9 billion. This represents approximately 40 per cent of all the potential gains to the developing countries from the liberalization of all tariffs and NTBs in these major markets.

Changing Patterns in World Trade

In the agricultural sector world production increased substantially over the period 1975-1985 and the growth rate of production was higher in the aggregate of developing countries than in the developed market-economy countries and the socialist countries of Eastern Europe. The secular decline of agricultural products as a proportion of total world trade has continued over 1975-1985. International price developments in the 1980s have been very unfavourable to agricultural exporters. There has also been a marked long-term decline of real agricultural prices which has been evident in a deterioration of the terms of trade of many developing countries.

In the Industrial sector, a comparison of the periods 1975-79 and 1979-1983 reveals that there has been a marked slow-down in growth in nearly all branches of industrial activity in the three groups of countries in 1979-83 and 1985-86. In the developing countries and the socialist countries of Eastern Europe a deceleration in changes in manufacturing output structure could be observed in 1979-83 whereas the pace of structural change in output appears to have been somewhat faster in the developed market-economy countries. Changes in the employment structure slowed down in all three groups of countries in 1979-83 and 1985-86. The expansion of output shares was generally concentrated in fewer industrial branches in 1979-1983. A number of industrial branches experienced simultaneously above average growth in output in the developing countries and below average growth in output in the developed countries.

The value of total world trade declined by 1.2 per cent per annum over the period 1980-84 and trade in manufacturers marginally by 1 per cent per annum. This contrasts dramatically with the period 1973-83, when total world trade expanded at an annual rate of 19.5 per cent and world trade in manufactures recovered an average annual increase of 17.7 per cent. The Group of developing countries expanding their manufactured exports at an average annual rate of 10.5 per cent.

The U.N.C.T.A.D. VII Session just concluded at Geneva has ended on an optimistic note of consensus in the areas of international trade, launching of the integrated program on commodities, debt and the special program for least developed countries.

Impact of Computerisation on Work Design

VINAYSHIL GAUTAM
R. THIAGARAJAN

In this paper the authors examine the impact of computer on the structure and people in the organisation and the work itself.

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Introduction

The popular belief that the Computer revolution in management is not far off is fast becoming true. Compared to 10-15 computers worth about 30 million $ in 1955 all over the world, the number in 1978 rose to 60,000 computers worth $ 18 billion and the latest data puts the number of computers to more than a million.[1] The anticipated benefits of computer based management system have been realised even by the developing countries and as such their policies are fast moving towards greater utilisation and application of computers. In India for example, greater emphasis has been now placed on computer education right from the school level and more and more institutions including public and service sectors are utilising it in their day to day functioning. However, this number is not as large as in industrialised countries.

An attempt has been made in this paper to examine the impact of computer-based management system on the members of the organisation and the work itself. More precisely, our focus is on : Are organisation structures becoming more and more centralized as a result of computers ? Are these organisational changes a necessary result of computer technology or are other factors more important ? How has the nature of managerial work changed ? And how will higher levels of management be affected ?

We may begin our discussion by briefly summarizing the benefits of computers in say a manufacturing unit. The list will include : reductions in cycle time from receipt of the customer order to shipment of original equipment and spare parts; reductions in inventory; more efficient use of manpower and machinery; reduced costs through elimination of indirect manufacturing expense jobs; and more timely, accurate schedules and management measurement reports.[2] At a broader level, the benefits could be as stated by Christopher Evans : "cheap person to person communication . . . favours the kind of open society and has just the opposite effect on autocracies—both right and left wing—who like to make sure that all information is handled firmly downwards".[3]

Despite these possible gains, we must realise that any form of technology should be understood primarily with the interaction of men and machines.[4] The lack of knowledge and its consequences have been reported by various scholars. One should be careful to avoid the alienation and frustrations of the kind which have been described long ago by such visionary minds as Kalka.[5]

As such, one must examine the impact of computers on the work system and various categories of employees. For the industrialised countries, some studies of this kind were conducted by Anderson;[6] Rathenau;[7] and Whisler.[8] What we learn from these studies is that problem of implementation of computer technology is primarily problem of the administration of change. For this reason, one should examine more closely the 'human' aspects of the change process, rather than the technical aspects of the programmes themselves. We must acknowledge that while writing about the progress in the developing world, the limited coverage by scholars often restrict to draw any meaningful conclusions.

Centralization of Organization Structures

Whisler's[9] study on impact of information technology on organisational control has shown that computer-based information system often leads to centralised control in organization. Functional areas such as accounting, production and supply manage-

ment, are also subjected to centralisation. Klahr and Leavitt[10] developed an analogy between computer programmes and organizational structures : closed—routine programmes and organizations will move towards centralisation whereas open-routine or executive programmes and organizations will tend to be decentralised. Similarly Delehanty,[11] while studying the life insurance companies found operational centralization as a result of computers.

On the other hand, work of Dearden[12] indicated strong doubts and mentioned that it was the lack of time by top management to make detailed decisions, rather than the lack of information, which was the real reason for decentralization.

It is, thus, difficult to say whether computers are making the system more centralised. Perhaps at various stages of organizational life, some amount of centralisation or decentralization will be there irrespective of the change that is occurring in the availability of information.

The Changing Nature of Managerial Work

Various terms are used to describe different types of managerial jobs—logistic, operations and structured, repetitive, routine etc. Managers dealing with purchase, production planning and control etc., perhaps, will have fewer people reporting to them for the same volume of activity and they will be freed of this responsibility devote more of their time to other problems. This also could raise a serious issue. Has the middle management group shrunk in size as a result of computerisation ? Delehanty[13] pointed out that possibly at a later stage of automation the total middle level group may shrink.

Forester[14] put the case for managers versus computers even more strongly. As computers are supposed to take over routine work from managers at all levels, there remain unstructured jobs that were getting done before because these managers were too busy.

Let us assume a partial reorganisation of an engineering factory in which machine shop and

assembly line have been automated. The consequence will be a change of tasks alongwith the loss of certain jobs. Work preparation, production itself and sales will be closer to each other. A new kind of broader specialist may be in demand.

Thus, the impact of computerisation could be seen as resulting in change of job and change in the structure or control system of the organisation. In Germany, attempts were made to estimate the number of jobs which change through the impact of information technology. It was found that about 50 per cent of the jobs will have changed character within about 15 years.[15]

Yet another change could be a shift from subordinate to supraordinate goals. Rewards will not be on the basis of their 'independent' accomplishments of the subordinate, specific goals in their own section, subsection or unit but would also include assistance in the attainment of the supraordinate goals of the total organisation. The possibility of losing control may cause (1) a great deal of massive resistance on the part of managers, particularly at the unit and subunit level and (2) the demand that the programmes, at the interface between different sections or subsections come under manual control of the individual manager.

Effect on Higher Levels of Management

Many of the foregoing comments apply also at the higher level of management where tasks are likely to be more unstructured and more 'amorphous'. The ill-defined, novel tasks on which top levels of organisations usually work generate flexible, open, non-hierarchical structures corresponding to participative management. Possibly the evolutionary application of more elaborate programmes will trigger a new wave of interactions and interchanges between organisations and computer programmes.

Man-machine interaction systems, 'using real-time and time sharing computer technology may be particularly applicable at higher management levels. Carroll[16] pointed out that these systems can be flexible, providing data at the moment of decision and offering capability to answer 'what if' questions about price policies, markets, product mixes etc.

Experience of Robert H. Guest[17] of General Motors' plant in using computers to reduce breakdowns indicated that as a consequence, the top managers had more time to work with their peers and subordinates on their problems. The perspective of the manager had been extended out in time.

Let us now look at the Indian experience. Let us view one of the large organizations, namely the Survey of India.

(1) WHAT IS SOI

Historical Background

Survey of India (SOI) was established in 1767 to assist the then East India Company in conducting topographical surveys of their land holdings, in and around Calcutta. Later, as the influence of the company grew in India, similar survey departments were established in Bombay and Madras Presidencies.

One of the notable achievements of the department during the initial years of SOI was the Great Trigonometrical Survey of India commenced in 1802, with the active participation of the persons like Sir George Everest (after whom Mount Everest was named).

The work of SOI increased manifold soon after India obtained Independence in 1947. The SOI has had to survey and map not only the various areas within the borders of the country but also the inaccessible borders as well as off-shore islands such as Andaman and Nicobar.

The SOI has approximately 18000 employees on its strength. While some of the employees have been taken from the Indian Army on deputation, some others are recruited directly from the market.

Organizational Structure

The SOI, as shown in Fig. 1, is organised into 9

regional circles and 6 specialised Directorates/Offices under the overall control of the Surveyor General (SG) of India who has his Headquarters at Dehradun.

The regional circles are the one which accomplish the main tasks of surveying and mapping. Thus, the Directors of Regional circles report directly to the SG in the present scheme of things.

Specialised Directorates or offices, on the other hand, have been established with the main purpose of

2. PRESENT STATUS OF COMPUTERISATION AND THEIR IMPACT ON SOI

Computers of various degrees of power have been introduced in different Regional circles and specialised directorates of SOI in the recent past. The computers that have been installed in-house are mostly mini and micro computers. On the other hand, specialised directorates such as Geodesy and Research Branch (located at Dehradun) use large computers for making large-scale mathematical calculations.
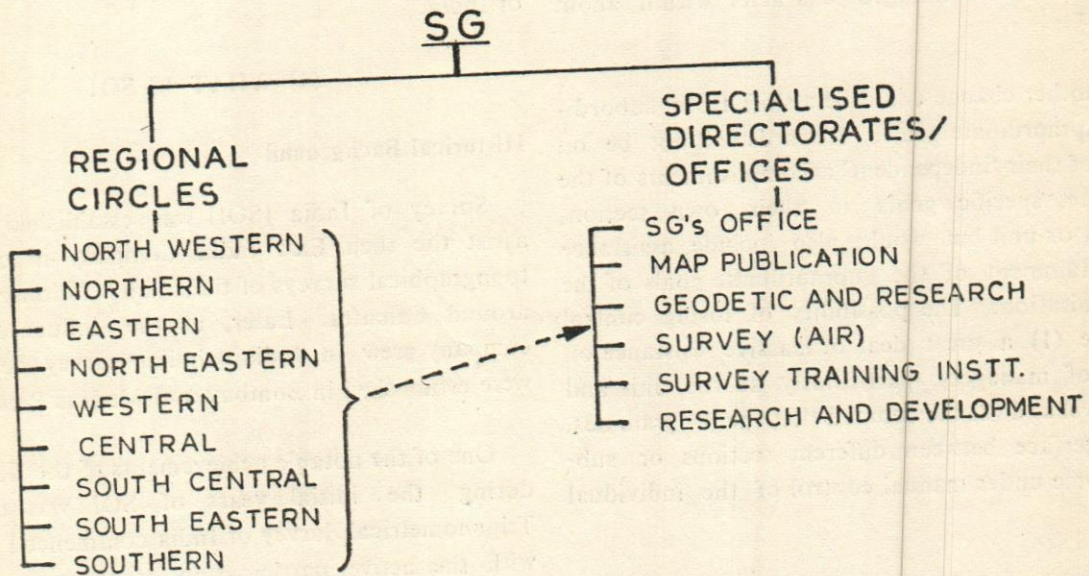

Fig. 1 Organizational Structure of SOI

providing Research and Development, Training, map production, satellite imagery studies and so on. The work of the specialised directorates, over the years, is being increasingly accepted by regional circles as an important component of SOI. Further, jobs like printing or training are found to be acceptable as centralised functions to Regional circles.

Output of SOI

The output of SOI is mainly maps in various scales and detail maps for use by Airlines, Defence Forces, Tourists, Revenue authorities and so on differ in size and the extent of detail so reflected. The present output is considered to be woefully inadequate considering the demand for maps on the one hand and level of accuracy on the other.

Impact of Computers on SOI

The impact of computers can be considered at two levels. These are :

(a) at the regional circle levels, and

(b) at the specialised directorate level.

At the Regional Circle Level : The work-load at the regional circle level is mainly confined to (1) field survey work and (2) office work for mapping. While the 'field Survery work' has not been affected by use of computers, it is the 'mapping work' at the office that has undergone some change.

Some Effects of Computerisation : Some of the

effects of computerisation at the regional circle level are as follows :

(a) creation of a central service,
(b) importance accorded to a few,
(c) work-load not shared by all.

Creation of a Central Pool

Before the advent of computers, a person who was good at doing calculations in a speedy manner using desk calculators and slide rules was considered important, but, with the heralding of computers, a new breed of 'Bright Boys' have been accorded importance. These 'Bright Boys' have been given direct access to the top management which was not existent earlier. Please see Fig. 2 & 3 in this context.

'computer boys' find it difficult to share such work. On the other hand, a person working in a field party may ask his colleague to do some part of a familiar work for sometime and thus, take time off, as it were. Because of this phenomenon, non-computer departments tend to resent 'computer boys'.

Specialised Directorates : Computer work at the specialised directorate level demands access to large computers which the organization does not have at present. Thus, the staff of specialised directorates are required to go to organisations (outside SOI) to process data. There has not been any major change in the strtucture of the specialised directorates, however, are required to put in extra work compared to their colleagues.
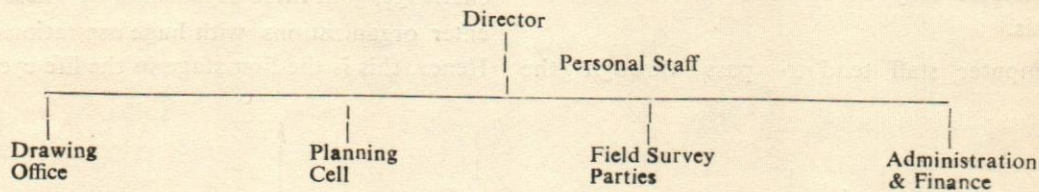
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                          Director
                             |
                       Personal Staff
    _____|_____
    |              |                  |               |
 Drawing       Planning         Field Survey      Administration
 Office        Cell             Parties           & Finance
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Fig. 2   Regional Circle Before Computerisation

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                          Director
                             |
  Computer Group ——— | ——— Personal Staff
    _____|_____
    |              |                  |               |
 Drawing       Planning         Field Survey      Administration
 Office        Cell             Parties           & Finance
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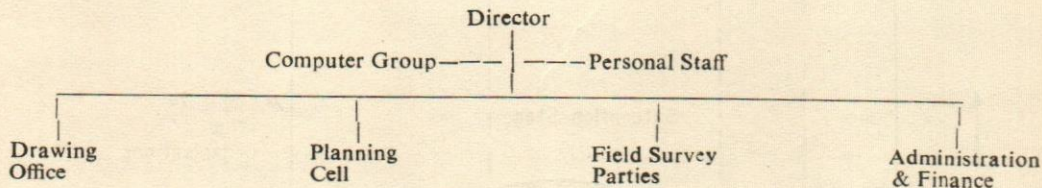
Fig. 3   Regional Circle After Computerisation

* Computer Group formed by taking 'Bright Boys' from other Groups.

Importance Accorded to a Few : Because computer work demands people with above Average Intelligence, the Director is forced to choose the best virtue of such relation, the members of this group tend to become 'elitist'.

Workload not Shared by All : By the very nature of computer work, no sharing of workload is possible. In fact, it would be difficult for a person working in a field survey party to appreciate the problems, frustrations and constraints faced by a person working in a computer cell. Since most of the work engaged in by the computer cell is intellectual in nature, the

(3) COMPUTERISATION PLANS OF SOI AND THE LIKELY IMPACT

Plans of SOI : SOI, like a number of other organisations in the country, has formulated plans for induction of large computers. Such computers have been found to be essential to cope with the SOI workload. Implementation of these plans is beset with some problems. These are as follows :

(a) Non-availability of expertise in SOI.
(b) Need for creation of a computer group.
(c) Role of this group vis-a-vis other groups.

Non-availability of Expertise in SOI : SOI is basically a surveying and mapping organization. Therefore, it is not appropriate to expect SOI to possess expertise in computers. Though some members of staff of SOI have been trained on computers in foreign countries, such training has not been followed up seriously. Therefore, it has become necessary for SOI to think of recruiting experts to work with computers (when they are installed by SOI).

Recruitment of outside experts is beset with the following problems :

(a) Outsiders (if they are experts) would demand more pay and emoluments than SOI staff (who might be in the same age group and are likely to possess more experience in survey and mapping matters).

(b) Outsiders may be recruited on a contract basis.

(c) Computer staff tend to pass through the

—Achievement
—Saturation
—Frustration
—Flight/Fatalism
    'Life Cycle' of progress of Computer Experts

(d) Insiders resent prominence given to outsiders.

Stages in the Life Cycle of Progress

Every organisation—Large or small; Indian or Multi-national; Industrial or Business; Religious or Military; Academic or otherwise: Governmental or non-governmental, tends to advertise for the best persons when it intends 'going computers'. Thus, a number of computer experts, in the hope of not only getting more emoluments than what they are hitherto getting but also contributing to professional calls of challenge, join these organisations. These professionals enter organizations with huge aspirations and hopes. Hence, this is the first stage in the life cycle.
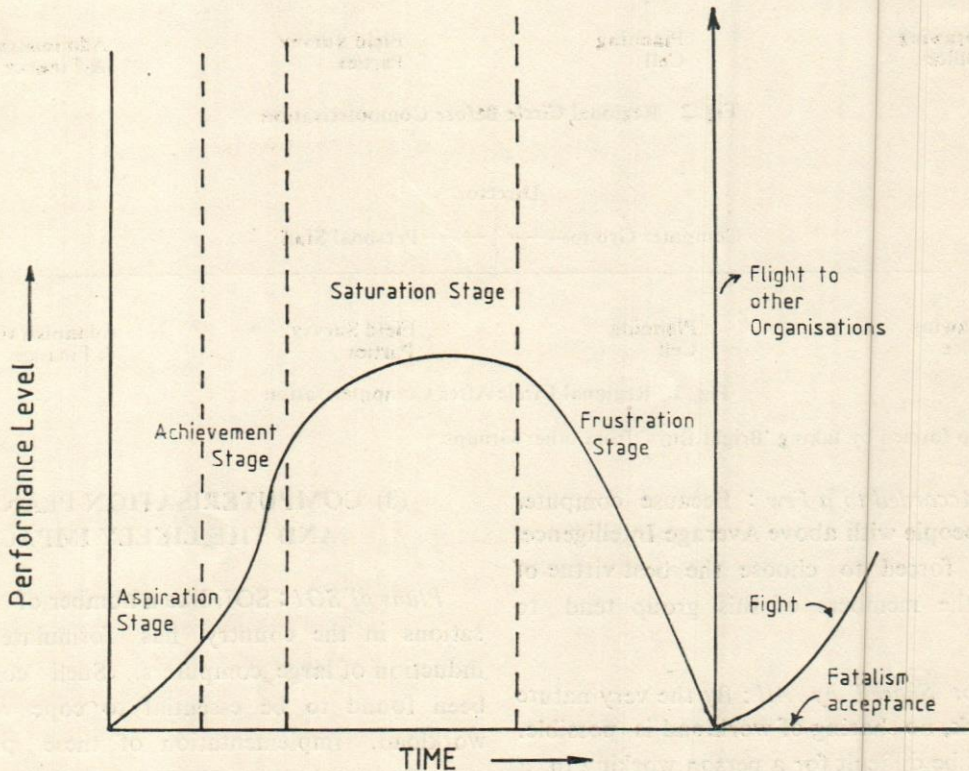

Fig. 4 'Life Cycle' concept of performance of computer professionals

following stages of progress in the organisation (as depicted in Fig. 4) :—

—Aspiration (hopes)

Achievement

Since the top managements of these organizations are also 'turned on' towards computers, the computer

professionals are able to show significant achievements in the initial stages of their stay in these organizations.

Saturation

As days pass and a few months roll by, a degree of saturation tends to set in. This comes about the degree of novelty wears off and the top management does not find much time to share the excitement of the 'Computer Boys and Girls'.

Frustration

With the onset of saturation, the computer professionals find that they have nothing new to offer, their efforts are not appreciated any more and even their fellow professionals in other organizations do not recognize the work done by them. Thus, a significant degree of frustration sets in. These computer professionals, therefore, start sliding in their performance. The organizational effectiveness also drops.

Fight/Flight/Frustration

To ward off a fall in professional competence, many professionals take to fighting the top management so that more job challenges are offered. Some professionals take to flight by looking for greener pastures in other organizations. Those who are not

on the behaviour of persons engaged in computer work. Computers have an equal influence (if not more) on other components of the organization and have a tendency to affect the performance of the various segments of the organisation.

New 'Power Centres' : As shown in Fig. 5, the 'Computer Division' or 'Cell' a concept conceptualised in the case of Survey of India (SOI), as in other large organizations, comes into existence when computers are introduced for the first time. These 'computer divisions' tend to become 'Power Centres' as they handle 'information'. In a way, Finance/Accounts Departments on the one hand and personnel departments on the other also have been handling sensitive information earlier. 'Computer Divisions' are able to store all information, whether sensitive or otherwise, in one central (and compact) place now. Thus, the 'Power' of information is gradually getting shifted to 'computer professionals'.

Sense of Insecurity : The various employees (whether they are managerial, supervisory or otherwise) working in conventional departments find themselves 'left out', as it were. They are not able to understand the new equipment (computers) fast enough nor are they able to adapt themselves to new procedures and forms as a result of computerization.

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                          SG
                        of SOI
                           |
      ┌────────────────────┼────────────────────┐
      |                    |                     |
 Computer               Regional            Specialised
 Directorate             Circles            Directorates

To plan, instal, operate and
control computer-based
information systems in the
organization.  All computer           Note : SG = Surveyor General
personnel controlled form here.              SOI = Survey of India
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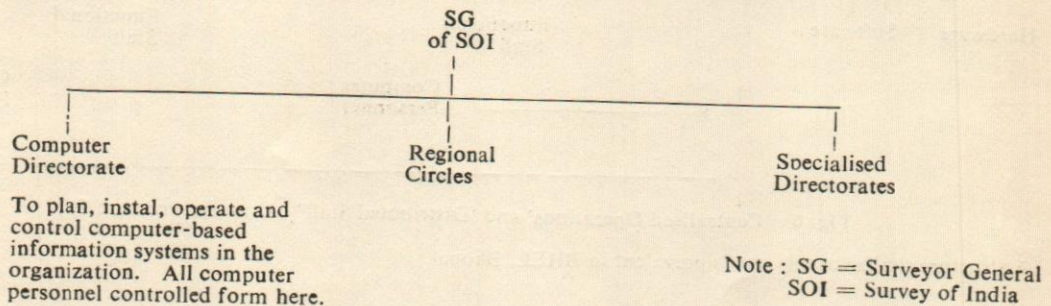
Fig. 5 Centralised 'Computer Division'

successful in either fight or flight tend to accept their position in a fatalistic manner. These employees could at best be considered to be 'routine-workers' with no new ideas to offer. Such workers would not find promotional avenues either, and are likely to stagnate.

Change in Structure

We have seen, so far, the impact of computers

Types of Structures : There are basically two structures that emerge in any organization 'going computers'. Of course, a third structure would also emerge but this structure is peculiar to academic institutions and will be discussed separately.

Centralised Staff Structure : As shown in Fig. 5, all work related to computerisation is vested in the 'computer division'. The staff of the Computer

Division work under the head of the Division. They may work with one functional department one day and with a completely strange department the very next day.

'Centralized Operations' and 'Distributed Staff'

In this structure, all planning, training and computer operations are handled by the computer division while development of information systems is achieved by attaching computer professionals, on a semi-permanent basis, with the functional departments. The computer professionals in effect, would be on the pay-roll of the concerned functional department. This structure is shown in Fig. 6. This structure is more open and would evoke confidence in the minds of the personnel in functional departments. Further, this structure has been tried out in the Government of India when Financial Advisers to various Departments work in the concerned departments and reporting to the Expenditure Secretary at the same time.

Structure in an Academic Environment

While we have seen various structures in a service organization like SOI so far, it would be worthwhile to look at the structure that is found in an academic environment due to the advent of computers. This structure entails more freedom to the functional departments than that found in Fig. 6. In an organisation like IIT or IISc, the various academic departments themselves are in a position to use computers without any large-scale help from the computer division. As shown in Fig. 7, only the hardware maintenance, software update and dissemination of information would be the responsibility of the computer division. Selection of tasks to be computerised, choice of software, maintenance of databases etc., would be the responsibility of the computer division. This structure is more of a
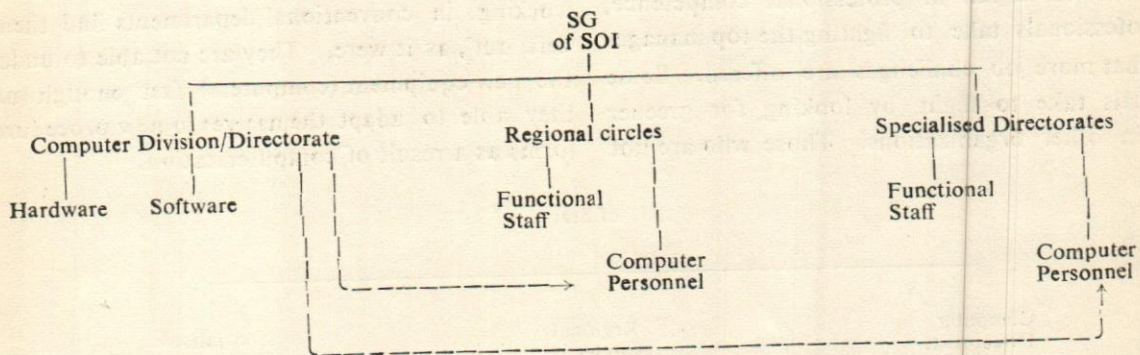

Fig. 6 'Centralised Operations' and 'Distributed Staff' (A matrix structure ?)

Note : A structure similar to this one is prevalent in BHEL, Bhopal.

In this structure, computer personnel would have to report to 'two bosses', as it were. One boss would be the 'Technical Boss' at the computer division for technical matters, while the other would be the 'Functional Operational Boss' at the functional division. This structure has been prevalent for a number of years in military organisations where the communications expert, engineering expert, expert etc. were brought under command of the Force Commander. In order to ensure coordination with other friendly forces, these experts would also report to their

'Laissez-Faire' structure.

Effect on Personnel

Whatever be the structure adopted, if computer professionals decide to stay in an organization, they normally find that they are not in a position to reach the 'top'. Can we expect a computer professional who enters the computer division of the Army to lead forces in a war ? Can we expect a computer professional to head a police force when he would not know how to handle a prisoner or a riot ? Thus, no

technical bosses. This is more like a 'matrix structure' of organization.

SG

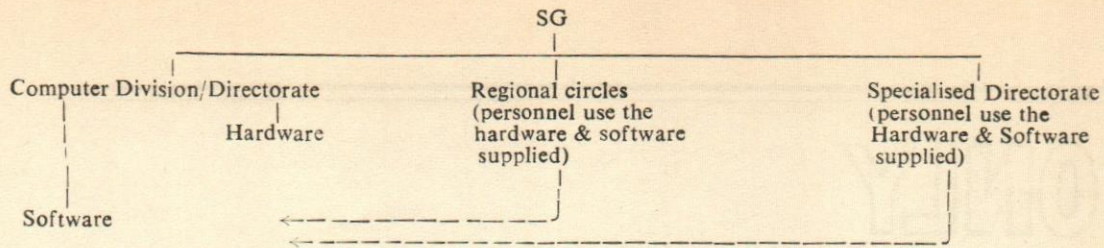| Computer Division/Directorate | Regional circles (personnel use the hardware & software supplied) | Specialised Directorate (personnel use the Hardware & Software supplied) |

Hardware

Software

Fig. 7   Structure in an Academic Institution (A Laissez-Faire Approach)

Note :   On many an occasion, functional department personnel become more proficient in computers as compared to personnel of computer divisions.

organisation permits a computer professional to head it. If a computer prefessional wishes to reach the top, he is expected to branch off into a functional area during his 'junior management' or, at best, 'middle management' days.

Conclusion

An attempt has been made in this paper to analyse the various issues involved in the induction of computers in an organization with special reference to organizational structures. A description of the merits and demerits of an 'endogenous (in-house)' as well as 'exogenous (external)' computer-professional group induction has been attempted in this paper.

One can, however, see a clear emergence of 'Matrix' organizations with the advent of computers. One can also see the possibility of internal frection between the restraining forces' of the 'state-quoists' and the 'driving forces' of the 'change-agents' in the organization.

Computers are tools just like typewriters, photo-copiers and the like with one major difference. Computers are 'active' in that they provide 'live' and hot information.

A number of studies undertaken in the Indian context on the impact of computerisation on organizational structures need to be undertaken so that a systematic guidline could be evolved for use by organizations 'going computers'.
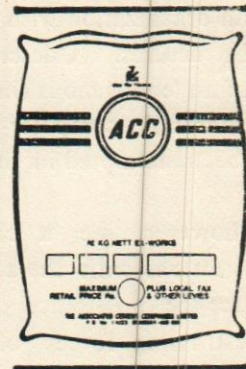
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Capital, Employment and Output Relations in Chemical Industry

A.S. RAO

This paper examines the capital, employment and output relations in chemical industry. According to the author the smallest and the most recent units have shown relatively high growth.

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Introduction

Small scale industries have been an integral and continuous element in India's economic structure. The importance of this sector lies in creating greater employment in the short run and its contribution to national income. Small scale industries are effective mobilizers of small and localised resources and entrepreneural skills thus leading to higher economic activity and regional development. These enterprises are thought to be less capital intensive, therefore more suitable for underdeveloped countries, where there is dearth of capital and skilled labour. The relations between capital, employment and output in these enterprises are determined by the technical progress, marginal productivity of capital, fluctuations in economic activity and host of other factors. In this paper an attempt has been made to study the capital, employment and output relations of small and medium scale chemical units in Baroda city.

Chemical industry rank first among the indigeneous industries of India. It was the largest creator of net value added (12.1 per cent) and output (13.3 per cent) in the factory sector in 1980-81.[1] In Gujarat State, chemical industry has been the largest creator of net value added (20.6 per cent) and output (19.9 per cent) in factory sector in 1980-81.[2] This industry is highly capital intensive and has a high rate of technological obsolesence. Chemical industry is diverse and the

fastest growing sectors within it are petrochemicals, plastics, fertilizers. Chemical industry makes valuable contribution in augmenting food production, conservation of water resources, provision of newer fibres, construction and material, meeting health needs, control of population etc. This industry also meets domestic needs in many ways.

Baroda has emerged as one of the most industrially progressive towns in Gujarat. There is a heavy concentration of large-scale industries in Baroda. Leading industrial groups are petrochemicals and pharmaceuticals. Chemical industry is the fastest growing industry in Baroda and the largest creator of employment since 1975.[3] There are 23 high tension (about 100 HP) chemical units in Baroda. The growth of small and medium scale units is high since early 1970's. In the year 1960 there were 36 chemical units in Baroda district and by the end of 1984 there were 512 working chemical units in Baroda only. The growth of chemical based industry is mainly due to location of GSFC, IPCL and other large scale chemical units. Around 90 per cent of Chemical Units in Baroda district are located in the city.

For the purpose of the study all the industrial estates in the vicinity of Baroda which are connected with Baroda for all practical purposes, are taken as part of Baroda City. The concentration of small and medium scale units in Baroda is as high as 61 per cent of the district. Data collected from Gujarat Electricity Board (GEB) records and Baroda Municipal Corporation show that the electrified industrial units in Baroda district have increased from 1446 units in 1960 to 8400 units[4] by the end of 1984 and have grown at 7.61 per cent per annum.

Small Scale Units—Definition

Generally small scale units are defined with reference to employment size or funds invested. Capital and employment are two major factors of production having varying degree of substitutability between them according to technological and economic considerations. Capital being a composite commodity, problems arise in measuring the value of capital. It is rightly pointed out by Hashim, Dadi and others[5]

that "Broadly two classes of industrial units could be identified i.e. (i) those using modern technology and (ii) those using traditional technology . . . . . . Identification of technology becomes easy with reference to the use of machines using power. Use of electricity as a source of power denotes modern technology. For electricity using industries, load connected in terms of Horse Power (HP), also becomes a good basis of classification of size. HP is a stable and easily identifiable criterion of size classification. It also represents technology". The definition of small scale unit has undergone various changes. The latest definition considers all units upto Rs. 35 lacs investment in plant and machinery and the unit is Rs. 45 lacs for ancillary units.

Data Base

In Baroda there are 4204 low and medium tension (less than 100 HP) units working by 1984 end, of which 512 are chemical units. A sample of 95 units was drawn out of 512 chemical units below 100 HP. The sample was drawn by way of random sampling. Due representation was given to various strata based on products and HP connected. 10 industrial units with above 100 HP connected were also surveyed and the results of which are incorporated in this study. The sample forms 18.6 per cent of total chemical units in Baroda. A questionnaire was canvassed personally and the data refers to the year 1984-85. All units were visited personally and information cross examined. The units from which information was collected are classified into seven industrial groups. Of the 95 units only 12 were established before 1970 and 26 after 1980, as many as 57 units were established between 1970 and 1980. The distribution of industrial units in sample by Industry and load connected is given in Table 1.

In what follows an attempt has been made to study the growth and capital structure of various chemical industries. Analysis has also been done on the basis of age of firms and load connected.

Growth of Sales and Development

Since the data is available for benchmark years, growth rate is calculated by considering the period as

TABLE 1

Distribution of Units by Industry and Load (HP) Connected

Industry	0-10	11-20	21-30	31-50	51-75	76-100	Total	% of Total
Inorganic Chemicals	2	1	4	2	3	5	17	17.89
Organic Chemicals	1	1	1	2	5	2	12	12.63
Fertilizers and Pesticides	2	—	—	1	4	4	11	11.58
Dyes, Paints and Lacquers	1	4	3	3	1	3	15	15.79
Drugs and Pharmaceuticals	3	—	1	5	1	4	14	14.74
Soap and Cosmetics	5	2	3	—	—	—	10	10.53
Other Chemicals	5	1	3	1	5	1	16	16.84
Total	19	9	15	14	19	19	95	
Percentage of Total	20.00	9.48	15.78	14.74	20.00	20.00		100.00

a whole. As the firms in the groups have different age structures, the growth rate is calculated for each firm and the average growth per annum for the group is calculated by drawing the average of the growth rates of all firms in the group. In this study the deflated sales are taken to calculate the actual growth in sales. Both the initial and final sales are adjusted so as to represent them at constant prices (i.e., 1970-71=100). The adjustment in prices is done taking the price index of corresponding products.

Employment and sales growth rates for various industries are furnished in Table 2. It is found that growth in employment is high for Drugs and Pharmaceuticals. The growth in sales is highest in case of soap and cosmetics which show least growth in employment. This could be because of the size of units in soap and cosmetics industry. All the firms in soap and cosmetics industry of the sample are below 30 HP and 7 out of these 10 units are in less than 20 HP group. The least growth in sales is in case of Dyes, paints and lacquers which also show lower growth in employment.

Table 3 gives the growth rates for employment and sales for various size groups (HP connected).

TABLE 2

Growth of Sales and Employment by Industry

Industry	Growth Per cent per Annum	
	Employment	Sales
Inorganic Chemicals	13.706	24.075
Organic Chemicals	16.1	12.267
Fertilizers and Pesticides	13.98	13.42
Dyes, Paints and Lacquers	9.407	12.207
Drugs and Pharmaceuticals	20.936	13.136
Soap and Cosmetics	3.512	33.512
Other Chemicals	6.406	18.00
All Groups	12.276	17.486

Note : Formula used $Y = ae^{bt}$ where Y = final years sales or Employment 'a' initial years sales or employment. Growth is calculated by averaging b's of all the firms in the group.

Units below 20 HP have relatively low growth rates employment and high growth rates of sales. The highest growth in employment is case of units in the range of 51-75 HP and least in case of units in 0-10 HP range. The highest growth in sales is for units

TABLE 3
Growth of Sales and Employment by Size of the Units

Horse Power	Growth Per cent per Annum	
	Employment	Sales
0-10	5.072	22.800
11-20	7.414	24.543
21-30	14.457	15.100
31-50	11.547	8.893
51-75	16.765	16.237
76-100	15.607	19.579
All Units (Below 100 HP)	12.275	17.486
Above 100 HP	10.986	28.029

Note : For the formula used—see Table—2, note.

of 11-20 HP range. For greater production of all units it is found that average growth in sales is greater than the average growth in employment. For units above 100 HP the growth rate in employment is 11 per cent per annum and 28 per cent growth in case of sales.

Table 4 gives annual percentage growth rates for employment and sales by the year of establishment of units. It is clear from the table that the growth rates for both sales and employment is inversely relat-

TABLE 4
Growth in Sales and Employment by the Year of Establishment of Units

Year of Establishment	Growth Per cent per Annum	
	Employment	Sales
1960 and before	0.933	10.133
1961-65	5.90	3.40
1965-70	5.60	8.50
1971-75	4.28	10.74
1976-80	10.024	14.024
After 1980	27.181	32.577
All Units	12.275	17.486

Note : For the formula used—see Table—2, note.

ed to the age of the firm. The growth in employment is least for units established before 1960 and is highest for units established after 1980. The sales growth is also highest for units established after 1980.

Age of the firm is found to be inversely correlated to growth in sales and growth in employment. The correlated coefficient for age, growth in sales and age, growth in employment are -0.2692 and -0.3618 respectively. They are both significant at 1 per cent level.

Capital Coefficient

Capital coefficient measures precise quantitative relation between a unit of gross output and the quantity of capital required to obtain that output. Capital required to produce one unit of output, gives the measure of capital intensity of the unit. In calculating the ratio, capital has been expressed at current prices (1984-85). The initial purchase price of plant and machinery and the subsequent additions to the plant and machinery were collected along with other data. As these cannot be aggregated, the gross fixed capital is inflated with corresponding price index to represent at 1984-85 prices. Therefore the total capital is expressed at current prices. The capital coefficients are shown in Table 5.

TABLE 5
Capital Per Unit of Gross Output (Capital Coefficient) by Industry

Industry	Fixed Capital	Inventories	Total Capital
Inorganic Chemicals	0.3837	0.1495	0.5322
Organic Chemicals	0.5013	0.1553	0.6566
Fertilizers and Pesticides	0.3490	0.1696	0.5186
Dyes, Paints and Lacquers	0.3378	0.1239	0.4617
Drugs and Pharmaceuticals	0.3744	0.2809	0.6553
Soap and Cosmetics	0.2685	0.1388	0.4073
Other Chemicals	0.3013	0.1430	0.4443
All (Below 100 HP)	0.3637	0.1753	0.5390
Above 100 HP	0.7472	0.1610	0.9082

For all chemical industries below 100 HP, 0.54 units of capital is required to produce a unit of gross output. For units above 100 HP the capital coefficient is 0.9082. In the study by Lakdawala and others, capital—Actual output ratio for all small industries is 0.3136.[6] Among units below 100 HP, organic chemical industry has capital coefficient to be 0.657 which is maximum, least being 0.407 for soap and cosmetics. Capital coefficient for chemical industry in 1963 at purchasers price is found to be 1.2278.[7] The capital coefficients are calculated for fixed capital and inventories separately. Among units below 100 HP, Drugs and Pharmaceuticals needs maximum inventory, which is largely due to large stock of semifinished goods. Fixed capital coefficient is highest for organic chemical industry, least for soap and cosmetics. For units above 100 HP fixed capital coefficient is 0.747 and inventory coefficient is 0.161.

Capital coefficients by size of units are furnished in Table 6. Here the size of the units is denoted by the Horse Power (HP) connected size of firm does not appear to influence the capital coefficients. The units with median groups show lower coefficients than at extremes. The units in 21-30 HP range have least capital coefficient of 0.492, highest being 0.578 for units in 76-100 HP range. The capital coefficients calculated with fixed capital inventories show similar results. Inventory coefficient appear to show correlation with size but least is in case of units in 21-30 HP range and maximum for units in 76-100 HP range.

TABLE 6
Capital Per Unit of Gross Output (Capital Coefficient) by Load (HP) connected

HP Connected	Fixed Capital	Inventories	Total Capital
0-10	0.3591	0.1646	0.5237
11-20	0.3347	0.1635	0.4982
21-30	0.3567	0.1358	0.4925
31-50	0.3195	0.1737	0.4932
51-75	0.3868	0.1916	0.5784
76-100	0.3766	0.1915	0.5681
All	0.3637	0.1753	0.5390

Capital—Gross Value Added Relation

Gross value added is the value created through the process of production by the interaction of various factor inputs and is arrived at by deducting the cost from value of gross output. The Capital-Gross value added ratio measures the quantitative relation between the gross value added and the amount of Capital required to create that value. The results are presented in Table 7. The Capital-Gross value added

TABLE 7
Capital per unit of Gross value added by Industry

Industry	Fixed Capital	Inventories	Total Capital
1. Inorganic Chemicals	1.7813	0.6940	2.4753
2. Organic Chemicals	1.8873	0.5845	2.4718
3. Fertilizers and Pesticides	1.6423	0.7982	2.4405
4. Dyes, Paints and Lacquers	1.2669	0.4646	1.7315
5. Drugs and Pharmaceuticals	1.2973	0.9732	2.2705
6. Soap and Cosmetics	1.0021	0.5179	1.5200
7. Other Chemicals	1.0262	0.4969	1.5231
8. All (Below 100 HP)	1.4026	0.6759	2.0785
9. Above 100 HP	3.8911	0.7362	4.6273

ratio for all units below 100 HP is 2.078 and 4.627 for units above 100 HP. Capital-Value added ratio for small scale chemical and related products in the study by Lakdawala and others is found to be 1.076.[8] In the study by Sandesara the capital-output ratio varies from 3.33 to 2.5 for year 1953 to 1958[9] and 1.987 in study by Hashim and Dadi.[10] Inorganic chemicals need 2.475 units of capital to create one unit of Gross value added. Drugs and Pharmaceuticals needs highest inventory per unit of Gross value added. Organic chemicals require highest fixed capital, for a unit of Gross value added least being, in soap and cosmetics. For units above 100 HP, 3.891 units of fixed capital is required to create one unit of Gross value added.

Conclusion

From the above analysis, it is observed that the growth rate in the sales is generally higher than the growth rate in employment. But the units in industrial groups of organic chemicals and drugs and pharmaceuticals show higher growth in employment than in sales. The growth in sales is not found to be correlated to size, but growth in employment is found to be least among the smallest sizes. It has also been observed that the growth rates are significantly correlated to age of the firms. It may be concluded that the units above 100 HP are more capital consuming. The units in middle HP groups are less capital intensive than units at the extreme (below 100 HP). Variations are found to exist in the productivity and the capital intensity among various groups in chemical industry.

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Relationship Between Measures of Personality Traits

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In this article the authors investigate the relationship between mechanical and clinical measures of managerial personality traits.

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Over the past several years, comprehensive research has been carried on, that deal with determinants of managerial effectiveness. These studies reveal three major aspects viz.

(i) managerial effectiveness demands intelligence, decision making, judgement, entrepreneurship and willingness to accept responsibility, etc.

(ii) there are different types of managers and their jobs differ greatly from one another in both qualities and modes of operation.

(iii) the managerial effectiveness is a function of the complex interaction between ability, motivation and opportunity and the organisational climate, incentive and reward systems of the organisation.

As the effectiveness of a manager depends upon the organisational environment to a great extent and as functions of managers vary widely depending upon the level in which they have to function, the researchers began to focus on the role, the managerial characteristics coming into play in specific situational context and specific managerial level. Tools and procedures are being developed to measure the traits which are expected to predict managerial effectiveness at specific level under specific organisational climate.

The procedures or instruments developed in the

process of research can be classified into two broad categories—mechanical and clinical. Standardised tests and inventories fall under the mechanical methods of collecting data whereas interview, examiners' ratings based on behaviour of individuals in a group are examples of clinical methods of collecting information. Comparison of the two methods with reference to their predictive efficiency shows that predictions derived via clinical combinations of information (no matter how they are gathered) have never yielded more accurate prediction than those based on mechanical procedure. The best possible result can be obtained by combining information gathered through mechanical and clinical methods.

The aim of the present study is to investigate the relationships between two measures of managerial personality traits, which intend to predict managerial effectiveness in their own way and each of which possesses considerable predictive efficiency as proved through past studies. One of the measures may be called mechanical while other one may be classified as clinical. Along with these two, a third measure was also considered and that was self assessment of managerial abilities. In recent years self assessment is gaining increasing attention and researchers are interested in testing the feasibility of its application in different situations. Considering these facts self assessment was taken into account along with other standard procedures of assessment.

Method

The instruments and procedures

The three measures which were considered in this study are (a) the Miner's Sentence Completion Scale (Multiple Choice Version, 1977); (b) the examiners' ratings on certain managerial qualities through Group Task; (c) the self ratings on the same traits based on the respondents performance in the Group Task.

Miner's Sentence Completion Scale (MSCS) is a projective measure developed entirely on the basis of theory. Each item consists of an incomplete sentence followed by six suggested answers. All total there are 35 items which measure motivation potential of the

respondents in areas like (a) Authority figures, (b) Competitive games, (c) Competitive situation, (d) Assertive role, (e) Imposing wishes, (f) Standing out from group, (g) Routine administration. All these as per the author constitute the structure of motivation to manage. A high score in this scale reflects a positive attitude toward certain aspects of the management role. Those individuals who have positive emotion with various role prescriptions which are identified as characteristic of managerial positions would definitely tend to meet the existing organisational criteria of effectiveness. This, of course does not mean that motivational factor alone can determine a person's performance level in managerial work. Cognitive factors like Intelligence, Verbal Ability, Job Knowledge, etc., are definitely important. But, at the same time the contribution of motivation cannot be ignored. The test-retest reliabilities of the entire scale varied from .83 to .90, whereas those of the seven subscales ranged from .44 to .63 (1977). The validity of the scale was established by comprising the average score of managers with that of non-managers and also by correlating its scores with those of inventories like Ghiselli's Self Descriptive Inventory (1976). Gough's Adjective Check list (1965) and Kuder Preference Record (vocational) (1960). All the estimated correlations between the relevant scales were considerably high.

In addition to Miner's scale, managerial qualities like Leadership, Application/Initiative, Cooperativeness, Effective Communication, Mental Alertness and Planning were assessed through Group Task. As already noted, in many respects, each managerial position is unique in demands it makes on its incumbents. Role to be played by individuals with identical job position can differ considerably from organisation to organisation. Yet there are some requirements which appear again and again in great variety of managerial positions. These may be identified as common factors which operate scores a great many managerial positions. Such factors are measured through Group Task.

In the Group Task, a problem situation is simulated in an unstructured group consisting of eight to twelve subjects. Each group/batch had to solve a

problem as a group within a period of one hour. Different tasks were given to different batches and adequate care was taken to keep the difficulty level of the simulated problem situations comparable.

Three examiners observed the participants during the entire one hour period and independently rated them on a five point behaviourally anchored scale under six different traits. For successful completion of the task, planning, cooperation, initiative, etc., by the participants were called for. Analysing the interactions that took place among the participants, the examiners rated them on traits mentioned earlier. It may be noted that the managerial behaviour is not confined to these six dimensions only as it is multi-functional and dynamic in nature. But, as mentioned earlier these six qualities were presumed to occur with relatively high frequency and across a considerable range of positions and organisations and that is why they were taken into consideration.

At the end of the task the independent ratings of the three examiners were added to obtain an average for each participant separately for each of the six traits. The raters' agreement was obtained earlier with different samples by the authors (1974) and the reliability values ranged from .60 to .94. The inter-correlations among the traits were quite high indicating presence of halo effect or it might be that the traits themselves were positively related. The validity of the ratings was tested by the authors through different studies (1974, 1983) and these indicated that the ratings were significantly related with the job performance as well as with peers' ratings.

At the end of the group task, a five point rating scale covering the six dimensions measured through Group Task was distributed among the participants and the following instruction was read out.

"As you have undergone this exercise, you have some idea regarding your own level of performance. Considering the role played by you so far as (a) understanding the problem, (b) planning of the steps and procedure, (c) leading others to arrive at the correct solution, (d) spirit of cooperativeness shown, (e) the clarity of communication, and (f) initiative shown

during the work, rate yourself on this scale where 5 is the maximum score and 1 is the lowest score. Our main purpose is to find out the accuracy of your judgement. Try to be as objective as possible. This, of course, will not affect the ratings already given by the examiners." The self ratings of the subjects thus collected were correlated with the averages of the examiners' to find out the accuracy of the self assessment. The correlations for different traits varied from .08 to .42 with a median of .28 (1983). The predictive efficiency of these self assessments with respect to managerial effectiveness however, were not verified earlier through any study.

The hypotheses tested through this study were as follows :

I. A strong and consistent relation would be obtained between the various subscales, as well as the total score of MSCS and the examiners' ratings on traits like Leadership, Initiative, Planning, etc. and the total of all ratings.

II. A strong and consistent relation would be observed between the examiners' ratings and self ratings on the traits considered here.

III. Self assessment on the managerial personality traits would be correlated with the different subscales, and the total score of MSCS as a person's self assessment of their managerial ability would be affected by their motivation to manage.

Sample : 184 engineers who applied for the posts of Management Trainees in a public sector organisation served as subjects. They were all first class engineering graduates within the age range of 22-28 years. The job in question was similar to that of first line managers whose main task is to keep the flow of production running by a group of skilled workers.

All the subjects had to pass a selection test and these 184 engineers belonged to the top 25 per cent of the original group of applicants. The written test consisted of one General Ability test and the medium was English. The multiple choice version of Miner's

Sentence Completion Scale was administered on these subjects and they were all subjected to Group Task. On the basis of their performance in the Group Task, the examiners' ratings as well as self ratings were collected following the procedure mentioned earlier.

Results and Discussion

The intercorrelations between seven subscales and total of the MSCS are presented in Table 1 along with their means and standard deviations.

found to be highly interrelated; it pointed out the presence of considerable halo effect in the examiner's assessment supporting the results of studies conducted earlier (1974, 1983). Intercorrelations between self ratings on different traits, however, were not so high though all of them were significantly different from zero. It means that though the subjects in general inflated their rating they did not do so uniformly over all the traits. The reliabilities of the examiners' ratings were caculated by using Ebel's procedure (1957) and all the values were above .90.

TABLE 1

Significant correlation among subscales and total of Miner's Sentence Completion Scale along with mean, standard deviation and maximum possible score

(N=184)

Miner's Subscales and Total score	AF	CG	CS	AR	IW	SOFG	RAF	Total score
Authority Figures (AF)	—	—	.15*	—	—	.16*	—	.52**
Competitive Games (CG)	—	—	.19**	—	—	—	—	.43**
Competitive Situations (CS)	.15*	.19*	—	.19**	—	.17*	—	.55**
Assertive Role (AR)	—	—	.19**	—	.14*	—	—	.50**
Imposing Wishes (IW)	—	—	—	.14*	—	—	—	.43**
Standing Out From Groups (SOFG)	.16*	—	.17*	—	—	—	—	.39**
Routine Administrative Function (RAF)	—	—	—	—	—	—	—	.38**
Total score	.52**	.43**	.55**	.50**	.43**	.39**	.38**	—
Mean	1.70	1.45	1.58	.65	.32	1.67	.73	8.07
Standard Deviation	1.66	1.58	1.39	1.58	1.52	1.18	1.31	4.77
Maximnm Possible score	5	5	5	5	5	5	5	35

*indicates significant at the 5% level
**indicates significant at the 1% level

The subscales were not much related with each other which is a desirable property of the Miner's scale, though each subscale had considerable relation with the total score. The intercorrelations between the examiner's rating and those between self ratings are presented in Table 2.

The examiners' ratings based on Group Task were

The intercorrelations between seven subscales of MSCS, self ratings were examiners' ratings are presented in Tables 3, 4 and 5. Scrutiny of the results reveals that magnitudes of the correlation between the subscales of MSCS and the managerial personality traits measured through Group Task were not at all high. Only a few were found to be slightly above the point of significance.

TABLE 2

Intercorrelations between the self ratings of the traits and those between the examiners' ratings of the traits. (The upper half of the triangle presents the intercorrelations of self ratings where lower half present those of the examiners' ratings)

(N=184)

Examiners' ratings	Self Ratings							Mean	Standard deviation	Maximum possible score
	MA	Coop	PI	Init	Lead	Com	Total			
Mental Alertness (MA)	—	.32	.33	.29	.42	.44	.67	2.26	.86	5
Cooperativeness (Coop)	.80	—	.25	.28	.34	.39	.62	2.64	.78	5
Planning (Pl)	.86	.80	—	.38	.30	.43	.66	2.25	.88	5
Initiative (Init)	.81	.86	.84	—	.30	.44	.65	2.71	.90	5
Leadership (Lead)	.81	.82	.88	.87	—	.46	.69	2.18	.90	5
Communication (Com)	.81	.85	.83	.86	.86	—	.78	2.60	.85	5
Total	.92	.92	.94	.94	.94	.93	—	15.05	4.81	30
Mean	4.17	4.29	3.76	3.66	3.61	3.90	23.39			
Standard deviation	.92	.92	1.02	.98	1.05	1.14	4.16			
Maximum possible score	5	5	5	5	5	5	30			

All the correlations are significant.

In case of ratings given by the examiners, subscales like Competitive Situation and Assertive Roles were significantly related with ratings on Alertness, Planning, Leadership and Communication. These two subscales were also related with the total of the examiner's ratings. Remaining ones, however, were not related with any other traits. On the whole it may be said that the obtained results did not support the first hypothesis that the subscales and total scores of MSCS would be strongly related with the managerial qualities measured by the examiners.

Correlations between self ratings and examiners' ratings across the traits were mostly significant though the magnitudes of the correlations were not very high. Moreover, the magnitude of the correlation between

TABLE 3

Significant correlations between Examiners' ratings and Miner's subscales and total score

(N=184)

Miner's subscales and total score	Examiners' Ratings						
	Mental alertness	Cooperativeness	Planning	Initiative	Leadership	Communication	Total
Competitive situations	—	—	.14*	—	.14*	—	.14*
Assertive role	—	—	—	—	—	.17*	.14*
Total score	.18*	.20**	.20**	.19**	.18*	.20**	.21**

*Indicates significant at the 5% level.
**Indicates significant at the 1% level.

TABLE 4

Significant correlations between self ratings and Miner's subscales and total score

(N=184)

Miner's subscales and Total score	Self Ratings				
	Planning	Initiative	Leadership	Communication	Total
Competitive games	.15*	—	—	—	—
Competitive situations	—	—	.17*	.14*	.14*
Standing out from the group	.18*	—	—	.19**	.15*
Routine administrative function	—	.17*	—	—	—
Total score	.22**	—	—	.17*	.19**

*Indicates significant at the 5% level.
**Indicates significant at the 1% level.

by the examiners and communication as measured by self. It means that so far as self rating was concerned, communication was regarded as the most important of all other traits and hence that had the maximum correlation with other variables. Another point which is to be noted here is that there was minimum agreement between examiners' ratings and self rating with respect to Mental Alertness. It might be that the concept was not very clear to the subject and hence their ratings deviated from the examiners' ratings considerably. The results, however, did not support the hypothesis that the self ratings on the same traits made under similar situation would show a high degree of agreement with examiners' ratings.

So far as self assessments of the traits were concerned, the subscales like Competitive Games, Competitive Situation, Standing out from group, Routine Administrative Function were significantly related with Application, Planning, Leadership and Communication respectively. Total of self ratings was significantly correlated with scores on Competitive

TABLE 5

Significant correlations between Examiners' ratings and Self ratings

(N=184)

Examiners' ratings	Self Ratings						
	Mental alertness	Cooperativeness	Planning	Initiative	Leadership	Communication	Total
Mental alertness	—	.18*	.18*	.16*	.31**	.33**	.32**
Cooperativeness	—	.23**	.28**	.19**	.28**	.35**	.36**
Planning	—	.27**	.25**	.25**	.26**	.38**	.37**
Initiative	.18*	.24**	.30**	.28**	.31**	.36**	.41**
Leadership	—	.25**	.24**	.26**	.29**	.30**	.36**
Communication	.18*	.24**	.32**	.25**	.32**	.40**	.42**
Total	.14*	.25**	.28**	.25**	.32**	.38**	.40**

*Indicates significant at the 5% level.
**Indicates significant at the 1% level.

the self rating and the examiners' ratings on a particular trait did not attain the highest value as one would expect it to be. On the contrary the maximum value was obtained between each of the traits measured

Situation and Standing out from the group. Hence the last hypothesis that self assessment of managerial qualities would be affected by the strong motivation to manage could not be totally accepted.

Conclusions

Taking the findings as a whole one can conclude that :

(a) Although managerial motivation as measured by Miner's Sentence Completion Scale was found to be related with managerial effectiveness on different occasions (Miner, 1977) it was scantly related with the measures of managerial qualities obtained through Group Task. These ratings also had considerable predictive validity with respect to managerial effectiveness as per earlier studies (Chatterji & Mukerjee, 1984). Hence, it may be said that managerial motivation and managerial qualities though considerably related with managerial effectiveness, were not related sufficiently with each other. It further implied that to judge a subject's competence for a managerial job, it would be desirable to assess "motivation to manage" and the "qualities required to manage" simultaneously and the prediction should be based on these two measurements. Of course, there is nothing new in this observation as it is well known that motivation to manage and qualities required to manage are two distinct and unrelated concepts and one cannot be a substitute of the other; but in practice often a single instrument or procedure measuring one of these concepts is used to predict managerial effectiveness without paying attention to other variable which is equally important in this context. The present study highlighted this point though indirectly.

(b) As already mentioned self rating is gaining attention in recent times and researchers are interested in analysing its basic qualities and in probing into its possible utilisation. Self rating showed varying predictive validity in studies conducted by Wagner (1973), Ference (1975), Edward and others (1977), Heneman (1974), De Nisi and Shaw (1977), etc. Its relation with motivation to manage as revealed through the present study was not very much different from that of examiners' rating. Total of self rating was significantly correlated with subscales like Competitive Situation and Standing out from the group, though the magnitude of the correlation was low. It points out that those who possessed pleasant feeling with the role prescription of managerial work did not inflate their own managerial qualities to a great extent.

(c) Finally, it is felt necessary to investigate the predictive efficiency of self-rating obtained on the basis of Group Task; if it is found to have significant relation with managerial effectiveness one can consider the possibility of adding one more variable to the set of predictor variables to forecast the complicated nature of managerial effectiveness.

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EVERY MINUTE WASTED ON THE JOB MEANS REDUCED PRODUCTIVITY
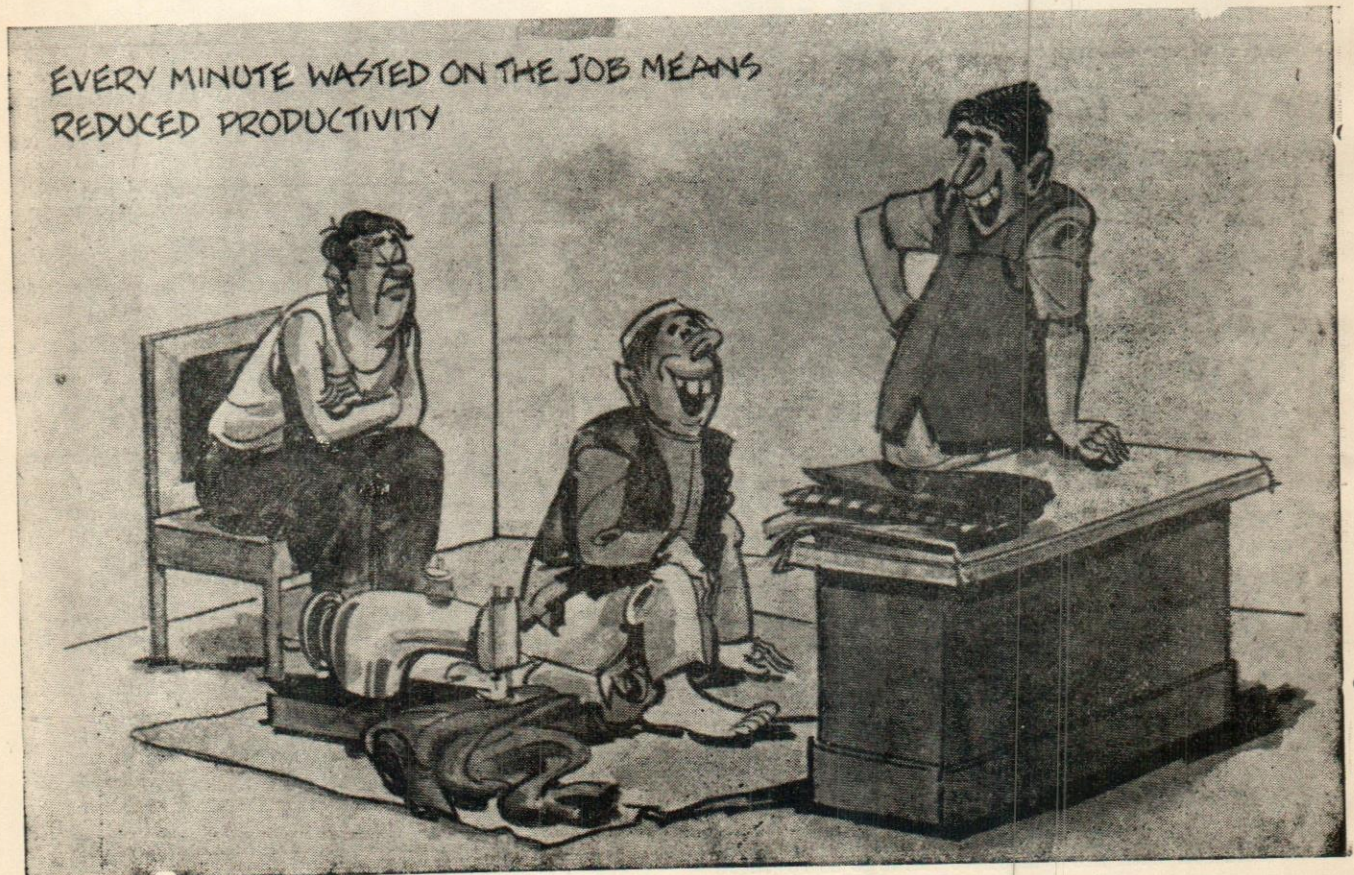
Organisational Effectiveness & Productivity: A Case Study

USHA SUNDERAJAN

The author on the basis of a study concludes that factors like policy, process, structure or behaviour of people do not, necessarily affect effectiveness or productivity of an organisation measured in terms of profits, turnover or manpower turnover.

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Introduction

Any manager in a responsible position in an organisation is concerned about efficiency, productivity and effectiveness of his department, unit or the total organisation. The question that arises is whether only efficiency and productivity should be the concern of the manager and whether efficient and highly productive units are sufficient to make an organisation effective. Effectiveness has been defined as a multi-dimensional phenomenon which encompasses not only productivity but the quality of management, the efficiency with which it utilises its resources in terms of money, material and manpower and the manner in which it copes with external influences of the Government and Unions.

This study, conducted in several units of one public and one private sector service industry highlights that financial performance can be good inspite of overtly ineffective systems within the organisation and that effectiveness of an organisation is not necessarily a function of systems and processes existing in the organisation. This paper demonstrates that behaviour of people within the organisation, impact of the environment et al also influence the performance of an organisation.

Methods of Measuring Effectiveness

A review of available literature on effectiveness

reveals that there is no single definition of organisational effectiveness nor is there a singlegroup of foctors which can be called predictors or measures of effectiveness as there are in the case of job satisfaction, work motivation or job involvement. However, there are different approaches used by behavioural scientists to measure effectiveness and these are briefly described :

(i) Goal Approach

This approach, used by Price[1] and Campbell[2] to name a few, states that an organisation is effective if it achieves it goals. This method is used to measure effectiveness of organisations in which goals are clearly defined and can be directly related to an organisation's output.

(ii) System Resource Approach

Argyris,[3] Yuchtman & Seashore[4] and Molnar & Rogers[5] are some of the social scientists who have used this approach. This model is used when there is a positive relationship between what the organisation produces and the resources it receives. The effectiveness of the organisation is measured by the efficiency with which it acquires the resources required for its operations.

(iii) Internal Processes Approach

An organisation is said to be effective under this approach when the internal processes or functioning of the organisation is smooth. This model has been used

by Bennis,[6] Likert[7] and is appropriate when the internal processes of an organisation are closely associated with what the organisation produces.

(iv) Strategic Constituencies Approach

The extent to which an organisation responds to the demands and expectations of its "strategic constituencies" or the people who have a stake in the organisation measures the effectiveness of an organisation. This model is used when external constituencies have a powerful influence on the organisation's operation. Cameron[8] is one of the social scientists who has this approach.

All these models have their advantages and disadvantages and an appropriate model has to be selected, depending on the objectives of the Study.

It is not possible to review all the literature available on organisational effectiveness here. However, for all the studies, different factors have been used as predictors and measures of effectiveness. There is no consensus on these factors and, depending on the objectives of the organisation and the study, various factors were selected.

The Study

For this study, a model was developed. (Fig. 1). As can be seen from the figure, structure, process, policy, behavioural and environmental factors were selected as predictors of effectiveness. Eight other factors were selected as measures of effectiveness. The objectives of the study were to determine :

(i) Factors which contribute to effectiveness of the organisations studied,

(ii) Factors which account for the difference in

1. Price, James L. "The Study of Organisational Effectiveness" Sociological Quarterly, 1972, 13 pp. 3-15.
2. Campbell, J.P., "On the nature of Organisational Effectiveness" in P.S. Goodman & J.M. Pennings, Eds. New Perspectives on Organisational Effectiveness, Jossey-Bass 1977 pp. 13-55.
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5. Molner J.J. & Rogers D.S. "Organisational Effectiveness: An empirical comparison of the goal and system resources approach." Sociological Quarterly, 1976, 17 pp. 401-413.

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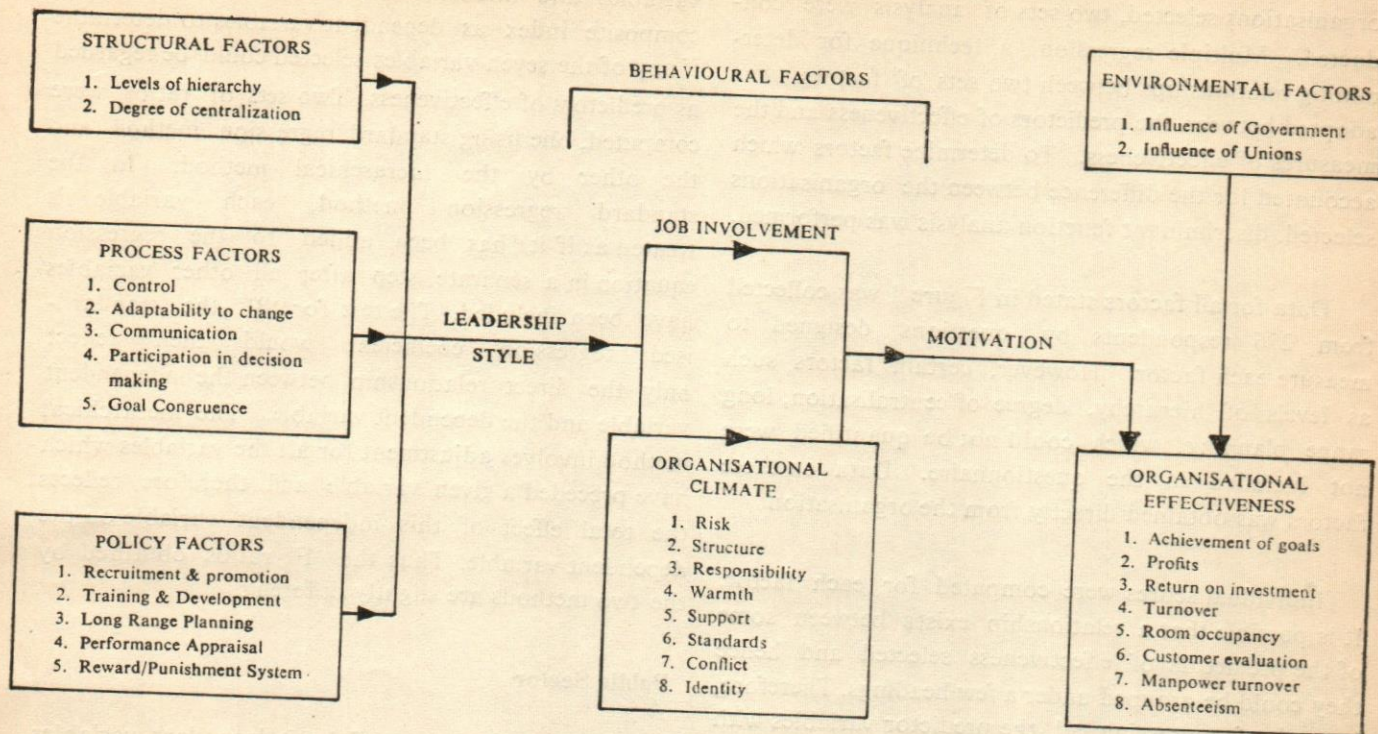
Fig. 1 Theoretical Model for Predicting Organisational Effectiveness

performance of the public sector and private sector organisation studied.

Method of Data Collection

A multiple-choice questionnaire was prepared to measure each one of the factors selected. This questionnaire was personally administered to 276 respondents, 138 each in the public and private sector.

Of the eight indices of effectiveness, achievement of objectives could not be quantified because objectives of the organisations studied were not in terms of figures. Profits, turnover, room occupancy and manpower turnover data was available for three years for both the organisations. Return on investment was computed in a different manner in public and private sector and since base data from which the ratio was obtained was not available, Return on Investment figures could not be used. Customer

evaluation was obtained by means of a questionnaire administered to persons staying in the units. This was quantified in terms of percentage satisfaction with the unit. Absenteeism for management staff both in public sector and private sector was negligible.

For the analysis, three indices of effectiveness were computed—Financial Index, Customer Index and Composite Index for each unit. The Financial Index consisted of profits and turnover per room, the Customer Index consisted of customer evaluation and room occupancy and the Composite Index consisted of the Financial Index, Customer Index and manpower turnover. Based on these indices, the units were ranked in term of performance.

Analysis of Data

To achieve the objectives of determining factors which contribute to effectiveness and factors which differentiate between public and private sector service

organisations selected, two sets of analysis were conducted. Multiple regression, a technique for determining relationships between two sets of factors, was adopted between the predictors of effectiveness and the measures of effectiveness. To determine factors which accounted for the difference between the organisations selected, discriminant function analysis was performed.

Data for all factors stated in Figure 1 was collected from 276 respondents by questions designed to measure each factor. However, certain factors such as levels of hierarchy, degree of centralisation, long range planning, which could not be quantified were not included in the questionnaire. Data on these factors was obtained directly from the organisation.

Individual scores were computed for each factor. It is possible that a relationship exists between some of the predictors of effectiveness selected and hence they could be grouped under a few headings. Therefore, instead of regressing all the predictor variables with the indices of effectiveness, it would be more meaningful to determine relationship with the groups and effectiveness indices. This process of clustering a number of variables into smaller groups is known as factor analysis.

When data was thus factor analysed, six groups of factors emerged as predictors of effectiveness. These were titled Managerial Style, Decentralisation, Leadership Style, Risk-taking Ability, Adaptability to Change and Communication. These six factors and Job Involvement, which was measured separately, using Agarwala's[9] inventory, were used for further analysis.

Results

Multiple Regression Analysis

Step-wise multiple regression analysis was computed separately for public sector and private sector. The regression was run between the seven independent variables and financial index, customer index and composite index as dependent variables to determine if any of the seven variables selected could be regarded as predictors of effectiveness. Two sets of ratios were computed, one using standard regression method and the other by the hierarchical method. In the standard regression method, each variable is treated as if it has been added to the regression equation in a separate step after all other variables have been included. The test for 'B' the standardised regression coefficient would then reflect only the direct relationship between the independent variable and the dependent variable. The hierarchical method involves adjustment for all the variables which have preceded a given variable and therefore reflects the total effect of this independent variable on the dependent variable. Thus the 'F' ratios obtained by the two methods are slightly different.

Public Sector

In public sector, none of the independent variables were significantly correlated with the financial index of effectiveness (See Table 1 on next page).

This implies that it may not be the structure, process, policy or behavioural factors which make the public sector organisation selected profitable or increase its sales and revenue. The findings indicate that profits and sales do not depend on how the organisation functions or how the people within the organisation work because irrespective of the processes within the units, the organisation did effect sales and make profits. This is possibly because the organisation has "assured business" which does not come as a result of employees' efforts. A major portion of this public sector organisation's income is from employees of other public sector organisations who, when visiting Delhi on tour, are bound by their organisation's rules to stay in a certain public sector hotel depending on their seniority.

These people, therefore, do not have the choice of staying in a unit which gives them maximum satisfaction but have to stay in a unit as per their entitlement. This is possibly one of the reasons why the financial index is not predicted by the variables selected.

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9. Agarwala, Umesh., "Measuring Job Involvement in India"—Indian Journal of Industrial Relations, Vol. 14, No. 2, 1978, pp. 219-231.

TABLE I

Multiple Regression with Financial Index of Effectiveness for Public Sector

	Multiple R	R Square	Beta	F (Standard regression method)	F (Hierarchical method)
Leadership Style	.204	.042	—0.180	1.793	2.45
Management Style	.256	.066	0.235	1.437	1.41
Job Involvement	.286	.082	—0.106	0.627	0.94
Decentralisation	.297	.088	0.090	0.410	0.37
Adaptability to change	.306	.096	—0.90	0.341	0.35
Risk-taking ability	.313	.098	—0.086	0.250	0.24
Communication	.313	.098	0.017	0.013	0.13

Number of cases 61 df 1 & 53

Sinha's[10] study has also demonstrated that in public sector organisations nobody gets affected if there is a loss and mismanagement and hence there is no compulsion to work. As a result, there is no relationship between employees' efforts and productivity.

using the hierarchical method. (Table 2 below) :

The variation explained by the Management Style is 6% and Decentralisation another 7%. The customer index constitutes customer evaluation and room

TABLE 2

Multiple Regression with Customer Index of Effectiveness for Public Sector

	Multiple R	R Square	Beta	F (Standard regression method)	F (Hierarchical method)
Management style	.240	.058	—0.442	5.429*	3.64
Decentralisation	.358	.128	0.294	4.707*	4.44*
Risk-taking ability	.374	.140	0.136	0.663	0.72
Job Involvement	.386	.149	0.091	0.500	0.60
Adaptability to change	.394	.155	0,089	0.363	0.37
Communication	.397	.158	—0.060	0.170	0.17
Leadership Style	.399	.160	0 045	0.121	0.12

*Significant at .05 level for 1 & 53 df Number of cases 61

The customer index of effectiveness was found to be significantly correlated with Management Style and Decentralisation in the public sector by the Standard regression method and with only Decentralisation

10. Sinha J.B.P., Some Problems of Public Sector Organisations, National, Delhi, 1973.

occupancy, both of which are indicators of a client's satisfaction with a unit. In a hotel industry, a client's satisfaction depends a great deal on the service he receives in a unit. Only when a client is satisfied with the service would he like to return to the hotel. The service provided by a unit depends on the efficiency and efforts of the unit managers. In a unit where the

Management Style is positive, that is, where the unit manager encourages his managers to be participative, innovative and creative, clearly defines their jobs and responsibilities, the morale of the manager is likely to be high. Pestonjee's[11] study has shown that morale of the managers is influenced by fair policies, behaviour of the supervisor, decision-making authority and a sense of worth in the organisation. Roy[12] has demonstrated that good communication, leadership style and participation in decision-making contribute to effectiveness. The manager would, then, perform well and give of his best to the organisation and its clients. When there is de-centralisation, he would also have the authority to take decisions at his level and meet with guests' requirements promptly. This explains the significant relationship between customer index and Management Style and Decentralisation.

Finally, when regression analysis was done using the composite index of effectiveness, again none of the predictor variables were found to be significantly correlated with the index (Table 3 below):

The composite index comprises of financial index, customer index and manpower turnover. The result implies that manpower turnover, like the financial index, is not dependent on the variables selected. Instead, it is possibly a function of some other variables like the social set-up of the organisation.

In the public sector organisation selected, managers were mostly middle-aged, who had come up from the ranks and acquired their present position by virtue of seniority rather than ability.

These managers had got used to a particular style of working with which they were comfortable. Not too many work demands were made on them and irrespective of their performance their job was secure. The salary scales in the public sector organisation selected compare fairly well with those in the private sector covered by this research, particularly at middle management level and hence there was no incentive for the older managers in public sector to leave a secure job. Therefore, most of the managers in the public

TABLE 3

Multiple Regression with Composite Index of Effectiveness for Public Sector

	Multiple R	R Square	Beta	F (Standard regression method)	F (Hierarchical method)
Decentralisation	.232	.054	0.242	2.964	3.158
Leadership	.257	.066	−0.105	0.620	0.688
Management Style	.274	.075	−0.098	0 278	0.545
Job Involvement	.275	.076	−0.024	0.022	0.033
Communication	.276	.076	−0.024	0.026	0.025
Risk-taking ability	.276	.076	0 018	0.011	0.011

Number of cases 61 df 1 & 54

11. Pestonjee D.M. "A Study of Employees' Morale & Job Satisfaction as related to Organisational Structures". Unpublished PH.D. thesis. Aligarh Muslim University, Aligarh, 1967.

12. Roy S.K. "Management in India : New Perspectives", Meenakshi Prakashan, Meerut, 1974.

sector were content with their present status and did not want to leave unless they were offered a very big difference in status and salary. Organisational or job-related factors were not very important to manager in this public sector organisation. It is the security this public sector organisation offered and the status a

public sector officer/manager has in society because of which employees were reluctant to give up their job. This is possible the reason why manpower turnover in this public sector organisation was low and not correlated with organisational factors. Sihna's[13] study has also demonstrated that 66% managers in public sector wanted to change jobs compared with only 50% in private sector. However the public sector managers seeking a change wanted to join another public sector organisation only because of job security and a 'relaxed working climate' there.

Private Sector

In the private sector hotel none of the factors were significantly correlated with the financial index of effectiveness by the standard regression method though Job involvement was found to significantly correlated using the hierarchical method. (Table 4) :

Exactly the same results were obtained in correlation with Customer Index (Table 5 below) : and

TABLE 4

Multiple Regression with Financial Index of Effectiveness for Private Sector

	Multiple R	R Square	Beta	F (Standard regression method)	F (Hierarchical method)
Job Involvement	0.212	.045	—0.168	2.802	4.76*
Decentralisation	0.284	.081	—0.179	3.229	3.81
Risk-taking ability	0.318	.101	—0.190	3.188	2.14
Adaptability to change	0.355	.126	0.162	2.608	2.71
Communication	0 359	.129	0.078	0.256	0.256
Leadership Style	0.362	.131	0.056	0.323	0.213
Management Style	0.366	.134	—0.068	0.322	0.319

*Significant at .05 level for 1 and 93 df.

TABLE 5

Multiple Regression with Customer Index of Effectiveness for Private Sector

	Multiple R	R Square	Beta	F (Standard regression method)	F (Hierarchical method)
Job Involvement	.228	.052	—0.188	3.523	5.60*
Decentralisation	.291	.085	—0.171	2.968	3.49
Risk-taking ability	.328	.107	—0.204	3.715	2.44
Adaptability to change	.367	.134	0.168	2.851	2.90
Leadership Style	.373	.139	0.077	0.609	0.53
Communication	.376	.141	0.069	0.374	0.22
Management Style	.378	.143	—0.052	0.189	0.19

*Significant at .05 level for 1 and 93 df.

13. Ibid.

Composite Index (Table 6 below) :

TABLE 6
Multiple Regression of Composite Index of Effectiveness for Private Sector

	Multiple R	R Square	Beta	F (Standard regression method)	F (Hierarchical method)
Job Involvement	.220	.048	—0.177	3.120	5.14*
Decentralisation	,288	.083	—0.176	3.125	3.68
Risk-taking ability	.322	.103	—0.196	3.427	2.27
Adaptability to change	.361	.130	0.165	2.724	2.805
Leadership Style	.365	.133	0.965	0.439	0.3522
Communication	.368	.136	0.074	0.425	0.2273
Management Style	.372	,138	—0.061	0.261	0.2583

*Significant at .05 level for 1 & 93 df

This implies that whether effectiveness was measured in terms of profits and turnover, customer satisfaction or manpower turnover, it was the extent to which a manager was involved in his job that contributed to effectiveness. By definition, a job-involved person has a strong desire to be at work, is willing to exert himself to scope with the demands of his job and experience his work activities as rewarding (Agarwala[14]).

In the private sector organisation, managers were required to work odd hours depending on the demands of their clients. In such a job, unless a person is fully involved, he would not be able to cope with the demands made on him. This explains the relationship observed between job involvement and the three indices of effectiveness.

It may be added here that in the private sector organisation selected, about 14% of the variation in the customer index and composite index was explained by all the seven variables acting jointly at .05 level of significance.

Discriminant Function Analysis (Table 7)

In order to determine the relative effectiveness

14. Ibid.

TABLE 7
Table showing step-wise discriminants functions analysis between most effective and least effective unit

Step No.	Variable Entered	F-Value
1.	Adaptability to change	23.65**
2.	Decentralisation	0.44
3.	Management Style	0.39
4.	Job Involvement	0.19
5.	Risk-taking Ability	0.02

**Significant at .01 level.

of the units studied, their indices of effectiveness i.e. profits, turnover, occupancy were ranked in order of performance. A composite index of effectiveness was then computed for each unit by summating the ranks. The most effective unit was in the private sector and the least effective in the public sector. To determine which of the seven predictor variables accounted for differences between the private and public sector units selected a discriminant function analysis was carried out. Only one factor, namely, Adaptability to Change, discriminated significantly between the two types of organisations.

Therefore, it may be deduced that the difference in effectiveness between the public and private sector organisations selected was explained by the manner in which they adapted to change in the environment.

Change is effected in an organisation as a function of many factors. Firstly, the organisation must have a profitability and viability motive. If an organisation has to be profitable, it must produce to the requirements of its clients and at a minimum possible cost. This implies that the 'best' should be made available to the client for him to choose the organisation's product in preference to those offered by other organisations. The public sector organisation selected did not have profit as its main objective. They had other social welfare objectives which may not necessitate change. At the same time, a substantial percentage of this public sector organisation's clients were required by rules of their company to avail of services of public sector units only. This security of an assured business and clientele considerably reduced pressure on this public sector organisation to change. On the other hand, the private sector organisation studied made a continuous effort to "woo" clients away from competitors by offering them something new and different.

Secondly, in certain profit-oriented, progressive organisations, managers are evaluated by the number and quality of changes they have brought about for improvement or by the innovations they have thought of and introduced into the organisation. In most public sector organisations, again, this culture does not exist. It is enough to perform one's routine job satisfactorily. Reward are based normally and preponderantly on seniority and seldom on such criteria as ability to bring about change and innovation. Therefore, managers do not need to attempt changes. In most private sector organisations, however, a manager's evaluation is based not only on how well he performs his job, but on how capable he is of improving upon his job. This means that the manager has to be continuously in quest of better, modern and more efficient ways of working. Another social force working within public sector organisations is that of the Unions. The public sector organisation studied has a powerful union which has considerable influence in the functioning of the organisation. Thus, unless these unions are amenable to change, it would not be possible to bring it about in the organisation. Besides the above, the bureaucratic set-up in public sector organisations is in itself an impediment to change. The time lag between awareness of the need for change and actual implementation of change is so great that by the time the change is introduced it is probably out of date. In private sector, if the situation warrants, change is brought about immediately without going through the total decision making procedure. Therefore, in public sector, adaptability to change is low or non-existent because of the system and the social forces within the organisation. This explains the difference in effectiveness of the public and private sector organisations studied. A recent study by FORE[15] has also demonstrated that one of the process factors contributing to effectiveness is ability to cope with environmental changes.

Conclusion

This study has again demonstrated that there is no standard formula to measure effectiveness of organisations. Depending on the objective of an organisation, different sets of factors need to be considered as predictors of effectiveness. It can also be observed from this study that factors such as profits, turnover etc, which are regarded as measures of an organisation's success or productivity are not affected by the structure, process, policies and behaviour of people within the organisation, particularly in the public sector. Thus, an organisation may show high profits and turnover and yet not have proper systems, policies and processes. By the same token, an organisation may not appear to be highly productive and efficient and yet have good policies and high satisfaction among its employees. Therefore, in order to make an organisation efficient, productive and effective, it is essential to define clearly what its objectives are, what kind of policies it wishes to adopt, how it plans to cope with changes in its environment, the government or the unions. The totality of factors

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15. FORE : 'A Study of the Indicators & Processes of Effectiveness Management'. Report on Phase I, 1984.

NPC Research Section*

Steel making is, perhaps, one of the oldest industries in India. Modern steel making technology came to India about 75 years ago with the advent of the Tata Iron and Steel Company. Despite that the modern steel industry has a long history in India, its growth in recent years could not be treated as exemplary when evaluated based on any reasonable index of performance, more so when compared to other Asian countries like Japan, Republic of Korea and People's Republic of China, not to speak of the achievements of European nations like Federal Republic of Germany, France, UK etc. and the United States.

The growth in steel capacity in recent ye... has

TABLE 1

Capacities of Integrated Steel Plants (1986-87)

Plant	Before on going Expansion		After Expansion	
	Crude Steel	Saleable Steel	Crude Steel	Saleable Steel
Bhilai	2.50	1.965	4.0	3.153
Bokaro	1.70	1.355	4.0	3.156
Durgapur	1.60	1.239	1.6	1.239
Rourkela	1.80	1.225	1.8	1.225
IISCO	1.00	0.800	1.0	0.800
TISCO	2.16	1.740	2.16	1.740

TABLE 3
Capacity Utilisation of Saleable Steel (Percentage)

Year	Bhilai	Durgapur	Rourkela	Bokaro	IISCO	TISCO
1980-81	93	48	80	43	65	89
1981-82	93	63	89	75	61	92
1982-83	94	66	81	78	62	93
1983-84	80	49	70	65	55	94
1984-85	90	50	83	74	48	98
1985-86	89	58	82	87	63	102
1986-87 (Estimated)	80	61	93	83	66	110

Source : Based on Production and Capacity data of the respective plants.

TABLE 4
Summary Working Results of Integrated Steel Plants

	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Gross Margin as Percentage of Capital Employed							
SAIL	8.75	8.76	6.74	2.08	9.97	15.33	12.23
IISCO	1.28	(—) Ve	(—) Ve	4.71	(—) Ve	(—) Ve	(—) Ve
TISCO	30.84	29.12	18.81	11.75	29.61	34.41	21.68
Gross Profits as Percentage of Capital Employed							
SAIL	4.70	5.54	0.63	(—) Ve	6.27	10.62	7.89
IISCO	(—) Ve	(—) Ve	(—) Ve	(—) Ve	(—) Ve	(—) Ve	(—) Ve
TISCO	25.02	23.54	10.14	3.60	20.08	25.72	13.26
Earnings as Percentage of Sales							
SAIL	0.05	1.48	(—) Ve	(—) Ve	0.11	3.56	1.23
IISCO	(—) Ve	(—) Ve	(—) Ve	(—) Ve	(—) Ve	(—) Ve	(—) Ve
TISCO	5.13	5.88	3.95	2.60	4.63	7.12	2.28

Source : Based on consolidated Annual Reports of the respective companies.

during the same year. During 1985-86 while SAIL recorded a margin of only 15.3 per cent, TISCO's was significantly higher i.e. 34.4 per cent.

The working results of any undertaking arise from the interaction of the performance of the factor inputs, their market costs and prices of the product. The major factor inputs in steel making could be identified as labour, raw-materials and energy. For the purpose of analysing the major reasons behind the dismal

financial performance of the public sector steel mills, the labour productivity performance ratios are computed and analysed in this study. Some international comparisons, also, are attempted in this study.

Labour Productivity Ratios

The Indian steel mills, currently, are arriving at labour productivity ratios for the purpose of annual bonus payments. Two types of ratios are, usually, computed in the case of steel mills i.e. ingot (tons) per man year and saleable steel (tons) per man year. The available data for years 1980-81 to 1986-87 are given in Table-5. It shows that the levels of labour productivity in Durgapur and Rourkela are unsatisfactory when compared to others. Although, among the public sector plants, Bhilai and Bokaro show better ratios, they may also be treated as unsatisfactory due to the fact that these two plants employ a later

technology when compared to TISCO. Over the years whereas TISCO's labour productivity ratio shows moderate rates of growth, those in the case of public sector plants do not show any definite upward trend. The ratio recorded by the public sector plants could at best,, be treated as stationary if not declining.

Value based labour productivity ratios were also arrived at in order to understand the impact of labour contributions on the financial performance. The details of the computations are given in Appendices 1-4. For these computations, two alternative concepts of output are utilised viz. value of production (income) and value added both at current market prices and at 1980-81 base prices. Value of production (Appendix-1) and the value added (Appendix-2) at 1980-81 base prices are arrived after deflating the respective values at current prices by the Index Number of Wholesale prices of total (Iron, steel and alloys) after bringing the series at 1970-71 base to

TABLE 5

Labour Productivity in Integrated Steel Plants (Production/man year) (Tons)

		1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Bhilai :	Ingot*	61	63	63	55	61	58@	55@
	Saleable Steel	30	31	31	28	33	35	NA
Durgapur :	Ingot*	26	34	35	31	28	33	35
	Saleable Steel	19	24	27	21	NA	22	23
Rourkela :	Ingot*	41	42	40	38	39	41	39
	Saleable Steel	27	30	28	26	35	27	31
Bokaro :	Ingot*	37	63	62	55	60	59	60
	Saleable Steel	20	34	35	28	33	35	35
IISCO :	Ingot*	31	30	30	25	20	27	26
	Saleable Steel	NA	NA	NA	NA	NA	NA	NA
TISCO :	Ingot*	57	56	58	58	61	62	66
	Saleable Steel	NA	NA	NA	NA	NA	NA	NA

* Production of ingot steel including equivalent of saleable Pig Iron assuming 1 ton of saleable pig iron equal to 0.25 of ingot steel divided by total number of personnel in position including those in Administration.
@ Inclusive of manpower employed in expansion projects.
  Source : 1. Statistics for Iron & Steel Industry in India—7th Edition.
             2. Unpublished Statistics from SAIL.

1980-81 base (Appendix-3). Two alternative concepts of labour input have been utilised in this context viz. employment and total emoluments. Employment is net of those in expansion projects (Appendix-4). Total emoluments at 1980-81 base costs are arrived at through a deflation of the values at current prices by the Consumer Price Index for Industrial Workers after bringing the series at 1960 base to 1980-81 base (Appendix-3).

The labour productivity data, thus arrived at, are presented in Table 6. The impressions based on

TABLE 6

Value Based Labour Productivity Measures for the Integrated Steel Plants in India

	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Value of Production per Employee (Rs. '000) (at current prices)							
SAIL	119.3	149.1	168.2	149.1	189.7	232.9	238.4
IISCO	58.4	72.8	75.7	74.1	71.2	99.7	113.4
TISCO	140.8	183.3	200.8	223.4	283.7	336.5	353.5
Value of Production per Employee (Rs. '000) (at constant 1980-81 prices)							
SAIL	119.3	122.5	118.5	97.7	111.5	117.6	119.7
IISCO	58.4	59.8	53.4	48.5	41.9	50.4	56.9
TISCO	140.8	150.6	141.5	146.4	166.8	170.0	177.5
Value added per employee at current prices (Rs. '000)							
SAIL	33.4	43.6	43.7	27.1	41.7	60.0	51.8
IISCO	16.2	16.3	(—)	23.2	13.5	13.7	10.3
TISCO	50.9	77.0	75.7	74.6	105.4	125.5	118.2
Value added per employee at 1980-81 prices (Rs. '000)							
SAIL	33.4	35.8	30.8	17.8	24.5	30.3	26.0
IISCO	16.2	13.4	—	15.2	8.0	6.9	5.2
TISCO	50.9	63.3	53.3	48.9	61.9	63.4	59.4
Value of Production per Re. of Total Emoluments at current prices (Rs.)							
SAIL	7.51	8.23	7.90	6.67	7.74	8.53	7.66
IISCO	3.73	4.21	4.19	3.46	3.00	3.96	4.16
TISCO	5.62	6.30	5.96	5.29	6.31	6.37	6.34

(Contd.)

TABLE 6 (*Contd.*)

	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Value of production per Re.							
of total emoluments							
at 1980-81 prices (Rs.)							
SAIL	7.51	7.60	6.74	5.96	6.60	6.66	6.46
IISCO	3.73	3.89	3.58	3.10	2.56	3.09	3.51
TISCO	5.62	5.82	5.09	4.90	5.38	4.97	5.35
Value added per Re. of							
Total Emoluments							
at current prices (Rs.)							
SAIL	2.10	2.40	2.05	1.21	1.70	2.20	1.66
IISCO	1.04	0.94	—	1.08	0.57	0.55	0.38
TISCO	2.03	2.65	2.25	1.83	2.35	2.38	2.12
Value added per Re.							
of total emoluments							
at 1980-81 costs (Rs.)							
SAIL	2.10	2.22	1.75	1.08	1.45	1.72	1.40
IISCO	1.04	0.87	—	0.97	0.49	0.43	0.32
TISCO	2.03	2.45	1.92	1.64	2.00	1.86	1.78

Note ; For Sources and explanatory notes see text.

physical productivity presented in Table 5 are duly reflected in the productivity measured by value of production at 1980-81 base prices per person i.e. while the performance of TISCO has been improving that of SAIL is stagnant and lie below that of TISCO. The performance of public sector plants deteriorated rapidly when productivity is measured in terms of value added at 1980-81 prices per person. Not only the figures of SAIL lie for below that of TISCO, there are visible trends of over time deterioration in the levels.

Labour productivity ratio measured in terms of value of production per rupee of emoluments at 1980-81 base prices showed some what a little different picture. In this case SAIL plants registered higher performance ratios when compared to TISCO, but over the years the ratio seemed to have declined in the case of both SAIL and TISCO. However, the deterioration was discernibly higher in the case of both SAIL and TISCO, when productivity is measured in terms of value added at 1980-81 base prices per rupee of emoluments. While TISCO suffered moderate losses in the case of this ratio, SAIL plants seemed to have suffered quite severely. The difference between productivity measures based on the output concepts of value of production and value added represents the impact of purchased inputs like energy, raw materials, semis and finished products, stores & spares etc. It is clear that both the groups of plants viz. SAIL and TISCO suffered heavily on account of the deteriorating direct input productivity; the impact being much severely felt in the case of SAIL plants when compared to TISCO.

Real Wages

The cost of labour per person in real terms seemed to have increased moderately in the case of both public and private sector plants. The incidence of the cost rise appeared to be much higher in the case of TISCO (Table-7). It is also important to note that

TABLE 7

Total Emoluments per Person (Rs. 000) in Integrated Steel Plants

	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
At current costs							
SAIL	15.9	18.1	21.3	22.4	24.5	27.3	31.3
IISCO	15.7	17.3	18.1	21.4	23.7	25.2	27.2
TISCO	25.0	29.1	33.7	40.7	44.9	52.8	55.7
At 1980-81 costs							
SAIL	15.9	16.1	17.6	16.4	16.9	17.7	18.5
IISCO	15.7	15.4	14.9	15.7	16.3	16.3	16.2
TISCO	25.0	25.9	27.8	29.9	31.0	34.2	33.2

Note : For sources and explanatory notes see text.

during any year, TISCO's labour cost seemed to be 60-80 per cent higher in comparison to those in SAIL plants.

Some International Camparisons

It would be useful, at this juncture, to know the productivity of Indian Steel worker in relation to their counterparts elsewhere in the world. Among others, labour productivity determines the competitiveness of Indian steel output in the international market.

Studies revealed that "Indian Price (without freight duty, steel equalisation levy, steel development fund levy, engineering export levy.........which together form 30 per cent of the Joint Plant Committees' prices for the individual items) were 85 (tin bars, sheet bars and seemless bars) to 153 per cent (unequal angles and sections) higher than the international prices (FOB) prevailing in the European market"*. (Table-8). The position was different some years/back. "The Mehtab Committee (1966), the Marathe Committee (1974) besides the Com nittee on Public Undertakings have brought out that the ex-works prices of select cate-

* FICCI, Background paper for Workshop on "Towards Cost Competitiveness", New Delhi 7th August, 1987 (Mimeographed) p. 8.
* Ibid. p. 9.

TABLE 8

Differential between International and Indian prices of certain steel products

Item	International prices (FOB) (Feb. 20, 1956) (Rs./ton)	Indian prices (Rs./ton)	Difference between Indian and International prices (%)
Tin bars Steel bars Seamless bars	2745	5080	85
Unequal angles and Sections	2730	6140	125
Joist	2730	6140	125
HR Coils	2790	6150	120
Plates 5-10 mm & above	3270	6570	101
Chequered Plates	3420	6670	95
CR Coils	3600	8040	123
GP Coils	3960	9113	130

Source : FICCI, op. cit., pp. 8-9.

gories of steel were lower in India compared to prices in USA, Japan etc".

A UNIDO study has found out that investment cost per tonne of steel capacity created in developing

countries is twice the cost in industrialised countries.* The investment cost per tonne of steel on a green field site in developed countries was estimated at US $ 700-1000 per tonne in 1970s when a corresponding sized plant was costing US $ 1170 per tonne elsewhere. If the size of the plant was small cost would be higher at US $ 1700 per tonne@. It should be remembered that the output of SAIL units, taken together, was found to be well below 25 per cent of the largest steel producer, NIPPON Steel in 1981. The production of

TABLE 9

International Comparisons of Labour Productivity in Steel Industry (Value added per person in US $)

Countries	1973	1975	1980
U.S.A.	18780 (100.00)	27675 (100.00)	41095 (100.00)
Japan	23454 (124.9)	20616 (74.5)	62061 (151.00)
Singapore	16148 (85.9)	15108 (54.6)	32333 (81.1)
Republic of Korea	7811 (41.6)	6277 (22.7)	22482 (54.7)
Australia	12857 (68.6)	19619 (70.9)	28235 (68.7)
Canada	21000 (112.0)	24507 (88.6)	34442 (83.8)
U.K.	8679 (46.2)	10690 (38.6)	18031 (43.9)
India	749 (4.0)	2011 (7.3)	4834 (11.8)

Note : Figures in brackets are the indices with US ratio as 100.
Source : UNIDO, Industry & Development, Global Report (1985).

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* A Benbouali, Long term Contractual Arrangement for Setting up Capital Goods in the Iron & Steel industry, UNIDO ID/WG 324/6, Sept., 1980 p. 33.

@ An exception was the case of Kwangang steel plant in Korea which is expected to be ready by 1988. See for details : W.T. Hogen "Pohong Steel Continue to Grow", Iron & Steel Engineer, April 1985, quoted by B.D. Mellock, "South Korea : Pointer to a New International Division of Labour" Economic & Political Weekly, September 21, 1985.

TABLE 10

Steel Industry Labour Productivity in Selected Countries, 1984

Tonnes per employee-year (crude steel equivalent)	Country
350—400	Japan.
300—350	Canada, United States, Belgium, Netherlands.
250—300	Federal Republic of Germany.
200—250	Australia, France, United Kingdom.
150—200	Brazil, Republic of Korea.
100—150	Mexico, Spain, Czechoslovakia, Poland, USSR.
50—100	Bulgaria, German Democratic Republic, Hungary.
1—50	India.

Source : ILO Sectoral Activities Programme, Iron & Steel Committee, Eleventh Session, Geneva, 1986.

TABLE 11

Specific Energy Consumption in Iron and Steel Manufacture in India and Japan

	Specific Energy Consumption in G. Cal per tonne	
	Japanese Steel Plant	Indian Steel Plant
1. Iron Making		
1.1 Blast Furnace	3.30	6.75
1.2 Sintering	0.75	0.75
1.3 Coke Ovens	0.44	1.50
Total :	4.49	9.00
2. Steel making	0.06	1.10
3. Hot Rolling	0.60	1.10
4. Slabbing & Blocking	0.19	0.60
5. Cold Rolling	0.91	0.70
Grand Total :	6.25	12.50

Source : FICCI, Background paper, Workshop on 'Towards Cost Competitiveness' New Delhi 7th August, 1987 (Mimeographed).

the largest Indian integrated steel plant, taken separately, was only 8 per cent of that of NIPPON steel.* In addition to the smaller size of Indian steel plants, there is the problem of cost overruns due to project implementation delays also. For example "Investment Cost at current prices per tonne of steel capacity which was Rs. 1,100 per tonne in 1953-54, had escalated to Rs. 4,600 per tonne in 1974-75 and further to Rs. 14,000 per tonne by 1983-84".**

Comparative data presented in Table-9 show that labour productivity in Indian steel mills when measured in terms of value added per person is a meagre 11.8 per cent of that in United States during the year 1980. In relation to that recorded by Japan, Indian level comes down further to 7.8 per cent. Whereas tons of crude steel per employee per year in Japan varies from 350 to 400 it is as low as 1 to 50 in India (Table-10).

Economic performance of integrated steel plants largely depends upon the efficiency of energy use because steel making is an energy intensive process. Comparative data from Indian and Japan (Table-11) show that the energy consumption per tonne of end product is higher by almost 100 per cent in India. The difference in specific energy consumption rates are strikingly high in India in blast furnace, coke ovens, steel mills, hot rolling mills and slabbing and blocking mills. While the energy consumption per tonne of crude steel is about 8-9.5 million K.cals in India, it is almost half i.e. about 4—6 million K.Cals. in the developed nations.

APPENDIX—1

Value of Production (Income) in Integrated Steel Plants

	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Rs. million							
At current prices							
SAIL	23100	29363	33521	29806	37952	46437	46832
IISCO	2426	3048	3341	3269	3197	4278	4722
TISCO	5637	7496	7985	8877	11095	13253	14224

Source : 1. Statistics for Iron & Steel Industry in India—7th Edition.
2. Unpublished statistics from SAIL.

* EIU Special Report No. 128, The Worlds' Steel Industry, Structure and Prospects in the 80's p. 42.
** Govt. of India, Ministry of Steel and Mines, White Paper on Steel Industry (1976), p. 51 and discussions at the Round Table on Steel Industry organised by the Ministry of Steel, Mines and Coal, Department of Steel, 18-19th Feb., 1985.

APPENDIX — 2

Value Added (Rs. Million) in Integrated Steel Plants

	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
SAIL							
Wages & Salaries, Bonus etc.	3077	3508	4244	4469	4906	5443	6117
Contribution to SDF	2140	3111	2857	1704	2159	1911	1879
Contribution to others	—	—	—	—	—	519	526
Interest	1237	1470	2670	1395	1312	2136	2061
Profits	10	391	(—) 1058	(—) 2146	(—) 41	1960	(—) 409
	6464	8580	8713	5422	8336	11969	10174
IISCO							
Wages & Salaries, Bonus etc.	651	724	798	944	1065	1080	1134
Contribution to SDF	—	—	—	—	—	—	—
Contribution to others	—	—	—	—	—	—	—
Interest	311	331	484	319	358	119	113
Profits	(—) 288	(—) 371	(—) 1710	(—) 241	(—) 816	(—) 610	(—) 819
	674	684	(—) 428	1022	607	589	428
TISCO							
Wages & Salaries, Bonus etc.	1003	1190	1339	1619	1757	2081	2242
Contribution to SDF	392	1000	838	693	716	752	888
Contribution to others						533	633
Interest	121	184	384	453	530	1577	995
Profits	521	777	449	200	1118		
	2037	3151	3010	2965	4121	4943	4758

Source : 1, Statistics for Iron & Steel Industry in India—7th Edition.

2. Unpublished Statistics from SAIL.

APPENDIX—3

Iudex number of wholesale prices of Iron and Steel Products (1970-71=100) and consumer price index for industrial workers (1960=100)

Products	Weight	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Pig Iron	0.17	225.0	312.6	376.1	438.8	5 18.6	594.0	594.0
Semis	0.17	319.5	424.7	477.6	499.6	543.6	586.9	586.9
Structurals	0.47	228.6	274.6	359.2	381.1	451.0	544.2	544.2
Plates & Sheets	0.60	233.0	279.2	322.2	349.7	414.4	507.2	507.2
Bars & rods	0.73	324.1	401.6	469.5	492.8	539.4	581.0	581.0
Wires	0.13	392.3	331.7	331.7	NA	NA	NA	NA
Rails	0.04	204.7	290.4	467.6	562.4	675.6	842.0	842.0
Sleepers, Bars etc.	0.03	184.2	262.4	386.5	454.4	543.6	662.6	662.7
Axles, wheels & tyres	0.04	213.4	281.4	511.8	651.6	792.7	868.2	974.2
Pipes & tubes	0.58	282.5	325 4	375.2	392.4	400.5	489.2	489.2
Skelp	0.13	280.9	336.5	326.7	365.8	435.5	532.0	532.0
Tinplates	0.11	334.2	372.1	384.4	384.4	384.4	437.6	478.4
Ferro Manganese	0.07	271.7	370.6	422.9	552.6	553.3	682.1	682.1
Tinbars	0.03	276.6	356.3	427.4	525.3	589.9	632.0	632.0
Ferro Silicon	0.01	440.4	417.2	396.2	409.5	564.8	628.2	683.6
Galvanised Plates & Sheets	0.13	220.3	261.9	265.8	280.8	309.3	366.9	366.9
Bailing hoops	0.03	346.0	475.6	475.6	475.6	488.2	598.4	635.5
Total (Iron, Steel & Alloy)	4.47	272.4	331.6	386.6	415.7	463.4	539.3	542.4
Consumer Price Index	—	401.0	451.0	486.0	547.0	582.0	620.0	674.0

Source : Index number of wholeeale price in India, various issues.

APPENDIX—4

Employment in Integrated Steel Plants

	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87
Recorded Employment in SAIL (Total)	193667	198399	202576	205278	206711	207839	205623
Recorded Employment in Expansion Projects	—	1620	3262	5404	6609	8455	9144
Revised Employment in SAIL Plants	193667	196979	199314	199874	200102	199384	196479
Recorded Employment in IISCO (Total)	41543	41866	44106	44140	44882	42914	41635
Recorded Employment in TISCO (Total)	40042	40901	39773	39744	39110	39387	40242

Source : 1. Statistics for Iron & Steel Industry in India—7th Edition.
2. Unpublished Statistics from SAIL.

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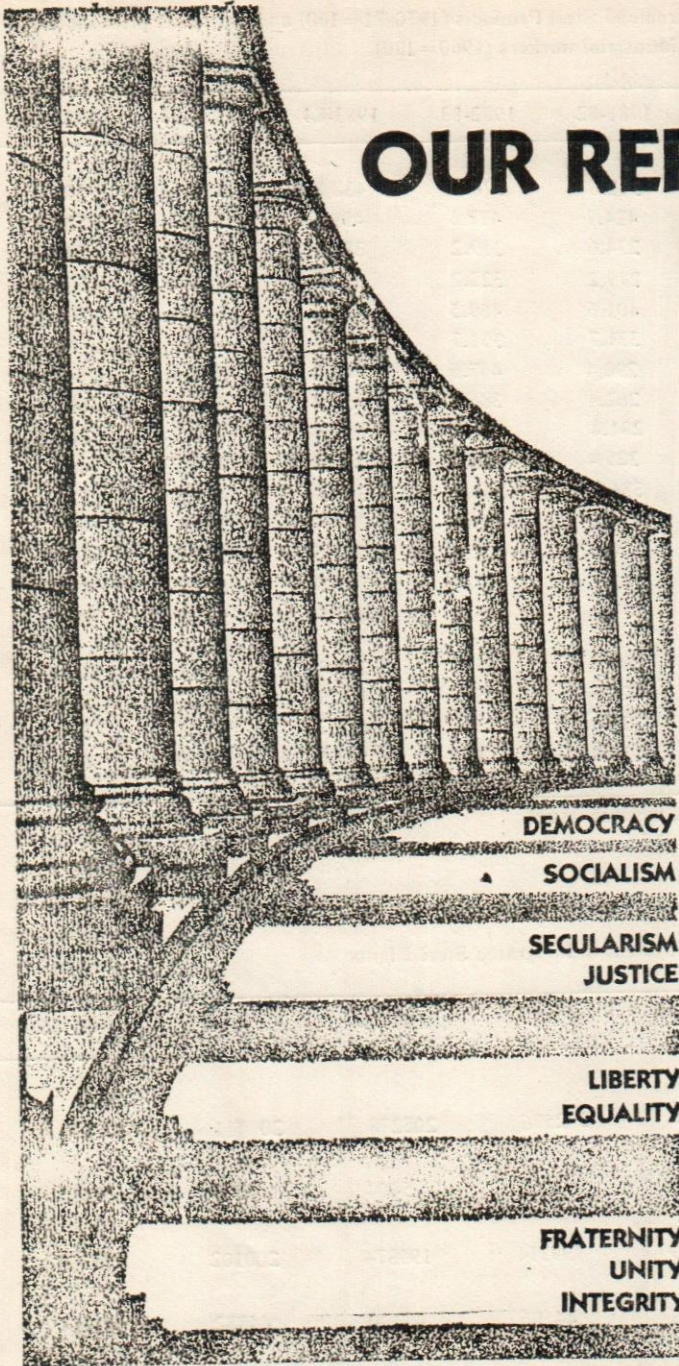
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Jawaharlal Nehru

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Wage Productivity Relationships in Indian Industries

VEENA BHATNAGAR

In this paper the author hypothesises that changes in wage rate affect productivity and productivity in turn affects wages. The paper examines the relationships between the two in the case of selected Indian Industries.

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The wage productivity relationship can assume the form of a circular self generating mechanism where increases in productivity lead to increasing wages and an increase in wages motivates the worker to further increase productivity. This link can be broken by the sectarian and irresponsible attitude of trade unions, by welfare based policies of the state leading to upward or downward wage rigidities, as well as economic instability generated by inflationary pressures. This paper hypothesises that changes in wage rate affect productivity and productivity in turn affects wages. It attempts to study how far the two are moving together in Indian engineering industries.

Productivity, it has been observed by economists, is strongly linked with technological changes which is defined in terms of changes in capital intensity. It is also justified to presume that technique is related to the wage rate, a higher wage rate leading to the adoption of a more capital intensive technique.

The aspects, thus, taken up for study in the paper are :—

(1) the trend of wages,

(2) the extent to which changes in wage rates conform to changes in productivity of labour, capital and total input,

(3) the share of labour in productivity,

(4) the retation between wages and technique of production.

The examination is carried out with the help of :

(i) A trend analysis based on the Annual Survey of Industries data from 1960 to 1980 for India as a whole in the case of some selected industries.

(ii) A case study of wage productivity relationship in selected industries in Chandigarh region for the year 1979 based again on Annual Survey of Industries data.

The all India data relate to the following group of products* :

Iron and Steel

Non-ferrous and basic metals

All machinery except electrical

Electrical machinery

Ship building and repairing

Rail-road equipment

Motor Vehicles

The data pertaining to Chandigarh cover the following groups of products** :

Basic metal and alloys

Metal products and parts

All machinery including electrical

Transport equipment and parts

Medical, surgical and scientific equipment

Photographic and optical goods

Watches and clocks

The all India data has been presented in the form of indices at constant prices with 1960 as base year.

Wage Trends. Table 1 gives real wage index with 1960 as base year over a twenty year period. The real

TABLE 1

Index of Real Wage per Worker at 1960 Prices

Year	Iron and steel	Non-ferrous and basic metals	Machinery except electrical machinery	Electrical machinery	Ship building	Railroad equipment	Motor vehicles
1960	100	100	100	100	100	100	100
1961	96	104	104	107	90	112	110
1962	93	99	106	107	93	111	119
1963	102	107	107	115	90	114	121
1964	94	96	101	105	83	112	112
1965	100	95	101	105	88	110	113
1966	104	96	102	106	90	110	110
1967	101	98	98	102	81	100	104
1968	102	106	101	104	91	109	114
1969	104	113	116	123	93	113	128
1970	111	115	116	127	107	121	141
1971	115	119	124	133	121	128	150
1973	115	117	126	123	124	120	139
1974	108	115	112	122	119	120	126
1975	118	118	122	127	118	132	147
1976	134	136	140	144	128	155	148
1977	125	132	135	145	111	147	140
1978	134	156	154	167	149	155	169
1979	149	153	157	166	152	144	155
1980	139	155	158	165	159	156	162

Source : CSO (Industrial Statistical Division) Ministry of Planning, Government of India, Wages and Productivity in Selected Indian Industries, Bulletin no. ISD/8 (1982) New Delhi.

*Two digit National Industrial Trade Classification Codes—33, 34, 35, 36 and 37.

**Two digit National Industrial Trade Classification Codes—33, 34, 35, 36, 37 and 38.

wage index refers to money wages deflated by Consumers Price Index. If we study five yearly indices, the general trend revealed by them shows a consistent rise in real wages, except for a slight fall in 1965 in the case of non-ferrous and basic metals and ship building industries. All industries except iron and steel have registered between 50 per cent and 60 per cent increase in real wages between 1960 and 1980. Even in the case of iron and steel industry there is a rise of about 40 per cent. This clearly indicates a rise in the average standard of living of the workforce engaged in this industry.

Labour Productivity. Index of value added per employee given in Table 2 shows differences among industries. Five yearly trends in the indices show that the iron and steel industry registered an increase of 30 per cent in labour productivity by 1965 but a decline set in thereafter, the index reaching a low level of 117 by '75. It however, again increased after that registering by 1980 a rise of 17 per cent over 1975. Labour productivity in non-ferrous and basic metals increased steadily till 1964, but fell drastically in 1965, showing a 5 per cent increase over 1960 after which it rose only to decline in 1970 by 2 per cent as compared to 1965 level. By 1975 it had declined by another 30 per cent registering an overall decline of 50 per cent in 1980 over the 1960 level. The industry group machinery except electrical machinery, has shown a steady increase, the index rising to 145 in 1965, 176 in 1970, 191 in 1975 and finally to 234 in 1980 registering an increase of 134 per cent

TABLE 2

Index of Gross Value added per employee (1960 prices)

Year	Iron and steel	Non-ferrous and basic metals	Machinery except electrical machinery	Electrical machinery	Ship building	Railroad equipment	Motor vehicles
1960	100	100	100	100	100	100	100
1961	106	121	119	110	94	109	91
1962	110	116	122	95	92	107	119
1963	125	136	129	110	101	120	104
1964	132	105	145	112	94	122	116
1965	132	105	145	118	104	105	123
1966	123	107	143	117	108	115	111
1967	108	125	144	122	101	115	106
1968	121	95	140	125	113	110	107
1969	116	114	181	134	115	114	120
1970	122	103	176	152	122	98	111
1971	123	83	176	160	132	119	128
1973	118	68	197	179	147	108	135
1974	135	76	204	172	152	109	133
1975	117	73	191	167	162	109	125
1976	125	113	225	179	172	124	155
1977	118	80	231	199	149	131	141
1978	131	83	236	204	185	178	132
1979	118	74	217	195	153	142	115
1980	135	50	234	215	159	142	114

Source : CSO (Industrial Statistical Division) Ministry of Planning, Government of India, Wages and Productivity in Selected Indian Industries, Bulletin no. ISD/8 (1982) New Delhi.

over the 1960 level of labour productivity. Labour productivity in electrical machinery also increased steadily between 1960 and 1980 recording an overall rise of 115 per cent during the period. Ship building and repairing showed an increase of 60 per cent in labour productivity between 1960 and 1980. Labour productivity in rail-road equipment has shown more fluctuations over the years, but there has been an overall increase of 42 per cent by 1980. In motor vehicles industry, labour productivity rose considerably in 1970s, but declined by 1980, showing an overall increase of only 14 per cent over 1960.

Wage-productivity Relationship

No significant relationship is seen between wage trends and productivity trends during the period under study. There is, however, some directional relationship over the long run between wages and labour productivity. Both have shown an increase over the years except in the case of non-ferrous and basic metals.

The relationship between productivity and real wages is even less if capital productivity is taken as an index of productivity. Capital productivity (Table 3) has fallen in all but two industries i.e. in Machinery except electrical machinery and electrical machinery. The most drastic fall was in non-ferrous and basic metals.

Total factor productivity (Table 4) also declined in two industries viz. non-ferrous and basic metals and rail-road equipment. It remained unchanged in the

TABLE 3

Index of capital productivity at 1960 prices

Year	Iron and steel	Non-ferrous and basic metals	Machinery except electrical machinery	Electrical machinery	Ship building	Railroad equipment	Motor vehicles
1960	100	100	100	100	100	100	100
1961	111	90	97	114	83	99	88
1962	51	70	83	78	87	91	112
1963	59	84	89	76	100	102	95
1964	69	77	85	71	100	100	88
1965	67	49	73	74	114	92	87
1966	61	41	57	55	109	96	64
1967	47	49	57	56	85	96	57
1968	59	41	67	56	89	83	58
1969	59	53	63	72	71	100	71
1970	68	44	75	63	67	94	71
1971	78	35	77	74	69	123	93
1973	97	20	97	105	54	104	107
1974	138	19	108	103	69	120	121
1975	84	20	101	111	81	135	114
1976	78	27	108	110	33	142	131
1977	69	18	107	115	29	155	116
1978	80	20	112	121	39	28	105
1979	65	25	111	125	35	36	95
1980	77	15	122	139	39	45	95

Source : CSO (Industrial Statistical Division) Ministry of Planning, Government of India, Wages and Productivity in Selected Indian Industries, Bulletin no. ISD/8 (1982) New Delhi.

TABLE 4

Index of Total Factor Productivity at 1960 prices

Year	Iron and steel	Non-ferrous and basic metals	Machinery except electrical machinery	Electrical machinery	Ship building	Railroad equipment	Motor vehicles
1960	100	100	100	100	100	100	100
1961	109	99	109	112	92	106	89
1962	70	82	103	85	92	102	114
1963	80	98	109	89	101	115	98
1964	90	92	112	85	95	116	97
1965	89	61	103	89	106	101	97
1966	81	54	88	72	108	102	76
1967	66	63	88	74	98	109	69
1968	79	52	97	75	109	103	69
1969	78	66	102	91	106	110	83
1970	87	56	113	85	110	97	82
1971	95	44	115	97	118	120	103
1973	107	27	139	129	120	107	116
1974	137	26	150	126	131	111	125
1975	98	27	140	131	143	115	118
1976	96	37	156	133	111	128	139
1977	87	35	157	142	97	137	124
1978	100	28	162	148	124	75	113
1979	84	34	156	149	106	82	101
1980	98	20	170	165	113	92	101

Source : CSO (Industrial Statistical Division) Ministry of Planning, Government of India, Wages and Productivity in Selected Indian Industries, Bulletin no. ISD/8 (1982) New Delhi.

case of iron and steel and motor vehicles industries. Only in the case of electrical machinery, electric machinery and ship building, total factor productivity increased.

Real wages however, have increased uniformly almost by 40 to 60 per cent, thus, showing no direct relationship with capital productivity and total factor productivity. This indicates to a certain amount of rigidity in wages in the downward direction. The rigidity is not a desirable sign as it shows that wage has not been acting as an instrument of productivity improvements. Increase in labour productivity does not seem to be a result of a rise in wages to any significant extent. This is evident from the fact that fluctuations in wages and productivity do not coincide

even allowing for a time lag for the effect to penetrate. Productivity increase seems to be more a result of increase in capital intensity, a reference to which has been made in the later part of this paper.

Share of Emoluments in Gross Value Added

Table 5 gives the share of emoluments at constant prices. In the iron and steel industry the share of emoluments in value added, by and large, remained constant. In the case of non-ferrous and basic metals however, the share increased to 99 per cent in 1980. Such a high percentage share can be accounted for by the very sharp fall in value added per unit of labour, coupled with over 50 per cent rise in real wages as shown in Tables 2 and 5. Share of emoluments

TABLE 5

Percentage share of emoluments in Gross Value Added (1960 prices)

Year	Iron and steel	Non-ferrous and basic metals	Machinery except electrical machinery	Electrical machinery	Ship building	Railroad equipment	Motor vehicles
1960	50.2	36.8	58.9	44.9	86.9	74.4	35.6
1961	45.8	31.1	52.1	42.8	88.7	76.4	41.2
1962	43.5	29.9	52.3	49.7	89.4	77.1	34.7
1963	39.9	28.3	51.7	48.0	82.9	69.8	40.5
1965	36.7	25.6	45.1	43.8	81.6	68.3	34.2
1965	35.3	31.1	43.4	40.2	70.8	73.5	30.4
1966	38.0	31.1	45.1	41.6	68.1	66.8	31.9
1967	44.9	25.5	43.8	39.6	67.7	61.2	33.0
1968	40 0	38 4	41.4	41.6	67.3	69.0	34.0
1969	44.0	34.5	41.0	42.7	68.5	71.3	33.17
1970	45.2	39.1	41.8	38.7	73.5	87.9	39.0
1971	45.8	49.8	43.7	38 0	75.5	74.8	36.8
1973	50.2	62.49	41.8	33.9	74.5	79.1	32.5
1974	42.7	69.3	37.2	34 2	65.0	77.0	31.3
1975	47.4	56.8	41.0	36.7	60.3	87.2	32.9
1976	51.4	41.5	41.0	37.8	63.3	88.9	34.6
1977	50.6	57.7	38.6	34.7	80.9	78.6	32.1
1878	45 3	58.6	40.1	33.9	64 0	61.3	38.2
1979	56.1	65.0	42.9	36.3	77 8	75.6	40.8
1980	46.7	99.7	41.8	33.2	79.1	77.0	42.5

Source :   CSO (Industrial Statistical Division) Ministry of Planning, Government of India, Wages and Productivity in Selected Indian Industries, Bulletin no. ISD/8 (1982) New Delhi.

declined slightly in the machinery industry. This is due to a much sharper rise in labour productivity than in real wages. The rise in wages in this industry, however, has not been less than in other industries. They seem to conform to the opportunity cost principle of valuation that labour is unable to demand a higher reward because of surplus in labour market. The differences in rates of increase of labour productivity and wages may also account for higher re-investment quotient, resulting in larger increase in overall efficiency.

Wages and capital intensity

A final observation with regard to wage productivity relationship related to the impact that wage rate has on productivity through its impact on capital intensity. Capital intensity has been seen to influence productivity to a large extent, and in so far as wage level can affect capital intensity, it can indirectly affect productivity. With regard to the above industries, the all India data reveal an increase of about 238 per cent in capital intensity between '60 and '80 in basic and non-ferrous metals, by 92 per cent in machinery except electrical, by 55 per cent in electrical machinery, by 308 per cent in ship building and by 217 per cent and 20 per cent in rail-road equipment and motor vehicles respectively. Since wage rate has also gone up in all industries during the same period, we can presume that an increase in capital intensity may have been partly due to an increase in cost of labour.

The degree of influence that wage rate along with

other variables exerts on productivity, has been analysed through a linear regression exercise. The data used are those pertaining to engineering industry in Chandigarh, since it required detailed information with regard to individual units. The year to which the data refer is 1979.

The following functions have been used :

1. C/L = f(FC/L, WG/L)
2. O/C = f(L/C, S/C)

Where WG = Wage, L = Labour, FC = Fixed Capital, S = Surplus, C = Total Capital and O = Output i.e. value added. In the first function, while C/L is presumed to be dependent upon FC/L, it is also affected strongly by cost of labour (WG/L). The surplus available per unit of labour would also determine the possibility of increasing the capital intensity of the technique.

In the second function O/C has been seen to be dependent on capital intensity of the technique, hence L/C ratio has been taken. Similarly surplus available would also affect capital productivity, by making possible improvements in methods of production.

The results are given below :

Equa-tion	Vari-able	Intercept	Regression Coefficient	't' Value	R^2
1.	WG/L FC/L	−30.12	2.0389 1.04405 DF=77	13.46	.95
2.	S/C L/C	0.03	1.0318 10.6348 DF=78	46.49 22.58	.99

Source : Based on data collected by the author from the Central Statistical Organisation.

Wage rate together with fixed capital per unit of labour, accounts for 95 per cent change in capital intensity i.e. C/L. Thus a rise in the wage rate significantly influences capital intensity of technique. On the other hand, capital intensity along with surplus per unit of capital accounts for 99 per cent change. An increase in C/L ratio thus, would considerably lower O/C ratio. Thus, it can be concluded that a rise in the wage rate, leading to an increase in C/L ratio, would lower O/C ratio. The same trend is visible in the all India data also.

The same result is also borne out on the basis of Rank Correlation Analysis to which the Chandigarh data was subjected. Correlation was worked out for capital intensity with wage per worker, productivity of labour and output per unit of capital. The correlation values are as follows :

Wages per worker	0.29*
Productivity of labour	0.48*
Productivity of capital	− 0.40*

*Correlation values significant at 5%.

Capital intensity is positively correlated with both wage rate and labour productivity and it is negatively correlated with productivity of capital. This further substantiates our earlier argument, that though the relationship is rather weak, (with regard to the all India data) the overall increase in capital intensity may have been influenced by an increase in real wage, which in turn was responsible for an overall increase in labour productivity and a fall in capital productivity.

In conclusion one can say that the impact of wages on productivity in the case of the selected industries seems to have been an indirect one. Wage being neither influenced by nor influencing productivity directly, has not acted as a motivating force for increasing productivity. This is a malaise which needs to be corrected by linking changes in wage rate, above a certain minimum, with changes in productivity.

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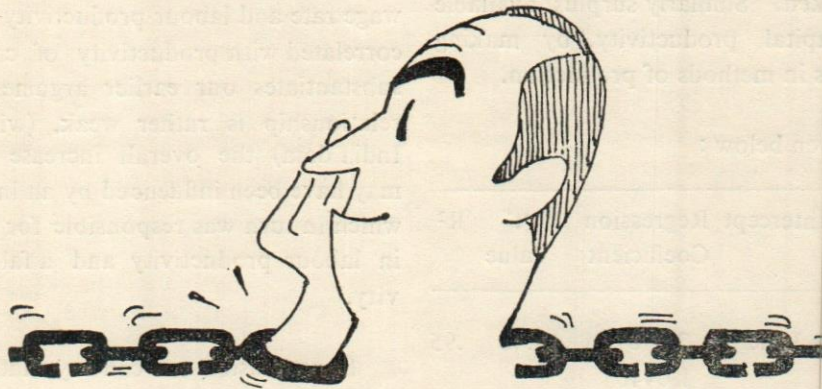
Agricultural Technology Change: A Study

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The authors in this paper study the nature and extent of the technological change in agriculture in different regions of the state of Punjab and spell out the policy implications of the same.

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Punjab State recorded spectacular rates of growth in agricultural output and productivity under the impact of technological advance in recent years. As a consequence thereof, the State has earned the title of granary of India and contributed more than half to the food reserves of the country. Initially, this State achieved a revolution in wheat production due to the adoption of Mexican wheat seeds. This was followed by a veritable rice revolution made possible by the Phillipine varieties of rice. These notable achievements on food front have taken place under the influence of two types of innovations, i.e., biochemical and mechanical. The strong base for assured irrigation enshrined in well-developed canal network backed by rapid tubewell energisation quickly lead to the adoption of these innovations on a large scale and pushed up the index for agricultural output from 109.76 in 1970-71 to 239.28 in 1985-86 and of productivity from 103.04 to 248.58 over the same period.[1] However, the performance of agriculture was not uniform throughout the State.[2] This differential performance may be due to differentials in soil-crop-

1. Statistical Abstracts, Punjab, Chandigarh for 1971-72 and 1986-87.
2. Singh, A.J., Sain Inder and Joshi, A.S., "Growth Performance of Punjab Agriculture : 1950-51 to 1974-75; An Analytical Study", *Productivity*, Vol. XIX, No. 3, October-December, 1978.

climate complexes, quantity and quality of irrigation, availability and use of fertilizers, pesticides/weedicides and more importantly the level of adoption of agronomic practices. It was, therefore, considered useful to analyse the nature and pattern of technical change in Punjab agriculture. Specifically, the objectives of this study were :

(i) to examine the nature of technical change in different regions of the State;

(ii) to measure the contribution of technical change and of growth in input levels; and

(iii) to spell out the policy implications.

Sampling Design of the Study

The data used in the study were taken from a comprehensive project "Cost of Cultivation of Principal Crops" being operated by the Department of Economics and Sociology, Punjab Agricultural University, Ludhiana. Three stage stratified sampling technique with tehsil as the first stage sampling unit, a cluster of three villages as the second stage unit and the ultimate holdings as the third stage sampling unit was adopted. The whole State of Punjab was divided into three agro-climatic homogeneous zones known as wheat-paddy zone (Zone-I), wheat-maize-groundnut zone (Zone-II) and wheat-cotton-bajra zone (Zone-III) respectively. In all twenty tehsils with probability proportional to the area under the principal crops were selected. In each tehsil, a nucleus village was selected and two more villages in the south-west direction formed a part of the cluster. In each cluster, ten holdings were selected at random and in all 200 holdings spread over 20 cluster villages were studied for 1971-72 and 1980-81 respectively.

Techniqce Used in the Analysis

The Cobb-Douglas production function has been used to decipher the nature of technology. Given the fact that output and input variables retain their homogeneous character, the product elasticity of capital or of human labour helps us to identify the underlying nature of technology. An improvement, constancy or decline in the product elasticity of capital

(the other way for human labour) denotes 'Hicksian' capital-using, neutral and labour-using technologies.

It is quite evident that the dependent variable, i.e., output has undergone change due to change in the crop-mix in Punjab. There has come about a rapid change in input variables as well. Since capital input in agriculture is more heterogeneous under the impact of technical change, we have to concentrate on some other variables which may retain their homogeneous character to the maximum extent. No doubt, human labour is also not comprehensive, yet we have concentrated on this variable. Since the analysis did not account for the quality of human labour (i.e., supervisory role) which has undergone a change, the manual component of labour input may be approximated as homogeneous and used for identifying the nature of technology.[3,4]

Several studies have been conducted on analysis of growth of agricultural output at the national/state revel using various types of decomposition schemes' Minhas and Vaidyanathan[5] used the four factor model which was later extended to seven factor model. Dharam Narain[6] decomposed changes in ouput into four components—pure yield effect, pure locational shift effect pure cropping shift effect and effect on productivity of interactions. Vidya Sagar[7] improved upon Minhas and Vaidyanathan's model by introducing the

3. George, Catephores, "On the Heterogeneous Labour and the Labour Theory of Value", *Cambridge Journal of Economics*, Vol. V, No. 2, June, 1981.

4. Samuel, Bowles and Herbert, Ginitia, "Labour Heterogeneity and Labour Theory of Value", *Cambridge Journal of Economics*, Vol. V, No. 3, September, 1981.

5. Minhas, B.S. and Vaidyanathan, A, "Growth of Crop Output in India—1951-54 to 1958-61", *Journal of the Indian Society of Agricultural Statistics*, Vol. XVIII, No. 2, 1965.

6. Narain, Dharam, "Growth of Productivity in Indian Agriculture", *Indian Journal of Agricultural Economics*, Vol. XXXII, No. 1, Jan.-March 1977.

7. Sagar, Vidya, "Contribution of Individual Technological Factors in Agricultural Growth—A Case Study of Rajasthan", *Economic and Political Weekly*, Vol. XIII, No. 25, June, 1978.

price effect. Bisalia[8] in his study on "Decomposition Analysis of Output Change Under Production Technology in Wheat Farming" worked out the contribution of technical change as well as of the changing level of input use in the Ferozepur district of the Punjab State. This study uses Bisaliah's scheme of decomposition to separate out the contribution of technical change and growth of inputs to the growth of output.

RESULTS AND DISCUSSION

Before the discussion of results, a brief introductory note of the changing behaviour of zonal situation would be helpful in interpreting the results. Therefore, the zonal behaviour particularly pertaining to the change ia crop-mix has been presented with the help of cropping pattern (Table 1). It would be seen that

TABLE 1
Pattern of Crops Grown in Different Regions of the Punjab State During 1971-72 and 1980-81

Crops	Zone-1		Zone-II		Zone-III		Pooled	
	1971-72	1980-81	1971-72	1980-81	1971-72	1980-81	1971-72	1980-81
1. Paddy	20.66	27.56	1.34	16.75	2.11	7.02	8.76	17.51
2. Cotton (American)	0.82	0.03	0.84	4.50	21.96	21.20	7.77	8.44
3. Cotton (Desi)	1.08	0.67	5.40	3.05	6.45	8.61	4.14	4.07
4. Maize	6.63	4.85	12.61	5.23	1.54	0.77	6.75	3.68
5. Groundnut	5.11	—	20.00	2.95	0.40	0.28	8.04	1.07
6. Sugarcane	1.69	4.64	1.47	4.22	0.60	1.00	1.27	3.39
7. Bajra	0.04	—	0.05	0.14	2.04	0.08	0.70	0.07
8. Kharif pulses	0.06	0.79	0.28	0.56	0.52	0.18	0.27	0.52
9. Kharif oilseeds	—	2.69	—	0.74	—	0.90	—	1.49
10. Kharif fodder	9.66	7.57	8.79	9.88	9.54	6.67	9.36	8.10
11. Miscellaneous	2.04	1.04	0.95	—	4.80	2.73	2.63	0.36
Kharif total	47.79	49.84	51.73	48.02	49.96	49.44	49.69	48.70
1. Wheat	42.46	41.02	44.43	43.56	34.00	36.23	40.28	40.67
2. Gram	1.92	0.40	0.05	0.32	4.52	3.69	2.85	2.11
3. Barely	0.18	0.09	0.23	1.26	0.13	3.59	0.18	1.63
4. Rabi oilseeds	1.81	0.13	0.50	0.16	6.70	1.85	3.02	0.32
5. Rabi fodder	4.43	3.70	3.01	3.23	3.19	3.04	3.10	3.36
6. Miscellaneous	1.41	4.82	0.05	3.45	1 50	1.16	0.38	3.21
Rabi total	52.21	50.16	48.27	51.98	50.04	50.56	50.31	51.30
Kharif, rabi total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

8. Bisaliah, S., "Decomposition Analysis of Output Change Under New Production Technology in What Farming", *Indian Journal of Agricultural Economics*, Vol. XXXII, No. 3, July-September, 1977.

zone-1 (wheat-paddy zone) comprising north-eastern part of the State did not experience any change in the crop-mix. This zone was relatively advanced and experienced technical change at an early stage. Zone-II (wheat-maize-groundnut zone) comprising central part of the State went in favour of wheat paddy over time in comparison to the initial period. Zone-III (wheat-cotton-bajra zone) constituting south-western districts of the State underwent a marginal change in crop-mix. This zone was relatively dry and still canal is the major source of irrigation as the underground water in major pockets of this zone is not suitable for irrigation. This zone also experienced technical change at a latter stage in comparison to other zones of the State.

Nature of Technology

Since there have been inter-regional imbalances in the development of Punjab agriculture,[9], [10], it is expected that different regions would behave differently in response to technical change. The nature of cropping pattern requiring different types of farm operations in different agro-climatic zones of the State may cast their influence on the underlying nature of technology The analysis done on regional basis lends support to this hypothesis.

As can be seen from Table 2, the coefficient of production elasticity for human labour registered decline in Zone-I while for Zones-II and III, it was positive and improved in magnitude over the study period. However, the difference was found to be significant in all the zones of the State. This trend indicates that Zone-I (wheat-paddy-zone) continued to use capital intensive technology over the seventies as well while Zone-II and III (wheat-maize-groundnut and wheat-cotton-bajra zones respectively) were found to be using the labour intensive technologies over the study period. Zone-I (wheat-paddy zone) which comprises Hoshiarpur, Gurdaspur, Amritsar and a part of Jullundur district is known for providing

TABLE 2

Output Elasticity of Capital and Human Labour for Different Zones of the Punjab State, Over Time

Zones	Capital		Differences T2-T1	Capital		Difference T2-T1
	1971-72 (T1)	1980-81 (T2)		1971-72 (T1)	1980-81 (T2)	
I	0.0342	0.0412	0.0070^{NS} (0.0556)	0.4315	−0.1104	−0.5419*** (0.1640)
II	−0.0865	−0.0436	0.0429^{NS} (0.0538)	−0.2154	0.3583	0.5737*** (0.1653)
III	0.0540	0.0370	−0.0170^{NS} (0.0476)	−0.1280	0.1553	0.2833** (0.1209)
Pooled	0 0322	0 0213	−0.0109^{NS} (0.0305)	0.0757	0.0520	−0.0237NS (0.0801)

Note : *** and ** stand for significance at 0.01 and 0.05 levels of probability while NS stands for non-significance of the respective coefficients.

9. Gupta, D.P. and Shangari, K.K., *Agricultural Development in Punjab*, Agriculture Publication, New Delhi (1980).
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human labour to the defence services and even for export to other countries. Accordingly, it is known for remittances particularly from abroad. Thus, the plenty of capital and scarcity of labour with no

qualitative change in crop-mix is obviously the capital using technology. The farmers of Zones-II and III who preferred labour using technologies were passing through a period of transition during the seventies. Even operation-wise capital requirements are different for different regions due to differentials in the cropping pattern and the extent of adoptation of the various components of new farm technology. For many operations such as transplanting of paddy and picking of cotton, appropriate mechanical technology are not yet available. Initial inertia is probably responsible for slower adoption of mechanised capital input even if it becomes available. It would not be surprising if in the eighties, Zones-II and III may also start behaving like Zone-I.

Contribution of Different Components Towards Growth in Productivity

Table 3 presents the decomposition of change in

TABLE 3

Decomposition Analysis of Total Change in Productivity for Various Regions of the Punjab State Over 1971-72 Through 1980-81

%

Component/Zones	Zone-I (Wheat-paddy zone)	Zone-II (Wheat-groundnut-maize zone)	Zone-III (Wheat-cotton-bajra zone)	Pooled
1. Total change	37.47	36.85	44.38	38.32
2. *Change explained by* :				
(i) Technical change	7.92	4.82	3.46	10.81
(ii) Growth in input level	29.53	32.03	40.91	27.49
3. *Change accounted for by components of inputs*				
(i) Bio-chemical inputs	26.44	28.59	30.49	21.11
(ii) Irrigation	0.68	3.25	7.12	3.52
(iii) Farm machinery	2.39	—0 95	2.66	2.39
(iv) Human labour	0.02	1.14	0.64	0.47
Total change explained (2+3)	37.45	36.85	44.37	38.30

agricultural productivity for different agro-climatic zones and for the State as a whole. It would be seen that the maximum increase in productivity was recorded for Zone-III (wheat-cotton-bajra zone) followed by Zones II and I (wheat-maize-groundnut and wheat-paddy zone, respectively). The overall increase was found to be 38.32 per cent. Out of this growth, 10.8 per cent has been attributed to technical change and 27.49 per cent to the growth in input level. Out of the different components of input variables, 21.11 per cent was accounted for by bio-chemical inputs, 3.52 per ce t by irrigation, 2.39 per cent by farm machinery and 0.47 per cent by human labour respectively.

In general, the inter-zonal analysis tended to follow the same pattern as observed in case of the pooled analysis. However, the detailed analysis highlighted the inter-zonal differentials in respect of the contribution of various components. The highest growth in productivity was recorded in Zone-III which was relatively dry and experienced technical change at a later stage. It was followed by Zone-I which did not experience any chance in product-mix but continued with its capital using technology (see Table 1). Zone-II which experienced maximum change in crop-mix recorded the lowest growth in productivity over the study period.

Though the extent of growth in different zones is different, yet a common feature of all the zones is the maximum contribution of input growth in comparison to technical change. Zone-III (wheat-cotton-bajra zone) which experienced technical change lately recorded the highest growth (i.e., 40·91 per cent) in productivity due to input growth followed by Zones-II and I with 32.03 and 29.53 per cent respectively. Amongst the input components, the maximum contribution to the tune of 30.49, 28.59 and 26.44 per cent was of bio-chemical inputs in Zones-III, II and I in the above order. With respect to other constituents of input growth, Zone-III (wheat-cotton-bajra zone) (which is relatively dry recorded the maximum contribution of irrigation while Zone-I (wheat-paddy zone) which did not experience any qualitative change in crop-mix registered the lowest contribution from irrigation. The share of farm machinery in the total growth in productivity was also the highest in Zone-III

relative to other zones of the State. The adequate use of farm machinery (being relatively the higher size of farm holding) seems responsible for this behaviour.[11] Zone-II (wheat-maize-groundnut zone) which has undergone change in crop-mix to the maximum extent favouring paddy recorded the highest contribution of human labour as certain farm operations such as transplanting of paddy in the absence of mechanised alternatives have improved its contribution. Zone-I with the capital using technology registered the lowest share of human labour.

So far as the contribution of technical change in the growth is concerned, Zone-I with no change in crop-mix registered as high as 7.92 per cent as its share through improvement in its efficiency parameter. Zone-III where a marginal change in crop mix was noticed recorded the lowest contribution, i.e., 3·46 per cent of this component. However, Zone-II lies between Zone-I and Zone-III in respect of the contribution of technical change over the study period.

Conclusion

From the foregoing analysis, it may be concluded that Zone-I continued with the capital using technology while Zones-II and III had bias in favour of

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11. Sain, Inder, *Transformation of Punjab Agriculture*. B.R. Publishing Corporation, Delhi (1987).

labour using techology over the period 1971-72 to 1980-81. The change in crop-mix favouring paddy at a large scale in Zone-II and partially in Zone-III with cotton as a dominant crop was responsible for this behaviour as there were no mechanical alternatives available for certain farm operations. So far as the contribution of various components in the growth in productivity is concerned, Zone-III which adopted the new farm technology at a later stage, being scanty in water resources, recorded the highest growth followed by Zones-I and II. However, the major share in this growth was accounted for by the increased level of inputs. Zone-I which was relatively advanced recorded the highest contribution of technical change in comparison to other zones of the State through improving its efficiency parameter.

It is suggested that the mechanical devices like the paddy transplanter etc. should be developed as in the future, the migrant labour which played a pivotal role in the Punjab agriculture may not be available as their parent states are developing fast. Besides this, some institutional organisations such as cooperatives may be encouraged to make use of the indivisible excess capacity particularly in tractors so that adequate use of this costly capital input may be made. There is also a need to promote some sort of cooperation or collective endeavour on the part of the farmers so as to avoid the problem of excess capacity in tube-wells.

Implementing Quality Control Circles in India

S.N. NANDI

There are a number of problems which need management attention to make the implementation of quality circles a success. These problems are related to attitude of management and trade unions, quality control practices and socio-economic environment prevalent in the country. This paper analyses some of the above mentioned problems and suggests some recommendations.

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1. Introduction

In order to increase productivity through quality improvement by utilizing energy and creativity of the people at the grass-root level and to provide intrinsic satisfaction to them, India started promoting Quality Control Circles (QCC) since 1980. On seeing spectacular success of QCC in Japanese Industries since 1962 and subsequently successful adaptation of the same idea in many of the organisations in Western Countries like USA, U.K., etc., one of the Indian public sector organisations—Bharat Heavy Electricals Ltd., (BHEL) implemented this concept first in 1980 in its Hyderabad unit. Today it is said that BHEL has about 1600 circles working among its 18,000 workforce at its various units. Since then, others belonging to both private and public sector followed this. It is estimated that till now about 200 Indian organisations have adopted this concept. But question is how are the circles in these organisations working? Are these circles adequately effective so as to motivate other organisations to adopt them? Is any general operating model emerging such that the same can be followed elsewhere? The above questions arise naturally because this approach is now with us for the last 7 years. Many conflicting views have already started rising. Interest among employees and employers are fading away. Certain distortions in its working have already been noticed. This paper attempts to discuss some of the major weaknesses as noticed through emperical

observations. It also mentions some of the possible ways to overcome them. While discussing, author has also kept in mind the principal factors as reported in literature responsible for failure in implementation of QC Circles in some organisations in Western countries especially in USA and UK.

2. The Studies

Though this approach has been talked about and in use outside of Japan since mid-seventies, a little research effort has been made on it especially related to causes of its failure so that lessons can be learnt by others (1). Dale and Hayward (2) made first an extensive survey on reasons for failure for 67 companies of U.K. in 1983. Frazer and Dale (3) made similar kind of survey on a wider scale in 1985/86. King and Tan (4) also made a survey over 157 companies which are members of British Quality Association in 1985. Like U.K. similar kinds of studies are also few in U.S.A. Notable exceptions are : Imberman and Deforests' study reported by Imberman (5), Good-fellow's (6), respective studies of 41 and 29 U.S. Companies. Kanter (7) listed out certain management considerations that are to be made to make participative programme like QC Circles successful in U.S. organisations. Nandi (8) made an attempt to develop a conceptual model for effective working of QCC working in India so that certain guidelines can be drawn. The present paper is an effort to detail out some of the principal aspects of the above model. This has been prepared based on :—

(i) Experience as a consultant with National Productivity Council (NPC) in implementation of QC Circles.

(ii) Survey made in mine Indian organisations in 1984 sponsored by one of the local Productivity Councils.

(iii) In-depth unit level discussion with a few organisations where QCC's are working.

(iv) Limited experimentations made over participants to NPC—run programmes on QC Circles.

3. The Problems

Based on limited studies made in India as mention-ed above, a few important observations related to effective implementation of QC Circles programme have emerged. Strangely enough, some of those observations are very similar to those found out in studies mentioned earlier, carried out in U.S. & U.K. These observations should be of great concern to all. Broadly speaking, these are related to following weaknesses :

Lack of management support

Weak quality management practices.

Absence of participative problem solving environment.

Lack of Interest on the part of unions to deal with work related problems.

Insufficient emphasis on process of problem solving

Covert or overt attempts to intervene.

Undue high expectation.

Above aspects will be discussed in the subsequent paras.

4. Management's Commitment to Quality and Participative Problem Solving

No programme could succeed without sincere support and guidance of top management. A firm belief is to be radiated that improved quality of products only should enter the market and that same could only be achieved through scientific application of quality control techniques and that too through efforts of properly trained and willing group of officers staff and workmen. Growing consumers awareness, increasing competition and need for higher export earning may gradually help building up this kind of commitment. Further, like in Western countries, Indian top management is also gradually realising the importance of participative style of working due to :—

(i) Rising expectations of increasing number of educated employees.

(ii) Specialised technologies and their complications are only known fully to those who are working with those day-in and day-out.

(iii) Easiness in implementation.

(iv) Better communication.

(v) Greater co-operation.

But sincere participative problem solving especially in the form of QC Circles involves delegation of power. It is argued that in Japan "it was this sharing of power with lower level employees and the investment in training these employees which marked employees innovation". (9) In India, very little power to influence changes even regarding work practices is left with ordinary workmen. This very observation has also collaborated by the survey (10) which has measured power distance between the management and ordinary workmen as given in the following table :—

Power Distance Between Top Management and Ordinary Workers (Evaluated by Key Persons)

	Mgmt. Policy	Personnel	Working Condition	Work- Place Issues	Total
India	3.27	2.09	1.76	1.25	2.07
Japan	3.63	3.26	2.46	0.04	2.33

Striking feature of the above table is the negative power distance existing between management and workmen in Japan on Work Issues. In India many managements may have reservations even about proper sharing of relevant information. In British industries too, lack of sufficient top management support has also been cited as one of the three principal causes for failure (4).

It is not that above weaknesses are only with top management persons. Majority of middle management groups have the same. In fact, it has been reported both in U.S. and U.K. industries that many of the middle managment personnel regard QC Circles as threats to their authorities (4). Even when management does have the sincerity, it is not believed by workmen and their leaders. Management Committment should be sufficiently visible. It is therefore necessary

that both the groups require orientation in the thinking regarding sincere need for quality consciousness and participative approach to above problems. This can be brought about through a series of discussions, communication and actions reflecting management's intentions.

5. Quality Management Practices

An analysis of quality problems reveals that majority (80-85%) of problems are attributable to management failures. Solution of these problems require involvement of officers from R & D, Design, Purchase, Production, Instrumentations, etc. Even in Japan JUSE (Japanese Union of Scientists & Engineers) has made the above observation. A number of studies made by Indian Statistical Institute in Indian plants have confirmed it (12). These management controllable causes need to be solved either through a traditional organisational set-up or through formation of task force or some kinds of QC Circles consisting of managerial level of personnel. Quality Control function in many Indian plants is not well organised. Scientific methods of managing quality are lacking. In fact Dr. J.M. Juran attributed 10% of success in quality of Japanese products only to QC Circles. Dr. K. Ishikawa who is "the father of QC Circles" has also confirmed that QC Circle activity is only a small part of company-wide Quality Control practices in Japan. Recent definition of QC Circles by JUSE explicitly states "(it is) a small group to voluntarily perform quality control activities within the workshop to which they belong. This small group with every member participating to the full carries on continuously, as part of company wide quality control activities; self development and mutual development, control and improvement within the workshop utilizing quality control techniques". (11) In fact, in many of the Indian organisations, participation of middle level and Jr. level management personnel both in an inter and intra-department functioning towards organisational objectives especially for quality improvement have been feared to be limited. So, some kinds of structure like QC Circles may help improving their effectiveness. Unless these steps are taken, QC Circles formed at grass root level may doubt management's sincerity about quality improvement and many

ceuses to be identified by them will be ice-berg of principal causes and therefore quality of products will not be improved or even if improvement occurs, benefits will be marginal and unsteady. It may also happen that many of the solutions presented by QC Circles may not be implemented on account of lack of interest among officials.

In the light of above mentioned consequences, many of the Indian organisations may have two-tier QC Circles first tier consisting of inter-department officials and second tier of grass root level of staff and workmen. Even in many Japanese organisations, there is multi-tier QC Circles known as QC Circle, Sub-QC Circle, mini-QC Circles, etc. In India, a two-tier structure is being tried out in M/s Jyoti Ltd., Baroda. A few problem oriented circles consisting of managers and workers from different departments are also working in M/s Kirloskar Electric Co., Bangalore and M/s Alfred Herber, Bangalore. These circles try to sort out problems directly. However, nature of problems required to be tackled by different groups need to be defined and clearly known to participants in order to avoid inter-group conflicts.

6. A Participative Problem-Solving Environment

Working of QC Circles is basically a structured approach to group problem-solving. Problem need to be perceived equally as well as theirs unlike presently made. This shift in perception could only come through continuous positive reinforcement process. All kinds of management behaviour contrary to above need to be modified. For example, an action reflecting "Mind your own task" or "You need not know what others do" should be discouraged. A rigid position-wise job description, individual incentive scheme, curtailment of one's interest to know about products/company, etc. need to be censored. Further, any credit which is due to better performance of the group should be given only to a group rather than to an individual. At present, head of the group/section has a tendency to think of better performance as his own. This outlook needs change.

King et al (4) has also confirmed in U.K. context

that in order to engender necessary conditions of trust and collaboration, it may be necessary to make changes in the organisation and adopt more partici-pative style of management. They cited a noteworthy example which is related to the company producing Jaguar Cars. The new management which took over this company in 1980 introduced the "In pursuit of perfection campaign, quality circles, which were an integral part of the campaign to improve quality, were considered as being of such importance, that a reorganisation of the management structure was speci-fically made for implementation and operation."(4)

In order to diagonise dominative leadership style of Indian managers and trade union leaders, the author applied Jarrel/selvin management instrument (13) among about 500 Indian participants consisting of management personnel and trade union officials. Most of the management participants appear to favour somewhat autocratic decision making style and not much believe in subordinates information whereas Trade Union Officials favour consensus approach.

Based on the above observations one may conclude that Indian managers need to learn true participative style of working in its decision making process. Indian culture as it exists now does not teach it in its natural course. We are much more 'boss-parent' centred at heart than we think normally. And participation can not succeed in an unsupportive, unprepared cultural climate. Therefore, there is a need for developing gradually a participative climate through training and use of various kinds of performance reinforcement techniques. One such technique which could be a forerunner is group performance based reward scheme. This kind of scheme has been found to be stimulating group working and goal congruence to some extent.

7. Interest to Solve Work-Related Problems

Matters which need to be discussed in an organisa-tional setting can be classified into any of the three categories :

(i) Interest related matters like wage, various kinds of privileges, etc.

(ii) Work related matters like production, quality, etc.

(iii) Those related to both.

On account of major attention having being given on aspects related to goal incongruence between management and labour, of prevalence of several labour laws and of exhibition of negative reinforcing behaviour, workmen do not have much enthusiasm left for solving work-related problems. Trade Union leaders do not have right mental attitude to think on this line. This has been confirmed by the author through a limited scale of an experiment made over about 500 participants to NPC run programmes on "Participative Management & QC Circles" held over last three years. Majority of these participants are trade union officials. This experiment consisted of asking each group of 5 to 6 participants to solve an open-ended and intentionally-made-ambiguous problem, for example, 'counting of large number of gift coupons-sized 4X2 inches.' Nature of problems and possible solutions are both to be visualized. Majority of T U. participants (more than 60%) tend to associate interest related-issues with this kind of problem. Such a high pre-occupation with interest related matters with staff and workmen in Indian Organisations acts as a detriment to growth of right type of QC Circles.

8. Emphasis on Process of Problem Solving

Principal aim of QC Circles movement is not realised through solution but through process in arriving at it. Individuals derive satisfaction through the process. But effective, efficient, productive, innovative, satisfying group behaviour and functioning do not just happen automatically when a leader is placed in a room with a group of people. Good group behaviour need to be gradually inculcated. Appropriate training with suitable mix of psychological intervention aids, role playing, behaviour modelling through films/plays etc. need to be used. Further, counselling or 'feed-back' session with leader may be made regularly in complete sincerity with objective outlook in the initial stages.

It is reported (7) that even in U.S.A. lack of proper group behaviour has been one of the main causes for failure of QC Circles in many organisations. The author has seen in many organisations that many of the Indian facilitators and leaders do not give enough attention to this aspect since many of these personnel are from QC or production departments who are not adequately equipped.

9. No Direct Intervention by Unions and Management

Though effective working of QC Circles affect both the parties favourably, later should not interfere directly with its working. Participation in circle activities should be entirely voluntary. Management and unions per se should view themselves as guardians and nourish these circles at higher level. Joint Steering Commitee may be formed for this purpose. British surveys (3, 4) have also confirmed that formation of steering commitee is an important issue for achieving success. However, under no circumstances unions should be indifferent to QCC since it is ultimately this institution which is getting strengthened by getting more informed and educated members.

10. Reasonable Expectations From QC Circles

Finally, it may be cautioned that nobody should expect that QC Circles will solve all organisational problems. It is essential that management develop realistic desired outcomes. Experience and research suggest that "participative programmes will not automatically and instantaneously improve productivity. Further, participation will also not automatically counter the 'alienation', low morale, absenteeism, turnover, poor quality and lack of commitment found in many workers and managers in this country".(14)

11. Conclusions

Based on limited empirical studies as enumerated above, one can discern that there are a number of problems that need to be considered while implementing QC Circles in India. These problems are related to attitude of top and middle managements, attitude of unions, existing management practices, etc.

However, present discussion has been based on empirical observations and discussion on ad-hoc basis. Since the QCC approach has been with us for the last

6 to 7 years and many organisations did have initial experiences, it is prudent that some kind of in-depth analysis of its success and failure is made so that mistakes are not compounded elsewhere. Looking at existing industrial situation in India and prevalent state of morale of all sections of employees, this approach has a lot more to offer provided it is reasonably well adopted. Therefore, impediments discussed here need attention from all concerned.

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Prosperity Through Productivity

EXECUTIVE READINGS

Regulation and Development : India's Policy Experience of Controls over Industry
Sharad S. Marathe

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The uniqueness of this volume lies in two factors viz., comprehensive coverage, and multifocal treatment. It goes into the socio-economic situation, ideological base and the dynamics of the policy process, legal framework and the administrative process, problems of complimentarity among the various instrumentalities of State and its inadequacy, and an analysis of the impact of policy, law, and its administration.

Sharad Marathe, the economist has had the advantage of not only observing but also operating the the system. His analysis documents how, over a period of time, the original content and purpose of various policy initiatives were rendered infructuous. An important finding is that once the system veered towards regulation rather than development it acquired a momentum of its own. A convergence of interests developed between politicians, bureaucrats and a powerful section of Indian industrialists. These vested interests, which operated at different levels, developed a major stake in perpetuating the system. Private industry that tended to enjoy a monopolistic and protectionist environment provided by the policy; itself started resistance towards liberalization. As a result and despite official pronouncements, there has been no serious effort to radically alter the system.

Marathe argues in favour of the need to move away from the traditional policy perspectives. The detailed regulation and control of industrial activity and state ownership of the means of production no longer be accepted as synonymous with democratic socialism. He opines that the emergence of an appropriate political ethos, and India's economic resilience provide an opportunity for a major and essential overhauling of the system.

The range and richness of data presented by Marathe is insightful and tempts this reviewer to undertake a detailed review of the volume as a case study in policy process, focussing on policy premises, legislative process, complimentarity of roles (and distortions) bureaucatization, and the intent and impact of policy.

Policy Premises : Concerns

The evolution of thinking on industrial policy and the elaboration of the strategy for industrial development shows a fair degree of continuity. From the early years of this century nationalist opinion,

reflected in *Swadeshi* movement, had always stressed the need for active Government intervention with the aim of protecting and promoting the Indian industry.

Protectionism and regulation provided a single axis, two wheel 'drive' to Indian Policy towards industry, which itself was seen as an instrument for development. The premises and perspectives in this direction were set out by the Directive Principles of State Policy:

The State shall strive to "promote the welfare of people by securing and protecting as effectively as it may, a social order in which justice, social, economic and political, shall inform all the institutions of the national life" (Article 38 (1)); "minimise the inequalities in income" (Article 38 (2)); "ownership and control of the material resources of the community are so distributed as best to subserve the common good"; economic system does not result in the concentration of wealth and means of production to the common detriment"; "equal pay for equal work"; "health and strength of workers, men and women, and the tender age of children are not abused and that citizens are not forced by economic necessity to enter a vocation unsuited to their age or strength"; and that "children are given opportunities and facilities to develop in a health manner and in conditions of freedom and dignity and that

childhood and youth are protected against exploitation and against moral and material abondonment" (Article 39); "operation of the legal system promotes justice" (Article 39-A); "just and humane conditions of work and maternity relief" (Article 42); and to "secure, by suitable legislation or economic organisation or in any other way, to all workers, agricultural, industrial or otherwise, a living wage, conditions of work ensuring a decent standard of life and full enjoyment of leisure and social and cultural opportunities and, in particular, the State shall endeavour to promote cottage industries on an individual or cooperative basis in rural areas" (Article 43).

Thus the policy frame encompassed a wide spectrum of highly idealistic objectives related to the social-political-economic development, with industrial development seen more as a means to achieve these policy objectives.

Legislative Process and Framework

There was an extensive debate on the Industries (Development and Regulation) Bill and it followed a tortuous course through two Select Committees. The First Select Committee emphasised the regulatory provisions of the Bill and inserted the word 'regulation' in place of 'control' in the title of the Bill. The Second Select Committee, however, laid greater emphasis on the developmental aspects and elaborated the pro-

visions relating to the mechanism of Development Councils. Personalities and their predelictions have had their sway on policy. T.T. Krishnamachari, who was an ardent critic of State administered 'regulation and development' had had to pilot an amendment providing for the Government to exercise the powers "under the Act without having the encumbrance of consultation with a large body like the Central Advisory Council or any other outside body". In fact, the reason for rejecting any proposal which would make it obligatory on the part of Government to consult an outside body was a curious one. To quote Shri T.T. Krishnamachari ...." I cannot understand why when you have two Houses which can always call Government to account, there should be a provision for consultation with so large a body on all matters. That means, the Hon. Member who seeks to float an amendment has no faith in this House".[1] This disposition may be a reiteration of the doctrine of parliamentary supremacy.

Yet, within less than five years from the time the original Industries (Control and Regulation) Bill was introduced in Parlinment, political thinking had move distinctly towards an unfettered use of Government's powers, something which was (a) not envisaged in the earlier Bills, and (b) regarding which assurances were given on the floor of the house, at each stage of the debate since the introduction of

1. India, Parliamentary Debates. Vol. IV, No. 1, 22 April 1953, p. 5740, Page No. 75 & 76.

the Bill. Referring to the exceptional provisions in the Bill Dr. Shyama Prasad Mukherjee made it clear that was not the Government's intention to exercise these powers indiscriminately. He elaborated, in the form of an assurance that "this power to direct and control management of particular undertakings can only be exercised in an emergency or in circumstances where government felt convinced that an industrial undertaking dealing with a vital industry in order to be protected has got to be so takenover by Government for the time being".[2] But, how this 'intended' exception and the criteria for 'takeovers' have been diluted is part of the history.

Sir Homi Mody as a representative of industry, brought out the Centre-State, as well as public-private sector perspectives and the import of proposed law on policy. Sir Mody, while conveying the general agreement with the principles of the proposed law in regard to questions like 'regionalisation of industry, location of industry in suitable sites, and availability of raw material which were sought to be controlled and regulated by the Centre to the great benefit of the country as a whole, ... expressed concern that the powers that were being sought were, 'very sweeping' in character' and warned that 'if these powers are strictly interpreted and applied, the private enterprise will be left in name only.[3]

The administrative dimension as also its implications to the federal political process was brought out by one of the critics of the Bill, Shri T.T. Krishnamachari, later the Commerce and Industry Minister and one who moulded the operations of the Industries (Development and Regulation) Act in the earlier years. He commented on the Bill : 'I do not think that as we are placed at present we are administratively competent in the Centre to handle all the subjects that my Honourable friend envisages in the schedule to this Bill.[4] He was also critical of the considerably high erosion of powers of the Provincial Governments.

That policy and the nature and extent of State regulation have been influenced not only by the political and social ideology but also by a variety of other 'situational' factors is best illustrated by the impact of scarcity of foreign exchange on policy.

The acute shortage of foreign exchange in the sixties and seventies and the administrative responses to it were one of the main causes of the distortion in the policy perspective. The attempt to conserve foreign exchange led to the evolution of a maze detailed regulations. Among them were industrial licencing, import of capital goods, and, regulating the allocation of both domestic and imported industrial raw material. The result was an emphasis on regulation to the detriment of development, and a drastic curtailment of the degree of competition and the scope for innovation. Though the 'situation' with regard to foreign exchange reserves has subsequently changed, the regulations didn't.

In the context of the federal structure in the post-independence period and the wider range of policy objectives such as regional dispersal of industries, avoidance of concentration of economic power in the hands of a few, selectivity with regard to the use of foreign capital and technology, and special protection to some of the employment intensive industries like handlooms, changes were introduced in the existing legislation and also major new enactments were introduced.

"While the Fourth Five Year Plan Document showed a refreshing realism and a willingness to accept changes in directions of policy, in actual practice very little, if anything changed". The licencing system continued much the same way as before. "Indeed, with the passing of the MRTP Act in 1969 further restrictions were sought to be placed on new licences for the larger industrial houses specified in the Industrial Licencing Policy Enquiry Committee Report. The delays in various approval—letters of intent, permission for import of capital goods, permission for capital issues, provision for medium long-term finance etc., were endemic. After the Congress split in 1969 there was a marked increase in the number of decisions or clearances.

Role Complimentarity and Distortions

The advisory and the decision

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2. Ibid., p. 2392.
3. Ibid., pp. 2413-14, Page No. 67.

4. Ibid., p. 2417, Page No. 67 & 68.

making roles of the Planning Commission and the Central Government in the formulation of policy got blurred, when the Planning Commission of which the Prime Minister was ex-officio Chairman, became an extension of the Prime Minister's authority in major areas of economic policy. This was especially when the Planing Commission gained in status after 1955.

Despite the announced intention to liberalise 'the system and to simplify the procedures in order to reduce delays in dealing with applications,[5] the regulatory system continued to be much more elaborate than was originally envisaged in the Industries (Development and Regulation) Act. The system seemed to have acquired a momentum of its own and any attempt to reduce its procedural rigours or to make peripheral improvements was being rejected by the system like an unwanted transplant. Over the years a formidable and pervasive vested interest had been built up in the continued operation of an elaborate system of regulation in which different agencies within the Government and at different levels of responsibility had to be involved.

Bureaucracy at different levels and in different departments/agencies of the Government including scientists and technocrats associated with the approval

5. G V. Ramakrishna, Chairman, Report of the Study Group on Industrial Regulations and Procedures, New Delhi : Government of India, February 1978 p. 5; Page No. 100 & 101.

processes. politicians-whether a legislator, a minister or an influential party member and also, to a considerable extent, sections of industrialists who benefited directly from the protective consequences of the regulations constituted a powerful lobby in favour of maintaining the system.

Nevertheless, the working of the system was found unsatisfactory both by those who were in favour of the regulatory system and those who were against it. The rhetoric, particularly because of the political compulsions of the time, tended to be more radical. But it was clear that contrary to the anticipations in the Fourth Plan, the growth of industrial production was far below the expectations.

The factors responsible for this unsatisfactory state of affairs were many but by 1973 it was increasingly clear that the gap between promise and performance, between policies and their actual implementation, between objectives and their achievement and greatly widened, necessitating a critical review of both policies and procedures.

By the early seventies, therefore, there was clear evidence that the licensing system in actual operation was not effective in terms of either achieving goals or as in instrument for planning. But the response from the system in terms of adjustment or shift in emphasis or change in direction was minimal.

Under ideal conditions, policy should be formulated with the full involvement of the field administrative unit in the concerned ministries both before and after legislation, on a continuing basis. But, how policy is neither formulated, nor implemented but twisted for no valid reason is best illustrated by the repeated amendments of the original enactment that empowered the Central Government to authorise any person to take over the management of the whole or any part of the undertaking after an investigation had been made under Section 15 of the Industries (Development and Regulation) Act 1951. This provision which was originally envisaged for a period not extending five years. was modified in 1965 to extend such period beyond five years, (for not more than two years at a time) provided the total period of such continuance did not exceed ten years. In 1974 this was further amended to provide for continuance of the order for a period of twelve years, thus making a total of seventeen years during which Central Government of an undertaking. The period of seventeen years is long enough to perpetuate sickness, with continued uncertainty all the time.

Marathe observes that "administrative convenience was permitted to take precedence over legal provisions", and that as a result "within a decade of coming into existence of the Industries (Development and Regulation) Act, the process of licencing acquired a very different character from what was originally envisaged".

The important conclusion, therefore, is that while the basic structure of socialistic democratic values

which constitute that Professor Raj Krishna called the value component of Pandit Nehru's ideology continues to remain valid, the institutional forms are the operating mechanisms have failed to achieve the result expected from them. Indeed, the time has come when in order to effectively pursue our commitment to the values of democratic socialism, i.e., growth, liberty and equality, it is urgently necessary to critically review and reconsider our traditional emphasis on State ownership or monoply of productive assets, and also the detailed administrative regulation and control over a wide range of economic activities. Marathe observes that there is enough evidence to suggest that a conscious policy of progressively reducing the degree of monopoly for public sector enterprises or even some of the public utilities may contribute more to the social good.

Worker's Participation in Managerial Decision-making
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The author who is currently the Director of the Institute of Chartered Accountants of Bangladesh opens that there is considerable scope for introduction and development of appropriate workers participation programmes in the public sector industries in Bangladesh, specially jute industries. According to the author there have been several attempts made in Bangladesh to introduce joint consultation type participation schemes through legislation. He blames the illiteracy of the workers and apathy of management for the non-enforcement of laws. However, he wants to establish the reasons for the non-success of the workers participation in management in Bangladesh.

The present book is a result of his doctorl work which centered around the objectives such as : How far a background for participative management has been created through the nationalisation of industries as perceived by the actors, i.e. workers, management and government ? How much is the existing organisational climate conducive to participative management ? What is the existing and desired degree of workers' influence in different decisions at various levels, in other words, the relationship between the amount of participation that they should have and the amount they perceive they do have in a variety of areas ? And, in what way workers should be involved in decision-making areas? How does each of the actors in the industrial relations system conceive the term 'workers' participation in management ? What are the desired forms of participative management as expressed by the actors ?

What should be the statutory status of participative schemes as expressed by the actors ? Should participation be statutory or voluntary ? How do workers and management perceive the impact of the Government's policy on participation ? How do they view the government intention.

What are the essential preconditions for successful implementation of participative schemes as desired by the actors ? And in the light of the views expressed by the actors, what is the future prospect of participation in the industrial enterprises ?

His study very interestingly shows that the industrial personnel in Bangladesh had perceived that nationalisation of industries in Bangladesh had failed to emanicipate the workers from the exploitative clutches of top managers.

According to the author both the parties equally desire for a better climate which is presently more feudal than democratic. Dr. Mannan also points out that the workers and the managerial personnel had differed in their meaning of participation from the managers. It was merely information sharing for the managers. It was taking part in the decisions for the workers.

The study by Mannan brings out another interesting revelation that the management was in favour of participation of workers mainly in the local issues and the issues which require cooperation of both workers and management. Whereas

the workers exhibit strong desire for influence in decision making at all levels.

The finding of the study point out certain preconditions as essential for successful participation. The preconditions listed by the author are as follows :

Decentralisation of the organisation structure as well as of the authority; Education of employees about the various aspects of participative management; Efficient channels of communication, the participants common perception and an appropriate system of rewards; freedom of organisation's leadership from the control of the political party; attitudinal changes both in workers and management to

adopt participative style of management; complete sharing of information by the company with the employees; having workers participation through their representative at plant level rather than external trade union representatives; existence of strong effective and honest trade unionism in the enterprise; clearly defined area of collective bargaining and separate identity of collective bargaining and participative management; management's recognition and acceptance of the concept of democratisation of work place; clarity of objectives of participative management; harmonius industrial relations climate; participation at all levels! and its extension to al! decision-making

processes; and it must not threaten or undermine managers' formal authority.

The above mentioned conditions brought out in the context of Bangladesh are as much relevant to India as to any other developing country in South Asia.

While the present work does not bring out any extraordinary finding that one did not know before, the book nevertheless makes an interesting reading for the simple reason, that this is a well researched book, well presented. This provides inputs to all trade union leaders, managerial personnel, government policy makers and research scholars. The get-up of the book is good but the price is extraordinarily high.

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on
Women and Development

M.S. LIMAYE

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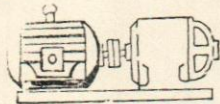
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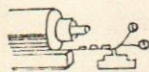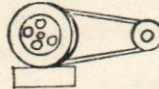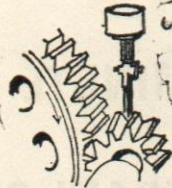
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