

## CONTENTS

	Page
I. PRODUCTIVITY STUDIES	
✓ Productivity and People	<i>M. Dillon</i> 227
{ Productivity Movement in India— Some Misconceptions }	<i>S. K. Goyal</i> 233
{ Productivity Movement and Management Responsibility }	<i>R. Madhavan</i> 238
{ Productivity and Trade Union Movement }	<i>A. N. Buch</i> 241
{ On Measuring Labour Productivity }	<i>Federalist</i> 245
{ Size, Technology and Productivity in Cement Industry in India }	<i>B. C. Mehta &amp; G. M. K. Madnani</i> 249
II. PRODUCTIVITY TECHNIQUES	
{ Cybernetic Management Systems in the Japanese Steel Industry }	<i>Dr. B. Hartmann</i> 254
{ Establishing a Retail Chain Store Branch — A PERT Application }	<i>Nesa Labbe Wu</i> 268
III. INDUSTRIAL RELATIONS	
✓ Corporate Industrial Relations Policy	<i>P. Chadha</i> 276
✓ Problems of Production, Productivity and Industrial Relations in India	<i>Late Satish Loomba</i> 281
✓ A General Manager Looks at the Industrial Relations	<i>B. R. Tulpule</i> 287

IV	TRADE UNION DEVELOPMENT		
	✓ Organised Labour in Singapore — Past, Present and Future	:	<i>C. V. Devan Nair</i> 293
V	MANAGEMENT DEVELOPMENT		
	✓ What Makes an Effective Manager — A Practical Approach	:	<i>G. Lobo</i> 301
	✓ Integrating Individuals with the Organisation — Foreign Concepts and Indian Management	:	<i>Dr. J. L. Rastogi</i> 306
V	INDUSTRIAL ENGINEERING		
	✓ Solving Assembly Line Problems	:	<i>Chander Bal</i> 317
VII	INDUSTRYWISE STUDIES		
	✓ Problems of Steel Forging Industry in India	:	<i>V. V. N. Somayajulu</i> 322
VIII	MARKETING		
	✓ Rural Marketing in India — A weakness and A Challenge	:	<i>N. K. Dhar</i> 331
IX	EDUCATION AND TRAINING		
	✓ On-the-Job Training — Some Approaches and Problems	:	<i>A. P. Saxena</i> 335
	✓ Relating Learning Theory to Behavioural Change in Organisations	:	<i>Thomas H Patten</i> 339
X	BOOK REVIEWS	:	352
	<b>HERE, THE ADVERTISERS</b>	:	358

# Productivity and People

M. Dillon\*

For the optimum realisation of the inherent potential of the MAN—the greatest single factor capable of contributing the most to the productivity—two questions must get satisfactory answers; they are : what are the needs and desires of working men? And what can the organisation do to satisfy these and thereby hoist productivity? Various theories have been propounded to explain the nature of man at work, some most important being Economic Man Theory, the Social Man Theory and the Theory of Self-actualising Man. Each theory depicts the successive stage of human understanding of man at work and provides some insight into human motivation. How in an actual work situation a human being could be motivated to give his maximum and what are its implications is the central theme of this paper.

**P**RODUCTIVITY, expressed as a mathematical relationship between input and output, depends to a significant extent on the way in which financial and material resources are deployed; but the greatest single influence on productivity performance is the degree to which the inherent potential of the human resource is realised. And here, I believe, is where we have most to learn, where we are failing most lamentably, and where the greatest advances can be made.

## The Real Problem

If we were guilty simply of failing to utilise our human resources to the full, then this would be serious enough. But the real problem is even more serious—there is still widespread misapprehension as to the nature of the human resource, the human being in a work situation, and ignorance of the means whereby his potential may be realised.

So we have a situation in which great numbers of employers, enlightened enough to be aware of the relationship between productivity and human resource utilisation, are seeking to motivate their employees on the basis of a sometimes erroneous view of working man's needs and desires. Doubly unfortunate is the fact that, while the employers' view apparently tends to remain constant, the needs and desires of employees tend to change over time (today's school leavers, for example, are better educated, more aware of social problems, less inclined to conform unquestioningly to institutional norms, and less concerned with security than their equivalents in the 50's).

Thus develops bewilderment on the part of the employer, who sees motivation, morale and company loyalty declining; and an increasing sense of frustration and alienation on the part of employees, who see a widening gap between their aspirations or values and the capacity of the organisation to satisfy or share them. The result is high absenteeism, high turnover personnel, of high recruitment and

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training costs, high wastage rates, high-incidence of industrial disputes, and low productivity.

Two obvious questions present themselves therefore:

- (i) What are the needs and desires of working man?
- (ii) What can the organisation do to satisfy these and thereby hoist productivity?

### The Nature of Man at Work

Over the years since the Industrial Revolution, there have occurred several major shifts in opinion among management writers, behavioural scientists and (generally some years after) managers, as to the nature and needs of man in the work situation.

The first view, particularly prevalent during the mid to late 19th century, is expressed in the theory of Economic Man, which holds that man is motivated primarily by economic incentives, that he is, in brief, greedy, lazy and materialistic with objectives almost invariably opposed to those of the organisation. Not all men share these undesirable characteristics, however. Aside from the selfish and untrustworthy mass, there is held to exist a moral elite whose task is to organise and manipulate the mass, using coercion, control and economic incentives.

The Economic Man theory, while academically discredited and not openly propounded by management in general, has proved very hardy and can readily be found even in today's industry, commerce and government.

Elton Mayo's famous experiments at the Hawthorne (Chicago) plant of the Western Electric Company stimulated a reaction against the Economic Man theory in the late 1920's.

Thus began the 'human relations' philosophy, or the theory of Social Man, which holds that man is motivated primarily by social, rather than economic, needs—that he is more responsive to the social forces of the workgroup than to the controls and incentives of management.

The task of management on this view, therefore, is to foster group life in the organisation—to create conditions in which employees are able to satisfy their need to belong, to be accepted, to participate, to be involved. If this is done, then job satisfaction and productivity, in that order, will follow.

The current status of the Social Man theory must be regarded as somewhat lower than that of Economic Man. Academically, Social Man is seen as an oversimplified notion, and few managers whose careers depend on the maintenance of output are likely to put such trust in the social needs of their subordinates.

The theory of Self-Actualising Man has been gaining support since the early 1950's and may be regarded as Social Man extrapolated in the direction of reality. It is certainly the theory to which most of today's researchers, consultants and enlightened managers subscribe, and has a large number of highly reputable proponents, including Abraham Maslow, Douglas McGregor, Chris Argyris, Rensis Likert and Frederick Herzberg.

Maslow provided the foundation for the theory when in 1954 he asserted that the needs of man are arranged in a hierarchy, from basic physiological needs (like food, warmth and sex) up through safety and security needs, social needs (affiliation, friendship etc.), and esteem needs (reputation, self respect) to the highest order of self actualisation or fulfilment.

needs. As the lower order needs are satisfied, so higher order needs emerge as motivators of behaviour. Now given that basic physiological needs and safety and security needs—on which, it should be noted, the theory of Economic Man is based—are satisfied in the work situation, then the individual will operate more on the basis of the third level, on which the Social Man theory is based. But if all three are satisfied, then the organisation must also provide for the satisfaction of esteem and self-actualisation needs, which, were not recognised by the earlier theories of man at work.

Other writers have followed Maslow, with distinctive theories of widely varying complexity; still others have warned of the dangers of naive generalisation of poorly understood concepts. There does seem to be general agreement, however, on the need for jobs to provide for the satisfaction of employee needs at every level on Maslow's hierarchy. Professor Hollis Peter, for example, listed seven factors which must be present in any job to meet the psychological and motivational needs of the job-holder:

- (i) Know the job: The need to know what one's job is and how one is performing in it.
- (ii) Variety: The need for work to be reasonably demanding (in terms other than sheer endurance) and to provide sufficient variety. Too little variety brings boredom; too much is frustrating.
- (iii) Learning: The need to be able to learn on the job and to go on learning. To learn, one needs attainable targets or goals to shoot at, and feedback in order to correct oneself and improve.
- (iv) Elbow room: The requirement for some

area of choice and decision-making where an individual can exercise his discretion.

- (v) Social support and recognition. The need for supportive relationships with peers, bosses, and others in the organisation.
- (vi) Meaning: The need for an individual to relate what he does and what he produces to the objectives of the company and to his life in the larger community.
- (vii) Desirable future: The need to feel that the job leads to some sort of desirable future (which does not necessarily imply promotion).

### Catering for Human Needs

So to our second question—how can we (assuming we have any control over events) cater for the needs of the employee, avoid alienation, improve productivity by effectively utilising the human resources at our disposal?

Over the last twenty years numerous individual approaches to this problem have been developed and implemented—often with entirely unforeseen consequences. These have included management by objectives, job rotation, job enlargement, job enrichment, grid organisation development, adventurous incentive systems, sensitivity training, productivity bargaining, employee attitude surveys, and a bewildering variety of management development programmes and training schemes.

A common finding has been that, however laudable the intention, these measures if implemented in isolation provide partial (and often temporary) answers only. The most suc-

successful approaches have involved systematic and comprehensive reviews of organisation and job design, with close attention to areas such as training, remuneration and industrial relations.

This approach also has been developing over about the last twenty years, since the pioneering studies by Trist and his colleagues from the Tavistock Institute of work organisation in Britain's coal mining industry. In brief, what Trist did was to alter the production system from one in which each individual miner performed a single and simplified task within a rigid organisation structure, to one in which he performed a variety of tasks, in co-operation with a semi-autonomous work group and within a simplified organisation structure. The new system, using the same number of men, yielded a 22 per cent increase in productivity and a 60 per cent decrease in absenteeism.

Since then, similar approaches, concentrating on the basic restructuring of jobs and work organisation, have been successfully used in a number of countries and industries, including textiles in India, oil refining in England (Shell), electronics in Holland (Philips), pet foods (Luv), chemicals (ICI) and aluminium manufacturing (Alcan) in Australia, car manufacturing in Sweden (Saab, Volvo) and a variety of industries in the United States.

The list of successes is not yet huge, and it should be noted that organisation and job design in the context of a newly established plant is much easier than organisation and job re-design in an old-established one. However, there is clearly a growing belief, founded on the results of experiments and on the beneficial effects of large scale implementation in some notoriously awkward industries, that only by means of such radical measures do we stand

much chance of making up lost ground and approaching full utilisation of the potential inherent in the human resources of industry.

#### An illustration

An example of full-scale organisation and job design was described recently by Professor Richard Walton of Harvard Business School. I'd like to repeat some of the key features of the design, since it seems to illustrate rather well the sort of comprehensive approach I have been talking about.

A large American pet food company, whose existing plants demonstrated many of the expensive symptoms of alienation—including sabotage and violence—had to set up an additional plant at a new location, and determined to design it to accommodate the motivational needs of employees. The design and early development phase took two years of planning, training, consultation with the management team and so on. Then was implemented a system with the following features:

- (i) **Autonomous work groups:** have collective responsibility for large segments of the production process. There are six groups, averaging about 11 members in size, with leaders (selected from foreman level) responsible for team development and decision-making; job allocation within each team is extremely flexible and subject to group consensus—individuals are not expected to perform the same functions indefinitely. During each shift, a processing team and a packaging team operate, and handle everything from unloading of raw materials through to warehousing and shipping. The teams also concern themselves with such matters as selecting re-

placement operators, redistributing work to cover for temporary absences, and coping with manufacturing problems.

- (ii) **Integrated support functions:** Maintenance, housekeeping and quality control, in addition to limited personnel functions, are the responsibility of the teams themselves, rather than separate staff units.
- (iii) **Challenging job assignments:** While job assignments are designed to facilitate re-definition according to particular circumstances, each set of tasks is initially structured so as to include functions requiring higher order abilities—such as planning, troubleshooting and liaison work. Where a particular basic task cannot be enriched (e.g. forklift truck operating), the team member is assigned additional and more demanding tasks (e.g. planning warehouse space utilisation).
- (iv) **Job mobility and rewards for learning:** Since each set of tasks is designed to be equally challenging, a single classification applies to all team members, who receive pay increases for learning more and more aspects of the total system. There is no restriction on the number of employees who can qualify for increased pay, and so employees are encouraged to teach one another.
- (v) **Managerial decision-making and self-government:** Operators receive economic information and management decision rules, and can, therefore, make decisions ordinarily made only by supervisors or managers. Plant rules themselves were not laid down in advance—instead, rules are allowed to evolve from collective experience.

(vi) **Uniformity of facilities:** No reserved parking spaces, no executive entrance, no variation in decor between plant and office. The plant's physical design emphasises uniform status and encourages human contact and free communication.

(vii) **Commitment to flexible developments:** Management is firmly committed to assess continuously both the productivity of the plant and its relevance to employee concerns in the light of experience.

Of course, problems were experienced in implementing this very adventurous system—training, education and consultation at all levels were critical factors in overcoming reservations among operators, and both suspicion and inertia on the part of some headquarters management staff. Problems inevitably occurred in connection with pay rates and pay progression. However, all the signs of a considerable success were evident eighteen months after the plant commenced operations—low turnover and absenteeism, high morale and job satisfaction and an across the board reduction in variable manufacturing costs compared with the old plant.

The case I have quoted is certainly extraordinary, for its thoroughness as well as for the favourability of the conditions in which it was initiated (new plant, small labour force, no lack of union co-operation, and so on). But it is representative of a developing trend of which we all have an obligation to be aware.

**Training,** of course, plays a key role in the successful implementation of organisation and job design. On one hand, there exists the need for education programmes to explain the rationale, nature and particular objectives of the project both to those involved and to those

not involved. On the other, comprehensive programmes of skill-training are necessary, to ensure that employees are capable of handling the increased responsibilities which they must bear in their enriched jobs.

**Industrial Relations:** Clearly the productivity performance of industry, commerce and government cannot be improved through radical measures of the type I have been discussing without active support from the trade union movement. And since it could I think be reasonably argued that trade unions in general are just as conservative as the organisations in which their members are employed, any moves to establish comprehensive training and educational facilities for union representatives in their activities and responsibilities should be welcomed.

As work design for motivation and productivity spreads, one would be justified in anticipating an increase in the incidence of productivity agreements. Productivity negotiation, in its modern form exemplified by the 'Fawley Blue Book' of 1960, is generally based on the payment of wage increases for improved productivity, which is achieved by improved flexibility of labour. This flexibility may involve eliminating demarcation lines between skilled trades, or increasing the scope of jobs carried out as part of a man's normal work, of abolishing craftsmen's mates, or facilitating job mobility.

It is, of course, possible to achieve productivity increases through better organisation and job design without engaging in productivity negotiation as such. A healthy industrial relations climate, however, is vital, and this means effective joint consultation **prior** to the implementation of major changes.

At a conference on the subject of productivity, some instances of such negotiations were described by a senior consultant from Urwick International. He commented on their beneficial side effects in these words:

'Productivity bargaining can be very effective in the area of industrial relations if for no other reason than that the preliminary negotiations offer an ideal opportunity for free and frank discussion of the implications of pay, prices, profitability and productivity'.

If such free and frank discussion were the rule in industrial relations, rather than the exception, then unions and their members, might be less inclined to distrust management's motives in seeking to implement anything that looks like even slightly radical change.

### Conclusion

Many problems face the employer who contemplates drastic measures to achieve productivity gains through people. However, goodwill and guts can solve these problems, as Volvo and others have shown. Much more serious problems face the employer who chooses, either from ignorance or from disbelief, to ignore the needs, aspirations and expectations of people.

May I conclude by quoting the philosophy of the Japanese Productivity Centre:

'Productivity is the belief in human progress, It is a state of mind which aims at perpetual improvement. It is a ceaseless effort to apply new technology and new methods for the welfare and happiness of mankind. It is the training of minds and development of attitudes of the people as a whole which determines whether the nation will realise high productivity and an affluent life or low productivity and poverty.' ●



# Productivity Movement in India—Some Misconceptions

S.K.Goyal\*

The message of productivity reached India very late and that too with many misconceptions and fallacies according to the author. The main causes of poor productivity were considered as the low labour productivity and the out-dated machines and the methods employed in industries and in agriculture. Few even dare to call Indian workers and peasants lazy and less productive as compared to their counterparts in other countries. In passing these judgements, the difference in wages and working conditions, socio-economic background and above all the economic environment are looked over. Unfortunately, not much has been done in India to expose these misconceptions and fallacies, maintains the authors. As a result, productivity schemes do not get the proper reception from those for whom they are meant. This article attempts to highlight some of these fallacies along with the alternatives.

THE basic concept of productivity is simple and sounds very reasonable. It appeals to a sense of logic. Because of its simplicity, people feel that it is enough to know the definition of this term and it gives them the confidence to speak about poor productivity in India. Industrialists, bankers, politicians and supervisors consider themselves to be competent to pass judgement on such issues. The attitude of those in authority, and misconceptions and fallacies about the very concept of productivity necessitate a critical look at the problem with a view to correct them.

## FALLACIES AND MISCONCEPTIONS

### A. Definition Fallacy

Productivity is defined as the ratio of output to input. The output may be in the form of goods or services produced, e.g. yards of cloth, tonnes of wheat, gallons of petrol, etc. The

input may be number of man hours, machine hours, area of land, etc. employed to produce the output. This definition can be applied to an enterprise, an industry or an economy as a whole. Productivity in actual practice is evaluated on the basis of arithmetical ratio between the amount produced and the amount of any resources used in the course of production. These resources may be: land, material, plant-machines and tools and the services of the man or, as is generally the case, a combination of all four.

It is to be realised that productivity is represented as a ratio and this is a major drawback of the definition. The ratio reflects relative rather than absolute values and can, therefore, easily be misinterpreted. Ratios do not reflect, as a general rule, the 'true' consequences of past actions but rather the relative consequences. A ratio (of output and input), for a particular resource, can result from entirely different situations.

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The productivity of all resources employed is conflicting in nature. If we try to improve material productivity then we may cause the labour productivity to decrease. There is no point in improving productivity of some resources and neglecting some. The problem should be tackled in the case of all the resources. We cannot simply treat some resources in isolation.

### B. Higher Production Fallacy

This fallacy existed for quite some time and I hope now it is not there. The production can be certainly increased by replacing the old machines with expensive modern machines. New machines may produce more without altering productivity.

### C. Sole Criterion Fallacy

In the sole criterion fallacy a single criteria is selected for the basis of evaluation. For example, we try to assess on the basis of labour productivity. Is productivity in a company low? This is difficult to say as there are no set standards by which all features can be judged.

The problem of selecting appropriate criteria is greatest when comparisons are made. The greater the difference in the methods, cultural, social and economical environment, the greater is the problem of selecting the appropriate criteria in order to make a realistic comparison of productivity in two countries.

### D. System's Input Fallacy

Even while comparing labour productivity in India with any other country (say, Germany), using the same machines and methods, we tend to ignore some most important factors. The output can be measured in both the places without any difficulty. The problem

arises in measuring the input of labour. While considering input of labour we must keep in mind that conditions in Germany are so different from those in India. Will a German worker be able to maintain high productivity if he is asked to work in the environment in which an Indian worker works?

Labour productivity, productivity of material and so on are consequence variables. These are the variables in terms of which we wish to assess the effectiveness of a system. While the amount of resources which can be employed by management is termed as control variables. These are the variables which are within the control of the management. The uncontrolled variables of the system are those which are not within the control of the management but they still effect the outcome. Labour morale, national and international political situation are examples of such variables. To some extent it is not correct to term labour morale as uncontrolled variable because this can be significantly controlled by the management by adopting right policies.

In normal circumstances a man works for money. This is the biggest single motivating factor. The productive work given by a worker is closely related to his wages. We expect the same output from an Indian worker, as is given by a German worker, while we pay him so less. We must keep in mind:

- (a) An Indian worker earns not even  $1/5$ th of what a German worker gets.
- (b) The daily consumption of calories by an Indian worker is about  $2/3$ rd of what a German worker consumes. The consumption of proteins by an Indian worker is miserably low.
- (c) A German worker is assured of a decent home and gets all medical aid

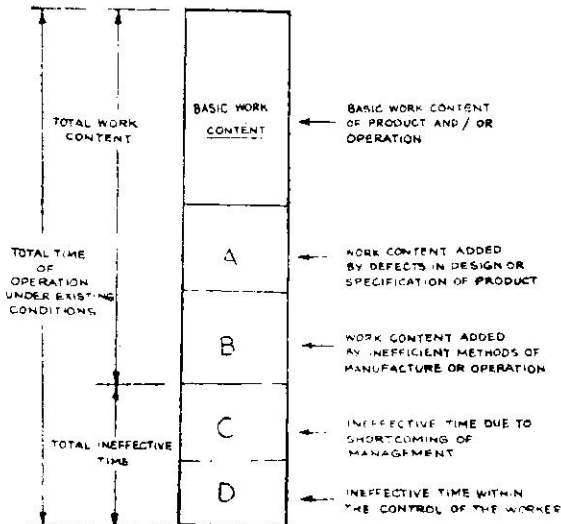
when required by him or his family members.

- (d) The climatic conditions in India are not very conducive to hard work.
- (e) The environmental conditions in most of the Indian factories are hopeless as compared to German standards.
- (f) Indian companies, unlike German companies, do not make much use of work study techniques for improving productivity.
- (g) The attitude of supervisors is so different in both the countries.

Unless we could take into consideration these factors regarding input while making a comparison of productivity, the comparison is meaningless and misleading.

### E. Responsibility Shifting Fallacy

The role which management and supervisor can play in improving productivity can be found in most of the text books and in conference halls, but it is very soon ignored while making an assessment of productivity. The



book on work study, published by International Labour Office, lists the break-up of total time of operation under existing working conditions. The time taken by a man or machine to carry out an operation or to produce a given quantity of product may be considered as made up in the following manner, which is illustrated in the diagram.

There is first the basic work content of the product or operation. It is the irreducible minimum time of a performance. In general actual times for operations are far in excess of it on account of excess work content. The work content is increased by the following:

(i) *Work Content Added by Defects in the Design of Specification of the Product*—the reasons for this excess work content are:

- (a) Bad design of product
- (b) Lack of standardisation
- (c) Incorrect quality standards
- (d) Design demands removal of excess material

(ii) *Work Content Added by Inefficient Methods of Production*—The reasons for this excess work content are:

- (a) Wrong machine used
- (b) Process not operated correctly
- (c) Wrong tools used
- (d) Bad lay-out
- (e) Operator's bad working habits

(iii) *Ineffective Time Due to Shortcomings on Part of the Management*—The reasons are:

- (a) Excessive product variety
- (b) Lack of standardisation
- (c) Design changes
- (d) Bad planning
- (e) Lack of raw materials
- (f) Plant in bad condition

- (g) Plant breakdowns
- (h) Bad working conditions
- (i) Accidents.

(iv) *Ineffective Time Within the Control of the Worker:*

The basic work content and the time added due to (I), (II) and (III) give the time of operation within the control of the management. However the workmen can also add some ineffective time. The actions on part of the workmen which may cause ineffective time are:

- (a) Absence, lateness and idleness
- (b) Careless workmanship
- (c) Accidents

If management adopts right policies then this ineffective time, though it is within the control of the workers, can be reduced significantly. The ineffective time, added due to faults of workers, reflects on the morale of workers. Poorer the morale of workers, the higher will be the ineffective time due to their faults.

**(F) Low Performance Rating Fallacy**

About six years ago I was attached to a work study engineer for two months and as such I was with him while he conducted some work measurement studies. I was surprised to note that only on two occasions he rated a workman as 100 (Normal rating=100). His argument was "you should not expect a performance of more than 100 from these workmen". His attitude was typical of what I noted among other work study engineers in India.

**(G) Negotiation Fallacy**

I remember the displeasure of one senior industrial engineer who strongly objected to my suggestion in one Indian journal that the

time standards should be negotiable with the unions. To him the idea of time standards being subject to union negotiation was strange and ridiculous.

My experience has strengthened my views that time standards should be negotiable with the trade unions. In a country like India, where work study engineers have yet to attain the reputation of having high professional ethics, this seems to be the only solution. By negotiating time standards with the unions, I do not mean that there should be bargaining about time to be allowed for jobs. By negotiations regarding time standards, I mean that trade union should be given the opportunity to conduct a work measurement exercise through any professionally recognised work study engineer. It is a fact that trade unions do not have faith in work study engineers employed by the management.

**(H) Fallacy of Blindly Following**

One particular area, which baffles me most, is that of using standards for relaxation and fatigue allowance based on practices abroad. Fatigue and the time to recover from fatigue depends on the climatic conditions like temperature, humidity etc. The relaxation allowance for a job being done in open in Assam should be more than what should be allowed if similar job is done in open in Punjab. We must try to set our own standards regarding time allowances.

**Remedial Measure**

The salvation lies in spreading the message of productivity through National Productivity Council and Institution of Industrial Engineers. The Institute of Industrial Engineers has got a tremendous responsibility in formulating code of conduct for its members. The strict obser-

vance of professional ethics will help in enhancing the prestige of the profession.

The position of an industrial engineer (in India they prefer to be classified by this more dignified term) is similar to a company auditor. Both owe their existence to good wishes of management but both should be fair, unbiased and honest if they want to discharge their duties truthfully.

#### **Conclusion :**

It is very misleading to compare productivity

in one country with productivity achieved in other countries. The reason is that the environment in which the input resources are employed to create output are different. We must keep in mind the difference in the environment. Failure to remember this fact generates misconceptions and fallacies which do not help in improving productivity. I hope many industrial engineers are aware of this situation though very few will accept it. I appeal to such industrial engineers to give a thought in this area. There is a lot to be done and we have not even started.

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## **Executive Time : A Key Resource**

The conviction that time—not money—is a company's most critical resource will soon be sweeping through executive offices. When a decision on capital budgeting, managerial promotions, and new organizational structures is made, a key question is going to be: "How much executive time will it take or save?" Curtis H. Jones of the Harvard Business School says that companies, which already have engineering departments to save time and money in the production process, ought to set up similar task forces for duty in the executive suite. Operations research and other specialists would concentrate on ways to conserve executive time. Until that day rolls around, the executive will be pressed to ration the valuable resource of time and allocate it well. Some contend that computerized simulation models haven't always worked out in practice because most models fail to recognise that time is the scarcest resource. But measurement of the money value of time is difficult. There seems to be no convenient discounting process based on an interest rate such as capital budgeters use to compute the "time value of money" and rank potential investments in terms of their "discounted cash flow". Executive salary is a poor measure of the value of an officer's time, and more sophisticated ideas—for example, opportunity or marginal costs present even more problems. Who now can measure, for instance, the benefit to the company of one more hour of an executive's time? One potential breakthrough: Experiments in "human resource accounting" that attempts to translate a company's investments in managerial talent into dollars-and-cents asset items on the corporate balance sheet.

# Productivity Movement and Management Responsibility

R. Madhavan\*

If productivity movement is to acquire the character of a mass movement, it is necessary that the concept is filtered down to workers. They should know what is productivity as also what implications it has for them. Not only this, workers should also participate in any scheme to raise productivity. No doubt, the management in many cases would face workers' resistance to change their traditional ways but it is here where lies the ingenuity of the management to persuade workers to give a willing acceptance for implementing productivity techniques. This can be done only when workers are convinced that the change would also bring betterment of their lot.

THE increasing importance of infusing productivity consciousness amongst the vast industrial population of our country needs no iteration. The ocean of labour force, supervisory teams and managerial multitude have to be necessarily brought into the chain of productivity movement. This mammoth task has to be overcome at three distinct stages :

- (i) Introducing and educating the concept of productivity movement.
- (ii) Effective implementation of productivity process at all levels of the industrial sphere.
- (iii) Maintenance and progress of productivity achievements.

It is rather heartening to note that the concept of productivity movement which emerged in the Indian Industrial scene, not long ago, has caught the attention of a vast majority of progressive as well as orthodox industrial institutions. No doubt, efforts to improve the

productivity is a basic instinct in any industrial entrepreneur. As such to bring the elite of the entrepreneur class into the productivity movement is not a difficult task. However the task becomes increasingly difficult in the case of the middle and bottom cadres of the industrial population and most difficult when it comes to the level of worker.

The factors which have been responsible for not so smooth an introduction of productivity movement at the lower levels can be classified as follows :

- (i) Haphazard and unplanned approach by which the concept was attempted to be thrust on them.
- (ii) Ignorance about the concept of productivity and lack of opportunity to get enlightened on the various positive aspects of the productivity movement.
- (iii) Sense of insecurity owing to preconceived ideas that they may be robbed of their employment opportunity or the

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may have to overwork if they give room for any productivity technique to be implemented.

### Tailor-made Techniques

It is a common experience that most of the managements while introducing productivity techniques in their organisation, have been rather hasty in trying to thrust them without giving full consideration for the peculiarities that are involved in their organisation. Though the concept of productivity is universal, it has necessarily to be moulded to a proper shape to meet the individual requirements. It is rather easy and equally vague to conduct general discussions and seminars on productivity, but it is not that simple task when one has to implement it at his plant. Hence, it is very essential that one gives full and detailed consideration of all the factors which he has to face before even a pilot attempt is made to introduce the concept of productivity anywhere. A wrong introduction will have far-reaching consequences in any future attempt to rectify the state of affairs. We should fully bear in mind that in this particular task of introducing the subject of productivity, it is very true that the first impression always happens to be the lasting impression.

A careful classification of the personnel and the labour force to whom one desires to introduce the concept of productivity has to be first made. A fool-proof design of the manner in which the introduction has to be made at each level must be laid down. Factors which may give rise to sharp reaction or even refusal should be completely avoided in the preliminary stage of introduction. Such things can always be brought into the picture when one has received the subject pleasantly and is ready to learn more.

### Resistance to Change

It is human to resist any change from the normal habitual way of working. Any concept of productivity, aimed at any level, will necessarily envisage certain rational changes to improve the existing state of affairs. But one cannot expect that majority of people would willingly accept any proposal that might force a change from normal habitual way of doing things. Unless one is basically convinced that the change is for the better not only from the organisation's point of view but from his own personal angle, it is impossible to expect him to extend his co-operation. Therefore only if the concept has been properly introduced to the person and sufficient confidence has been infused in him regarding the advantages of the proposed changes, we can expect him to join the band of productivity movement. This is universally true irrespective of the category to which the individual belongs. This alone can remove the psychological barriers from the way of productivity movement.

### Disseminate Knowledge

It is true that there has been a positive awakening in the higher-ups to the promises that higher productivity holds for them. But the question arises whether this awakening will in itself be enough to achieve the goal. There is a vast treasure of knowledge available to those who have sufficient opportunities for participating in various gatherings and meeting men from various sections of industrial society, which in turn makes them totally submit themselves to the chain of productivity movement in our country. But unfortunately, the knowledge and experience gained by the fortunate ones do not at all get disseminated to those who are low in the ladder. In my opinion it is a great

disservice if one fails to pass the knowledge, he gained, to his subordinates.

Though there is bound to be difference in the magnitude of opportunities at various levels, it can to a certain extent be ironed out if one takes it as his prime responsibility to disseminate his knowledge and experience to the people around him. It will be extremely effective if the seminars and such other gatherings planned and conducted by various national agencies dedicated to the cause of productivity movement are so designed as to provide ample opportunities to various cadres of the industrial population to get themselves involved and benefited.

#### **Dispel Misconceptions**

Unfortunately, an extremely wrong notion of productivity movement has been impressed in the minds of a vast majority of industrial population in our country. The very concept of productivity study in a factory necessarily means to an average worker as a prelude to make him overwork and/or retrenchment of some of the existing workers. Who is to be blamed for such a situation? The answer is that we should blame ourselves, for this has been a direct resultant of haphazard planning

and implementation of productivity programmes. Determined efforts to demonstrate that productivity programmes will positively bring benefit not only to the organisation but to the individuals also, have to be made. Small and manageable projects can be taken up as pilot projects to pinpoint to the worker the profitability of improved productivity. Since little drops of water make the mighty ocean, such small successful attempts repeated over a number of times in every organisation, will serve as a powerful tool in establishing and gaining a healthy confidence in the minds of our not-too-sophisticated industrial workers towards productivity movement.

If, as a country, we have to march forward setting a strong foot towards a prosperous future, nothing else other than proper education of our industrial population to enable them to join in the gigantic task of raising productivity will help. We should not lose any time in assuming this vital responsibility of propagating the concept of productivity in a planned and purposeful manner. If only managements engage themselves in this mammoth national programme with a firm conviction and determination, it is certain that we are going to lead in the list of countries where higher productivity is a proud achievement. ●

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# Productivity and Trade Union Movement

A.N. Buch\*

In the present context of Indian situation, trade unions cannot afford to have a negative approach towards production and productivity. While right to strike must be regarded as the undeniable right of workers, WILL to produce more and more must be considered as the high road to prosperity and social justice. It must be frankly admitted that neither all trade unions nor all government policies have this necessary 'Will'. One has, therefore, to discriminate between 'negative trade unionism' and 'positive trade unionism' as also between good government policies and bad government policies. The reward for positive trade unionism should not be its neglect but due recognition, pleads the author. The cause of productivity would be served much more effectively if all—trade unions, employers and government and political parties—understand and have conviction that "nation is bigger than ideology", maintains the author.

**T**RADER unions and workers are positive agents of production and human welfare. The organised workers under the trade union movement are required to undertake multifarious activities that will lead to the welfare of working class in particular and society in general. Welfare of community cannot be achieved unless every citizen is extended job, he or she is educated to perform their job responsibly and create a sense of involvement in the duties they perform. Some of the trade unions entertain feeling that managements are not extending economic and social justice to working class and therefore it is not possible for them to cooperate management in the process of production and productivity. It may be true to a larger extent, however trade unions in a democratic set up of a country cannot afford to have such a negative approach.

## Immense Benefit to Working Class

Within last 25 years of our freedom number

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of labour legislations conferring right and responsibility on both the managements and workers have been enacted. These legislations are likely to be imperfect or need additions and alterations but till amendments to the liking of labour movement is achieved, trade unions cannot and should not behave like warring groups and confrontation camps. Trade unions can certainly be proud of their achievement on legislative fronts and these measures have received wider and sympathetic support of public opinion of the country. Some of the legislative measures like Employees' Provident Fund and Gratuity Law, have done immense benefit to the working class. Such benefits extending a widest coverage to employees both organised and unorganised can never be achieved by trade unions and Central organisation of labour howsoever they are powerful. Such legislations cannot survive, unless it is supported by continuous stream of productivity.

### **Ethics of Socialism**

Trade unions, anxious to seek justice for workers, should also modernise their weapons for confrontation with the management. Right to strike is considered to be a most valuable right but right to work has a greater value in a country which has accepted creed of pervading socialism through democratic process. Democracy in any organisation cannot survive if high-handedness at any level of State or the people is allowed to grow. This is even true for the growth of Industrial democracy. It is essential to nourish the plant of socialism through observance of socialist ethics, education and morality. At times some trade unions having their staunch views on socialism are working contrary to the ethics of socialism. There may not be everything safe and sound under public sector management but to an extent, behaviour of some trade unions have played a role to run down public sector and nationalisation. If trade union authority imitate the same behaviour of high-handedness, self-centredness and selfishness of management in its own look, there is no scope for the success of the public or the nationalised sector.

### **Arbitration—Voluntary or Compulsory**

Production and productivity can only be enhanced if creative energy, mental peace, fearlessness sense of participation, open-mindedness, mutual respect, and tolerance to other's views can be accepted as guideline by both the management and trade unions. Some of the grievances are aggravated due to temperamental disability, dislike to understand each other and suspiciousness which in turn encourages industrial dissensions. This can only be remedied through arbitration, voluntary or compulsory so that the country will not be required to pay heavy cost arising out of work

stoppages. Trade unions or managements cultivating the atmosphere of frustration in working class retards the growth of productivity. It is futile to believe that trade unions and managements alone possess the monopoly of wisdom, foresight, reasonableness, progressiveness, rationality and only their plans and programmes can bring economic and social balance. State can certainly play a decisive, effective and positive role to eliminate economic and social imbalance. The leadership at Government level should be bold but impartial. There are two types of leadership, one that builds the worker from below, the other builds the top floor without any base. The first type of leadership brings in responsibility while the latter nourishes mobocracy.

### **Who Can Operate Vehicle of Productivity ?**

When one enters into the area of Government and its leaders and their duty to the nation various ideological questions crop up. If leadership at Government level uses the State power to fan up the dissensions and strikes obviously the dream of higher productivity cannot be realised. If Trade Unions adding to the mandays lost are sympathetically treated and are extended prize posts of Government machinery and those who work incessantly for growth of productivity and industrial peace are termed as non popular and reactionary, the latter type of leadership is not at all worried, but those who have no faith in the productivity movement cannot operate the vehicle of productivity while sitting in Government post and positions. The leadership at Government level in their enthusiasm and, at times, crazy to fight out the capitalism need not divert its warring energy towards trade unions opposing such negative ideology. There are honest and welfare-oriented labour leadership in the country and its continuous neglect will not

add to the strength of party trade unions.

### **Continuity of Industrial Unrest**

The orbit of arbitration, adjudication, settlement of industrial disputes in recent years has moved from tribunals to those who are leaders of Government. If they can successfully attend this business no one will have any objection to their taking decisions. However it is feared that those who are in leadership will not be able to discharge this duty and patch-up and opportunistic decision will lead to continuity of industrial unrest. Again, decision taken by such leaders are likely to be pressure-oriented and at times, even outside the orbit of the labour legislations. It happens that fight against capitalism may not necessarily be a fight for the welfare of workers. Some of the Government leaders do not enter labour field to do good to poor. Their aim is to find out which of the management are useful to them in conducting their leadership policies and programmes. Such a tendency has given birth to unscrupulous leadership in the trade union field and their obstruction to productivity can never be corrected by the combined strength of Central organisations of labour in the country. Such a scene can be visualised from north to south and east to west, which has brought bad name to the trade union movement. If the experience of last two years of interference by State leaders in labour disputes has brought in good results and lead to improvement in national economy, by all means it should be multiplied to achieve triple growth. If the result is contrary, and it is, the policy should be forsaken.

### **Small Side of Socialism**

To bring down those who are high-ups in power and position may be one small side of the socialism but this cannot be created if

persons of smaller means and energy are not taken to higher goal. Industrial workers' biggest contribution to socialism and democracy is production and productivity and those who stand for socialism and democracy should not bring down the very ideas which are only cure to evils of present day economy. Discipline at every stage of life is an absolute *must* and attempts should be continued by trade unions to cultivate the same in their own field. A conscious, loyal to the nation and disciplined working class can prove a better check on erring managements. Trade unions have to bring out managements from cess pool of stagnation and corruption, expose its extravagance and bureaucratic attitude in organising production and distribution.

Managements, quoting productivity consciousness of American and Japanese workers forget about their own responsibility in the field of production. Pattern of management in a democratic State must necessarily change. Its performance should be judged from quality and quantity of production, workers' wages and working condition rather than how dirty part some of the management play in obstructing genuine trade unions and dividing the workers for their own selfish ends. Wage rise, profit rise and rise in the prices of the product cannot be said to be a socialist approach. On the other hand, wage rise accompanied by lower cost of products and decrease in the profits are decisive steps to socialism and as such workers will be justified to oppose productivity movement if it aims at increasing the profits, enhancing the tax return and adds to inconvenience and denies the sharing between consumers and workers.

### **Act as a Trustee**

The thesis of trusteeship may not be relished

by all but managements. Government and trade unions can certainly act as trustee of the society without naming it. Trusteeship is different from paternalism that prevails in the country in all the organisations including political parties. It is not necessary to call out a strike to set right a management. No doubt it is easy to call out a strike but always difficult to manage. Again, strike by unions having no backing of political party lose the battle and strengthens power of onslaught of management on trade unions and workers. This also leads to the subject of relationship of trade unions with political parties. This is a subject by itself but suffice it to say at this stage that whatever may be the relationship, it should not retard economic growth and national discipline. Managements in the country have almost lost its moral to confront trade unions. If trade unions at the shop level takes little more interest in augmenting productivity, management, whatever it be but temperamentally selfish and greedy to earn higher results, are most likely to tolerate the intervention of trade unions.

### **Nation is Bigger than Ideology**

The nation is bigger than ideology. The nation and Government in power are two different things. Whatever be the party in power and what ever be its tyranny towards trade unions which do not belong to their party, genuine trade unions working for the welfare of workers and community at large should lead the movement of production and productivity unless power shortage, material shortage, mismanagement gallons of strikes from one to another industry makes it difficult for them to accelerate the pace of productivity at all stages. Trade unions consciously taking part in productivity movement, possessing technical knowhow and drawbacks of productivity are bound to have their voice in distributive side of the national economy and none including Government will dare to confront such trade unions possessing positive outlook and constructive approach. Any power, creating confrontation to such a trade union movement, will invite its own exit and this will further create scope for trade unions to manage such industries for the good of the nation. ●

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## **Lasers May Help Combat Pollution**

Laser technology is helping scientists solve one of industry's oldest problems—factory chimney smoke. A mobile unit has been developed by Laser Associates Ltd. in Britain which can "measure" polluted air and may one day be used to police heavy industrial areas to enforce legislation.

The system acts rather like radar, using a powerful beam of light instead of radio waves, measuring light scattered back from vapour and smoke over a factory chimney. The strength of the signal indicates the amount of pollution.

—British Information

# On Measuring Labour Productivity

Federalist\*

Theoretically productivity of various factors of production can be measured by obtaining simple output-input ratios. But these ratios have a meaning only if both numerator and denominator, i.e. output and input can be clearly defined and isolated. In practice, however, it can not happen. Various factors affecting productivity are so interlinked that it is difficult to say whether increased productivity is the result of purely technological advancement, organisational changes or better skill and effort of the workmen. As a matter of fact, increase in productivity may be the result of judicious combination of all factors of production. In some quarters, however, partial productivity measures like labour productivity are taken to be regarded as the absolute measures of productivity of given inputs. In this article some of these misconceptions are exposed for the benefit of those who are concerned with the measurement of productivity.

AN economic activity is said to be productive if it replaces the value of the inputs it uses by output having a larger value. The productivity of an input is its ability to lend itself to such replacement by a larger value. Labour productivity is the ability of labour to make to output a larger contribution of value than the value of labour itself.

A worker producing eleven units a day would appear *prima facie* to be more productive than his colleague in the same factory making ten units daily. But this would be true only on the assumption that the wages of the two are equal. If the first worker's wages are more than ten per cent higher than those of the second worker, the latter would clearly be more productive in spite of the first one's ten per cent higher output. The customary output-per-worker measure of labour productivity assumes equality of wages.

There can be no valid comparisons of productivity between workers working with different types of capital equipment and raw materials. It is pointless to insist that a weaver produces more cloth on an automatic loom than on the ordinary powerloom, or that a spinner spins better yarn with long-staple cotton than with the short-staple variety. The customary output-per-worker measure of labour productivity assumes similarity of equipment and materials and working conditions in general between workers whose productivity is sought to be compared.

A worker turning out the same number of units every day may be found to have made a larger or a smaller contribution to the value of output depending on the rise or fall in the price of the output. Even with the price of the output being constant, his contribution to the value of output would be more or less if his wages fall or rise in the period under consideration. His ability "to make to output a larger contribu-

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\*Pseudoname of the Author.

tion of value than the value of labour itself" depends thus on the price of output as also the price of labour. The customary output-per-worker measure of labour productivity assumes constant prices for both inputs and the outputs.

The output per worker is a simple ratio between output and the number of workers employed in the course of its production. It neither means that the value of the entire output is attributable to labour alone, nor can it indicate how much of the value could be attributed to labour. Its utility is purely comparative, to show whether one worker is more productive than another. In another words, the customary output per-worker measure of labour productivity is only an ordinal, and not a cardinal, measure.

Having regard to the assumptions underlying it, the customary output-per-worker ratio can be a valid measure for comparing productivity only of workers similarly placed in the same factory, and that too only for a short period. The assumptions do not hold good in the long run even in respect of one and the same worker, let alone for comparisons between different workers.

### Value Added

The ratio, "value added" per worker, is often preferred to the output-per-worker ratio in measuring labour productivity. The term "value added" or "value added by manufacture" connotes "the contributions made by an enterprise or industry over and above the value of the materials and services it purchases."\* Whatever be the other advantages of using the value-added-per-worker ratio, it must be noted that it

is equally subject to all the assumptions mentioned above in regard to the output-per-worker measure of labour productivity.

The Annual Survey of Industries (ASI) defines the term value added as, "the part of the value of the products which is created in the factory and is computed by deducting from the gross *ex-factory value of output*, the gross value of input", the term input being defined to include the value of materials and fuels consumed and amount paid to other concerns for work done for the factory, and depreciation, etc. Since the ex-factory value of output, which is generally arrived at by adding to the cost of inputs purchased (i) the wages paid to workers, (ii) the expected return to capital, and (iii) the expected return to management, is bound to be realised in the scarcity conditions obtaining in the country, it stands to reason that the ASI concept of value added represents the sum of these three items.

The National Commission on Labour\*\* as well as others have relied upon the ASI statistics of value added per worker to conclude that labour productivity has shown a rising trend during the last few years. It is, indeed, very strange that a rise in the value added per worker should have been taken as evidence of a rise in labour productivity, when the value added per worker might well have gone up simply because of an increase in wages. It is even more strange that such a rise in the value added per worker should be further made a ground for justifying still higher wages !

This may be countered by the argument that the value added per worker has risen, not so much because of a rise in wages, but because of a

\* Measuring Labour Productivity (Geneva: International Labour Office, 1969), page 35.

\*\*Report, p. 224

rise in the return to capital and management. But such an argument, if accepted as true, only raises the question whether the larger return to capital has been necessitated by the larger input of capital.

Let us look at the ratio of value added per worker from another angle. As already seen, this ratio assumes equality of wages. The assumption can be removed, and it is necessary to remove it in dealing with aggregate or time-series, data, by weighting the workers covered by the ratio with their respective wages. When this is done, the ratio has to be worked out with value added in the numerator and the total wage bill (instead of merely the number of workers) in the denominator. That is, it becomes a ratio of value added to wages. A rise in this ratio will mean a fall in the reciprocal ratio of wages to value added. If this ratio is considered indicative of labour productivity, then a rise in labour productivity results in a fall in the workers' share in the total value added, and *vice versa*. To expect, therefore, that higher labour productivity should be accompanied by a larger share of wages in the value added would amount to expecting the impossible.

A curious innovation conventionally made in the value-added-per-worker ratio is to take value added at constant prices by deflating the value added with the appropriate price index: this is claimed to reveal the *real* changes in labour productivity. It is not clear what is real about this imaginary value added at constant prices. In a monetized economy, changing prices are the reality, and it is out of the total value added under these prices that labour, capital and management have to be remunerated.

Both the concept of labour productivity and the value-added-per-worker ratio supposed to measure it have been much abused by persons

ignorant or forgetful of the assumptions underlying them. The output-per-worker and the value-added-per-worker ratios can be considered valid indicators of labour productivity for certain purposes only for a short period in respect of similarly placed workers in the same factory.

Attempts to measure changes in the productivity of a single factor like labour over a long period are based on a misconception of the production process. An entrepreneur, before taking a decision to produce and sell any particular product, makes an assessment of the total costs of production and the revenues expected at different product prices and different scales of production. If the expected returns on that product are found relatively attractive as compared to those on other products, he then decides to produce that product on a certain scale in the hope of selling that much quantity at a particular price. The scale of production determines the technology to be used, which in turn determines how much of each factor like labour, fixed capital, raw material, power, etc. should be employed to turn out the desired volume of output. Let the productivity of labour, at this scale of production, be X. If after some time the entrepreneur comes to expect a higher return with a larger scale of production, he will expand output and buy more of labour, machinery, power, etc. in the appropriate quantities. The productivity of labour at this higher scale may be more or less than X. Some time later again, if the entrepreneur expects a large decline in the return on that product, he may reduce the scale of production, in which case labour productivity would change again. If the return on output were to decline further, he may close down altogether and transfer his resources to another line of production, in which case the productivity of labour employed on the earlier product and now idle, would vanish into thin

air. The point to note is that in all his calculations, the entrepreneur is concerned with the total revenues and the total costs of production, and not with the productivity of this or that individual factor of production. In other words, labour productivity is not an independent entity, but is merely the by-product of economic decisions taken on entirely different considerations.

Productivity comparisons over a long period, therefore, if they must be made at all, should be made on the basis of the total output-input

ratios, and not the output-labour ratios alone.

Lastly it is necessary to beware of the vague but nevertheless evocative words like the national level of productivity and the productivity of Indian labour and so on. Labour, like every other factor, has to be either productive or not so primarily to its actual user, the undertaking, and to none else. If a worker is productive to his undertaking, then what his productivity amounts to at national or any other level does not matter. If he is not, then ten angels swearing he is productive at some other level will not help him to retain his job. ●

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## Social Background of Students Emphasised

The I.Q. of a child is only one of the factors which affects performance at school, says a recent United Nations Educational, Scientific and Cultural Organization (UNESCO) report which identifies other major influences on educational performance including deprived social backgrounds, poor food and health and the general effects of poverty.

The report, considered by the 33rd International Conference on Education at Geneva is based on answers to a questionnaire sent out to UNESCO's 125 member states.

Commenting on the replies, the report concludes that the principle of democratization of education remains "merely a theoretical one" and although there have been many reforms they have not generally provided equality of educational opportunity.

The answers confirm that factors as decisive as I. Q. range from the occupation of the father in the family, how much he earns and how regularly he works, to whether they live in a town or hamlet and the level of economic and social development in the country in which they live.

The report advocates educational reforms to offset the effect of the background of a student including "compensatory" education at all levels of the education system. It calls for "new strategies" to win the battle against inequality with communities, families and school forming a "common front", and adds that the situation cannot possibly be changed by traditional teaching methods.

—UNCESI Note



# Size, Technology and Productivity in Cement Industry in India

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Based on the data of twelve companies† consisting of some twenty-eight units, the present study attempts to test the validity of the hypothesis that better technology and economies of scale have a significant positive correlation between them and the level of productivity. The analysis of data reveals that size and technology are negatively associated, i.e. small-sized units use improved and better technology. On the other hand, there is ample evidence that the plants which are more capital-intensive and more mechanised have also higher levels of productivity.

IN this paper an attempt has been made to examine the effects of size and technological developments on Productivity in the Cement industry in India.

## The Hypothesis

- (a) *Size and Technology* : On a *a priori* reasoning it should be expected that as the size of the firm increases, improved and better technology can be adopted. Also firms with better technology would tend to grow faster. Thus size and technology may be expected to show positive correlation.
- (b) *Size and Productivity* : It is generally held that because of economies of Scale larger units show higher Labour and

Capital Productivity. A significant positive correlation should, therefore, be expected between size and productivity.

- (c) *Technology and Productivity* : The purpose of technological development is to raise productivity, hence on a *a priori* basis, there ought to be positive correlation between technology and productivity.

## The Approach and Method

This study is based on the returns furnished by the 12 Companies controlling 28 Units, in reply to questionnaires sent to all companies operating in the Cement industry. Data from remaining have not been received so far, despite several requests. All the same, since the total installed capacity and production of these companies together contribute  $\frac{3}{4}$ th of the total installed capacity and production of the industry as a whole, the results arrived at in this study may be considered as broadly representative of the industry.

The precise connotation of the terms used in this study, is as follows:

*Size* : Size of the plant can be represented either by installed capacity or by the number

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†All the companies were requested to supply information about their average daily employment (excluding quarry workers and persons employed other than where the factory is situated) during the years 1965-1968. This average number was multiplied by 330 or by the number of working days in the year of the corresponding company to arrive at the total factory employment. The total number of manhours was calculated by multiplying the above total employment by 8.

of workers employed. But as the Table No. 1 shows that the rate of capacity utilisation in each plant varies from its actual capacity from year to year, we have, therefore taken the total factory employment as the indicator of the size of the plant.

*Technology* : Two alternative measures of technology have been used (a) Degree of mechanisation, which has been measured by power consumption per manhour and (b) Capital intensity. It has been observed that some units in the industry have installed better mechanical devices at different stages of production, specially for handling raw material (limestone) and the intermediate products (slurry and clinker). In Indian situation, and specially in Indian cement industry installation of better mechanical devices require more power and as such power consumption per manhour also increases. Hence this has been used to measure mechanisation and technological developments.

Alternatively, technological development and the consequent mechanisation would require fresh capital investments. Therefore, capital intensity (capital-labour ratio) can also

be used to measure technology.

*Productivity*: Four productivity measures have been used in this study: (a) Net value added (NVA) per unit of capital; (b) Surplus per unit of capital; (c) NVA per unit of labour and (d) Surplus per unit of labour. Capital refers to total capital fixed and variable, employed for production purposes. Labour stands for total manhours put in by workers in a year. The surplus is defined to cover residual of value added after wages are deducted.

*Analysis*: We have conducted the analysis to calculate the coefficients of rank correlation and test their significance between: (I) Size and Technology, (II) Size and various measures of productivity, (III) Mechanisation (Kwh per manhour) and productivity and (IV) Technology (Capital intensity) and productivity.

The hypothesis on the previous page is tested on the basis of the results of this analysis.

*The Results*: (I) Size and Technology: Table-1 gives coefficients of rank correlation between size measured by employment and technology measured by capital intensity.

#### Values of Rank Correlation Coefficients between Size and Technology

Table 1

Years	When Technology measured in terms of total capital per employee.	When Technology measured in terms of fixed capital per employee at constant prices (see footnote of Table-6).
1965	— .80	— .81
1966	— .77	— .73
1967	— .70	— .70
1968	— .62	— .55
1969	— .69	— .79

(Note : All the values except —.55 are significant at 5% level)

The above table shows that the size of the plants is negatively correlated with the capital intensity in the plant. In other words small sized plants are more capital intensive and thus

are more technically developed than the bigger units. As such our first hypothesis that size and technology generally show positive correlation does not appear to be true in case of cement industry.

(II) Size and Productivity: Table 2 gives the coefficient of rank correlation between size and the four measures of productivity, namely: NVA per unit of capital and labour, and surplus per unit of capital and labour for the years 1965-68

### Values of Rank Correlation Coefficients between Size and Productivity-Ratios

Table 2

Productivity Ratios	Values of Coef.				Av. for 4 years
	1965	66	67	68	
(a) NVA per unit of capital	+ .49	+ .40	-.21	-.50	-.07
(b) Surplus per unit of ,,	+ .14	+ .39	-.65*	-.61*	-.35
(c) NVA per unit of labour	-.49	-.61*	-.81*	-.64*	-.68*
(d) Surplus per unit of ,,	-.40	-.47	-.77*	-.55	-.72*

(Note : Values marked with Star are significant at 5% level).

Column 5 of table No. 3 gives the same for the average of 4 years. The co-efficient for NVA per unit of capital are insignificant throughout for all the four years, in other words size of the plant does not affect capital productivity. Surplus per unit of capital shows uneven behaviour and fluctuates widely. For the first two years the coefficient (r) is positive (though insignificant) and for the last two years and four-year period as a whole it is negative. For the last two years this co-efficient shows a significant negative relationship with size. Thus contrary to general belief bigger firms do not show higher productivity (of capital), in fact in the last two years smaller firms show higher surplus per unit of capital.

Correlation coefficient for both the measures of labour productivity: NVA and surplus per unit of labour, is consistently negative. For the four-year period as a whole both the co-efficients are significant. Thus small units contribute more production per unit of labour employed, thereby our 2nd hypothesis that size and productivity have positive correlation cannot be accepted. In fact for the cement industry in India, for the period under consideration, smaller units show higher productivity.

(III) Mechanisation and Productivity: Table-4 shows that mechanisation ratio is positively correlated with productivity, specially with labour productivity.

### Values of Rank Correlation Coefficient between Mechanisation Ratio and Productivity Ratios

Table 3

Productivity Ratios	Values of Coefficients				Average for 4 years
	1965	1966	1967	1968	
(a) NVA per unit of Capital	+ .37	+ .20	+ .45	+ .75*	+ .33
(b) Surplus per unit of Capital	+ .45	+ .13	+ .65*	+ .71*	+ .44
(c) NVA per unit of labour	+ .57	+ .52	+ .71*	+ .76*	+ .65*
(d) Surplus per unit of labour	+ .60	+ .36	+ .61*	+ .76*	+ .71*

(Note : Values marked with Star are significant at 5% level).

For the average of four-year period 'r' with NVA per unit of labour input comes out to be +.65 and with surplus per unit of labour +.71. Capital productivity is not significantly associated with mechanisation ratio for the four years average period. But 'r' is significant with surplus per unit of capital for last two years 1967 and 68. With NVA per unit of capital, 'r' is found significant only for one year 1968. Our hypothesis that greater mechanisation means higher productivity stands vindicated, though more strongly in the case of labour productivity

than in case of capital productivity. It can also be concluded that mechanisation has begun to effect labour and capital productivity only after 1966; prior to 1967 'r' does not come out to be significant.

(IV) Technology and Productivity: Adoption of better techniques when measured in terms of capital intensity (capital per factory worker) also shows positive correlation with both the indicators of labour productivity as shown in table No. 4.

#### Values of Rank Correlation Coefficients between Technology and Productivity Ratios

Table 4

Productivity Ratios	Values of Coefficients				Average for 4 years
	1965	1966	1967	1968	
(a) NVA per unit of capital	0	+ .10	+ .14	+ .29	— .17
(b) Surplus per unit of ,,	+ .04	— .06	+ .39	+ .40	+ .51
(c) NVA per unit of labour	+ .55	+ .55	+ .67*	+ .65*	+ .65*
(d) Surplus per unit of ,,	+ .46	+ .30	+ .70*	+ .65*	+ .77*

(Note : Values marked with \*(Star) are significant at 5% level).

The positive values of 'r' with the two indicators of capital productivity is not found significant at 2.5% level of significance for one tailed test. Thus technological development increases productivity via increase in labour productivity rather directly by affecting productivity of capital employed.

#### Labour Efficiency, Mechanisation and Capital Intensity

Though the period of 4 years is too short

to have a time series analysis, yet some pattern can be seen in movement of the indices and ratios considered here over the period 1965-68.

On putting the indices of labour efficiency (as measured by output per manday) against the indices of units of power consumption per manday and capital intensity, Table No. 5 shows that in 1966 and 1968 the labour productivity index was 16% above the 1965 level. Against this, mechanisation ratio was 52 and 56 percent above the 1965 level.

## Indices of Labour Efficiency, Mechanisation and Capital Intensity

Table 5

Year	Labour Efficiency		Mechanisation		Capital (fixed) intensity† at 1961 prices.	
	Output per manday (tonnes)	Index	KWH per manday (KWHrs)	Index	Fixed capital per employee (Rupees)	Index
1965	0.788*	100	67.85*	100	16,906*	100
1966	0.913	116	103.46	152	18,168	107
1967	0.871	110	101.26	149	20,080	119
1968	0.913	116	106.13	156	23,683	140

†Fixed capital has been deflated by Investment Cost Index for Indian Economy 1951-52 to 1967-68 prepared by Shri T. R. Talwar (Sixth Indian Conference on Research in N. I. Bangalore, 3-5th May 1968). Index for year 1961-62 has been treated as the index for 1961. Due to non-availability of index for 1968, cost-index for that year has been assumed to be the same as that of the year 1967.

\*Refers to 11 Companies only.

During 1967 productivity index declined by 6 points as also the mechanisation index by 3 points. On the other hand fixed capital intensity has shown steady increase. Whereas the mechanisation index has shown a sharp increase in 1966, fixed capital per employee increased sharply in 1968 when the lull in industrial activity due to recession was broken and larger additions of new capacity were made. Hence over the 4-year period there has been complete correspondence between labour productivity, mechanisation ratio and capital intensity, all the same it is also clear that labour productivity is not rising as fast as the mechanisation ratio and capital intensity.

### Conclusion

The above analysis reveals that size and technology are negatively associated; in other words small sized units use improved and better technology. Also the plants which are

more capital intensive and more mechanised show higher productivity. Thus the labour efficiency of the units operating in cement industry is commensurate with the extent of adoption of better technology and mechanisation.

Incidentally, the higher rank correlation coefficient between capital intensity and surplus-labour ratio, and also between mechanisation and surplus-labour ratio reveals that the main effect of mechanisation and technological development is to extract more surplus value from the workers. This, to some extent, also means that the wages may be lagging behind productivity increases. Nevertheless deeper studies need to be conducted at micro-level for each unit using larger time-series data so that problems arising due to different processes, age of the plants, grade of coal and raw material used, and even the product-mix (in case of certain units) may be taken into account. ●

# Cybernetic Management Systems in the Japanese Steel Industry

Dr. B. Hartmann\*

For utilizing the benefits of computerisation to the fullest possible extent EDP systems have to be developed into more and more sophisticated. The last goal on this way is a cybernetical system which enables an entire production cycle from raw material's entry to product exit. This last stage of complete automation is characterized by unmanned plant operation in the production and also in the administration areas. There are two prerequisites which must be realized: feasibility and economy. It is a must for a system to be feasible as well as economical. Considering, the present computer technology and experience, cybernetical systems in the full theoretical sense are neither feasible nor economical in most of the cases. But they can be realized in the practical sense of the word and further more, they are being used already in some cases. The present case is a typical example.

**T**HE development of EDP systems in the Japanese steel industry represents a remarkable milestone towards the target of almost fully unmanned operations. Even intellectual routine work in all administration functions is handled almost automatically. The significant ideas are two fields of job activities which are usually operating separately and the linkage of these two fields.

Process control computers are connected with the production control systems which are also connected with the administration EDP systems. In this case administration refers to all kinds of business work from routine on the bottom to certain types of creative planning and decision making in the management level.

## Theoretical Foundation

For visualizing the target of total business systems some theoretical foundations may be

helpful which come out from experience. By the way in this field science and scientific research work can't help very much and also couldn't be useful in the case of my presentation. Theory in this respect means to build up a scheme of generalized results derived from practical experience.

For designing a highly elaborated EDP system there are two possible concepts. The one follows the latest advances in technology which means proceeding the integration of all EDP activities in the firm step by step. The second way is originated in the idea of the last step of future systems elaboration, it is an abstract of an ideal system, not considering the present stage of computer technology and economy. The ideal model has to be transformed to present reality concerning technological, economical and organizational aspects of the computer and the goals and requirements of the firm. The first way is going forward start-

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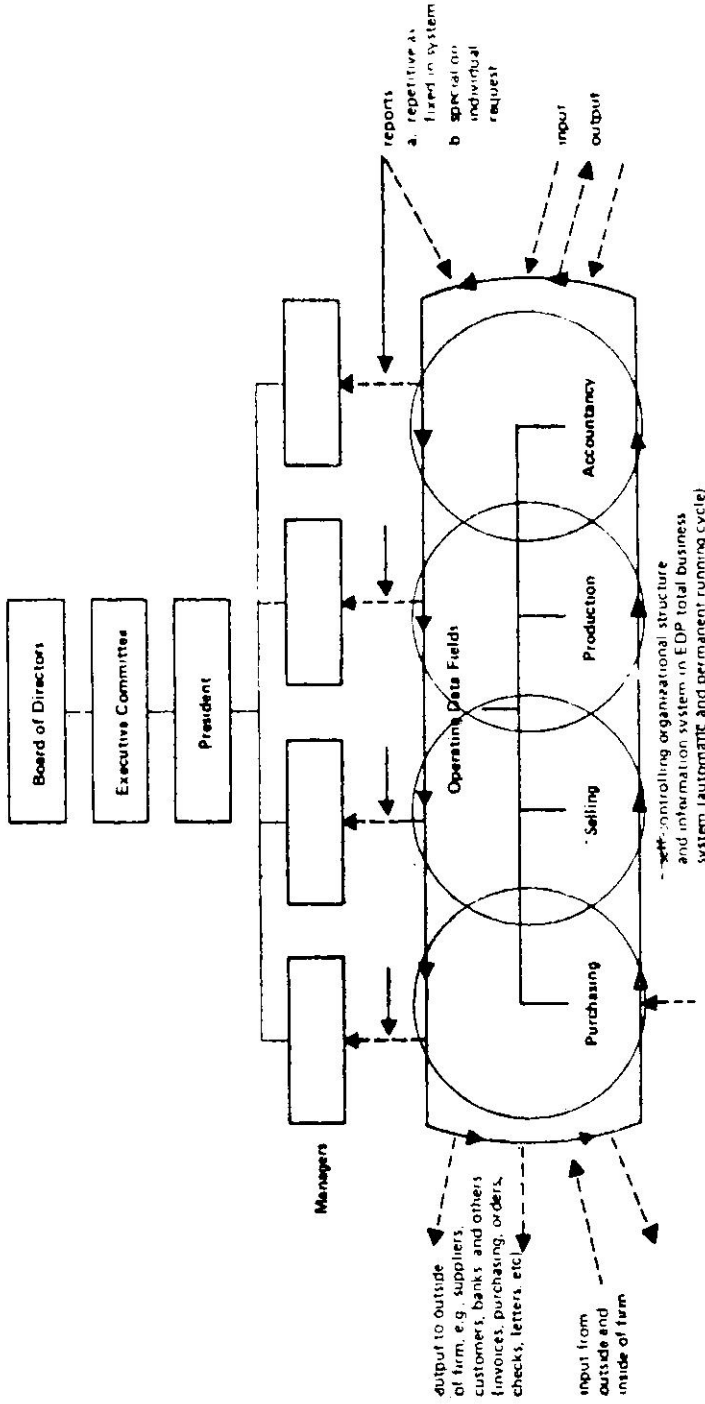


Figure 1 ORGANIZATIONAL STRUCTURE OF EDP TOTAL BUSINESS SYSTEM

The system has to be constructed by sub-systems, e.g., for production planning, purchasing, inventory control, selling. The sub-systems may be designed simultaneously by several analysis groups. In the first stage sub-systems are working separately which is a *must* for testing them, although they are conceived for the linking to a total system. The concept of subsystems and the connecting them together in a bilateral and multilateral way is prescribed by experience.

Fig. 2 demonstrates the working of the system as to organization structure and feedback principle. Information requirements have to be fulfilled for planning of management (first stage) and also for operating in the workshops (third stage). The second stage represents the administration functions of planning and controlling by EDP processing. The fat printed arrows indicate the automatic feedback system for controlling and adjusting the operations in the fields of purchasing, production and selling.

The planning field is restricted to the running production programme not comprising strategic decisions like incorporation of other firms or changing the long-range goals of the firm.

### Individualized System Modelling

*Prerequisites* : Concerning EDP systems requirements the situation for setting up a cybernetic system is characterised by three items;

#### 1. *Technology of the production area*

A cybernetic system affords most modern automatic equipment, for instance a workshop with an extension up to 5,000 feet long (for heavy plates and sheet). Process computers are a *must* for all machine operations.

#### 2. *Situation in the purchasing and selling market*

Any neckshole in purchasing of material should be avoided. On the selling market there are two types for steel-makers which are oriented to order or to market. For coping with the always changing selling market the system is more complex, of course. This type of selling market is true for steel production and also for the case of this presentation.

#### 3. *The internal organization of the firm*

Mostly it is more difficult to change an old system into a modern one and to erase reminiscences. In this case brand new production equipment had been built up within the last few years and induced a most modern EDP organization.

As to the production type there are two kinds which are different in EDP techniques:

1. Mass production of great series of a restricted number of products. This category is usual for the anonymous market, but mostly not for steel production.
  2. Production in small series of a great variety of products. Steelmakers belong to this type unfortunately as to the demands of complex EDP organization. The variety of products is due to raw material, kinds and measures referring to individual customer's wishes. All data for the production planning derive from customer's wishes.
2. *Transforming of the Generalized Model (Fig. 2) into an Individualized One for the Steel Industry (Fig. 3).*



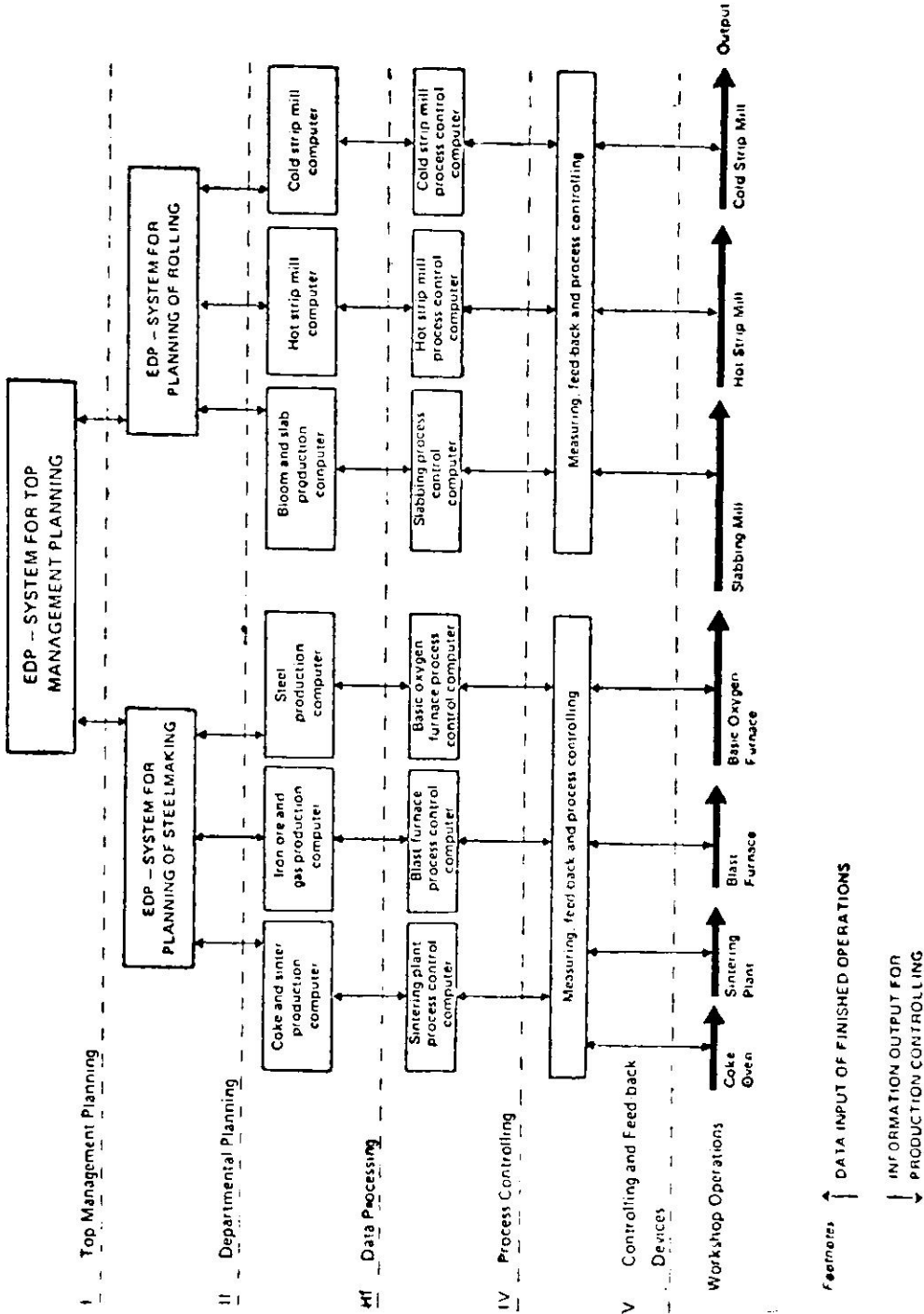


Figure 3: EDP CYBERNETIC CONCEPT FOR STEEL PRODUCTION

It would be easy to give a mere description of a certain cybernetic application. Rather than going too far into the details it is more informative to work out the highlights and the fundamental structure of such a system. In this way experience can better be used also for other branches, obviously.

Fig. 3 shows the EDP cybernetic concept of a steel producing firm. Each of the five stages is run by separate computers. The integration in this case is much more developed than usual up to now. The limitation of EDP systems to all kinds of administration work is erased.<sup>2</sup> The operations in the production area are involved in the systems for the first time of computer applications. The traditional separation between production data system and administration data system does not exist in a cybernetic system.

In the branch of steel production the system works in five hierarchical stages :

(1) *Top Management Planning*

A long range production planning is based on the long range market data for future sale development. This planning embodies the stock of customer's orders and also a pretty difficult order entry system which transforms the incoming orders into economical production units considering several stages of workshop operations.

Besides the production field there are more planning fields, of course, such as investing, financing, corporate organizational problems, research and technology planning and many more. I am preferentially treating the production field in the details for demonstrating the coherence of the hierarchical stages and the integration of subsystems.

(2) *Departmental Planning*

On this stage planning is getting more complex for working out the time schedule of semi-finished and final products in a somewhat optimized sequency.

(3) *Data Processing*

This stage deals with the handling and processing of data in the computer systems for transforming of stage 2 into stage 4 for respective process controlling. On the other hand the data of production output are input data on this stage and processed for adjusted and corrected new production planning data.

(4) *Process Controlling*

The submodels of this stage concern the production equipment capacity, divided into operational units. They are very detailed and comprise all quantitative relations between all parts of the production fields for short periods, days or weeks.

(5) *Controlling and Feedback*

There are as many subsystems necessary as submodels in the preceding stage No. 4. This stage makes the connection between process controlling units and production equipment.

The five stages are integrated in the way that the results of each upper stage are transformed to the computers of the next lower stage. These input data work as independent variables in the respective subsystems and submodels. On the other hand the results of each stage are transformed to the computers of the next higher stage. By closing this circle the real integration of the five stages is realized. The circles are running forward and backward automatically by computer to computer systems. They

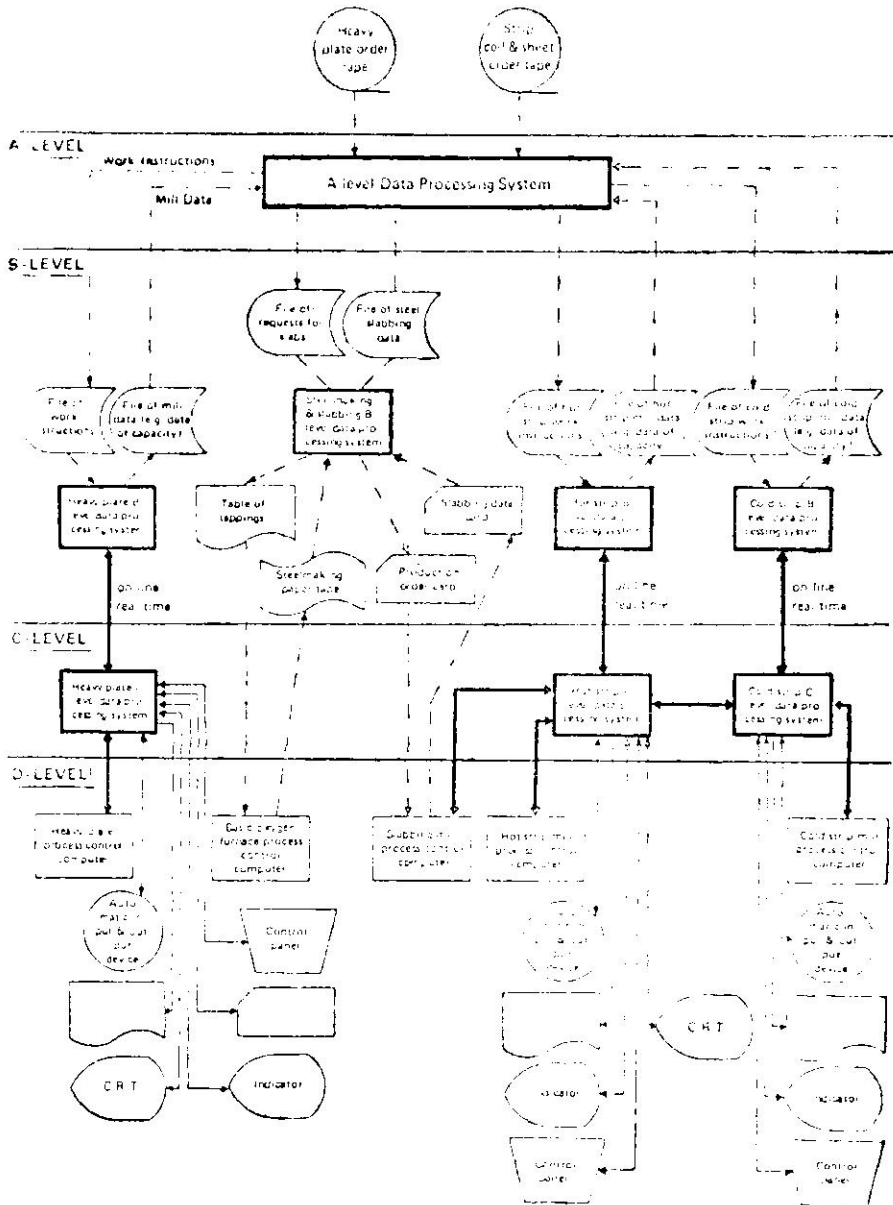


Figure 4: STRUCTURE OF INTEGRATED EBP SYSTEM

Footnotes

--- Batch transmission of information through batch tape, magnetic tape, disks and tape-to-tape lines

— Real-time transmission of information between computers by electric connection (bus lines)

- - - Real-time transmission of information between computers and terminals by electric connection (routing)

are running permanently or within short periods, especially at night time between the shifts.

All the five stages with all subsystems could be operated by a large scale computer. In the Japanese steel industry separate computer systems are preferred. This solution seems to promote the reliability and independency of the part systems. Besides, the system can be constructed in separate stages, in sequence or simultaneously. The computer systems are linked on-line or off-line in some parts of the system in some firms which means a higher or lower degree of integration, subsequently affording more or less manual interaction. In the Japanese steel industry the large scale computers are IBM made, the little ones especially for process controlling, are Japanese made.

### Detailed Description of a Cybernetic System in a Steel Plant

#### 1. Background Dates

Some Japanese steel works are the most modern in the world as to technology and also as to tailor-made EDP systems which practically spoken are cybernetical systems.

The production equipment of one of the modern steel works is as follows:

- 2 Sintering Plants (altogether 12.000 T/D)
- 2 Blast Furnaces (altogether 13.000 T/D)
- Converter
- Continuous Casting Machine (75.000 T/M)
- Slabbing Mill (450.000 T/M)
- Heavy Plate Mill (150.000 T/M)
- Hot Strip Mill (329.000 T/M)
- Reversing Cold Strip Mill (25.000 T/M)
- (among other things) 2 Tandem Cold Strip Mills (altogether 180.000 T/M)
- Galvanizing Plants (20.000 T/M)

The personnel of the plant consists of 6.600 people only including all administration functions. The firm has an own quay (especially

for discharging of raw material) for ships with a capacity of 150.000 tons.

The system for production, planning and control embodies the latest advances in computer technology. It is a centralized and a nearly perfect on-line-real-time system based on the man-machine concept. The automation phase was established by several large computers which are connected with the process control computers on the computer-to-computer basis. Through the entire production cycle from raw material's entry to product exit the data flow is handled on a real-time concept to the actual movement of the material on the production line. All administration data from order entry to the delivery of products are processed in the centralized computer department. The whole system is very close to full automation.

A staff of 90 experts has been working for about two years for designing and constructing this system. After introduction about 400 people could be released from plant work. The yearly net savings, even with all expenses for the computers and EDP organization taken into account, amount to \$ 650,000.

### Organizational Structure of Integrated EDP System in the Production Area

The production planning and controlling system has four control levels according to scope of function cycles. These levels are organized in four separately structured EDP systems. The two production lines are heavy plate and sheet, and the organization system is equal for both of them. (See Fig. 4)

#### A-Level

This stage handles materials computation from order entry through product shipment. The production planning is scheduled for daily work on a ten-day cycle. The transforming of

customer's orders into economical production units in several steps of operation is included, for quantities and qualities, also changes of the running programme, also handling of shipping with a lot of administration data and shipping papers required.

All planning work is based on the latest dates of work progress, so former planned dates are continuously corrected. Major functions of this level are order processing and modification request for all materials, order status and general work instructions.

#### *B-Level*

On this stage the firm is using an off-line system. Levels A and B use the same data which are stored on tapes or discs. The detailed time schedule for all operations is elaborated by the computer concerning allocation of products and semi-finished products and work scheduling (daily by shifts). The controlling system comprises the cross-checking of all workshop operations especially the collection of mill data (daily by shift) with the data of shipment output. Many changes in customer's order and in production output or which may occur in the production area afford very fast repeated elaboration of scheduling details.

#### *C-Level*

There are three on-line real-time systems, one for cold rolling and one for hot rolling and one for heavy plate. In this individual case production planning for steel making and slabbing is made partially in level B or D. There is also some manual interaction by using the outprints of level C.

The computers operate, as opposed to other computers, in the on-line real-time concept. The system gives operator guides and collect mill data, all being very much detailed. So the

operator guides and working structures are given for each working place (by on-line terminals of level D). Data for production planning are transmitted to the production control computers. The processing of these data are based on results for production planning made in level B which are transmitted to level C on-line-real-time. The dates of progress of all operations in the workshops are collected by on-line devices and terminals from level D. All these data are transformed into gross values and materials and product groups for the requirements of level B. Computers of the level C are Japanese made.

#### *D-Level*

This level embodies the process control computers which are also Japanese made. By these computers all operations in the workshops are initiated and the results of the operations checked and collected by special devices. These input data from the production line are transformed for the processing in level C and transmitted on-line-real-time.

Most of the process control computers are connected on-line with a superior EDP system which is true for the communication between level D and C. So data exchange in both directions is performed very fast and automatically. From level D data quote level C and from there, transformed as said above, to level B for the daily production planning. The data transfer from D is performed daily before office hour.

The communication for the data for steel-making and slabs is made off-line between level D and B by paper tape and punched cards. In this case the degree of integration is lower of course and not performed automatically. The lowest degree of integration is represented

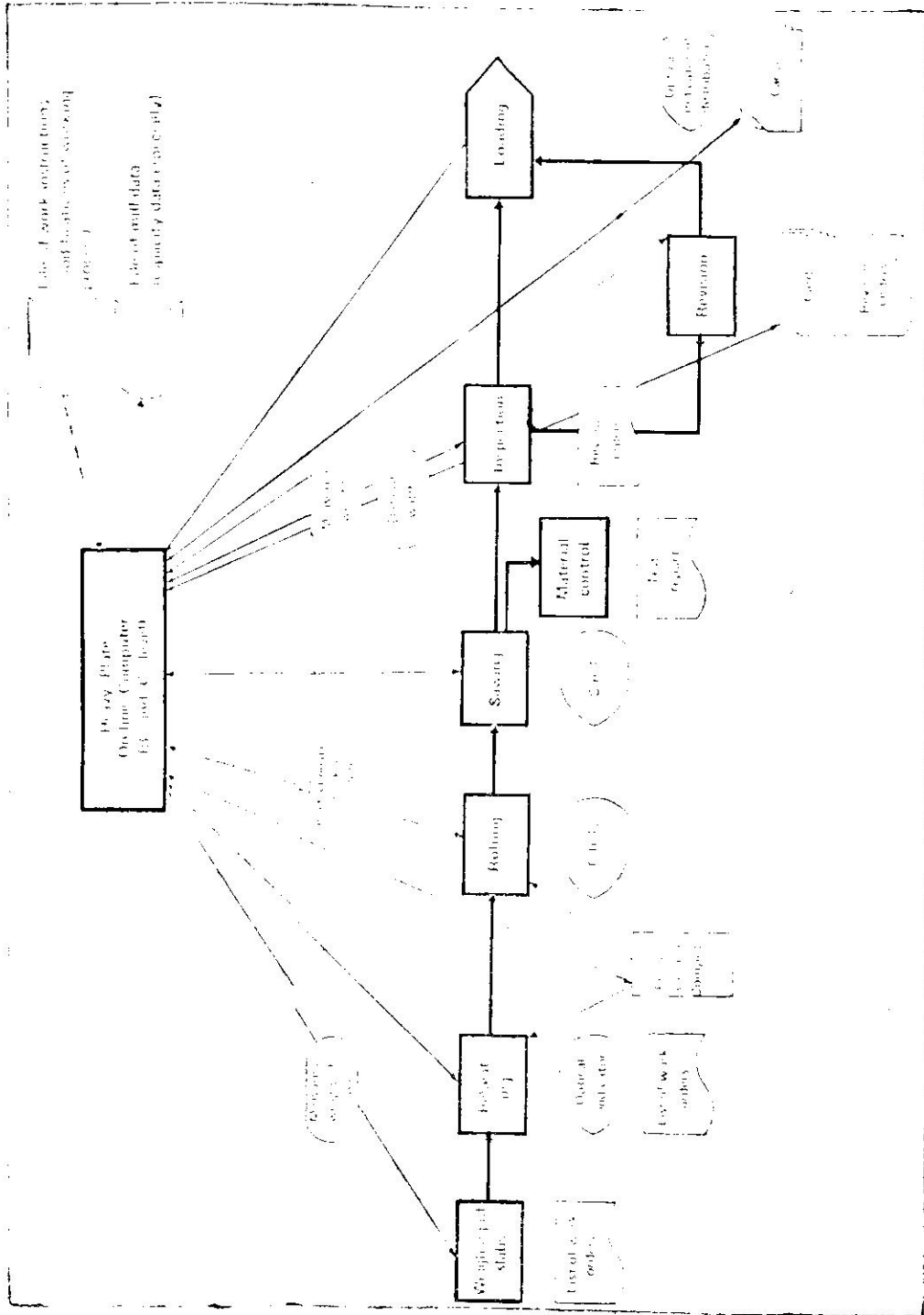


Figure 3. THE HEAVY PLATE LDP SYSTEM OF B AND C LEVEL

Execution — Workshop Operations

Dotted line: Information flow; dashed line: Information

Solid line: Real time data; dashed line: Information

by the table of tapings which is printed out on level B and put in by manual work into the process control computers.

Fig. 5 illustrates the details of the organizational structure and operations on level C and D for heavy plate production. Modern techniques are used for data collecting and data transfer. Terminals, monitors, optical indicating devices and telewriters are located close to the production equipments. Data are collected automatically or manually. All devices are connected on-line with the computers. The engineers in the production area receive all data for operation indications at their working place. So they are able for any interaction by steering the devices of production processing.

The described system represents a mostly perfect on-line real-time system. The extension of residual off-line operations is not a question of feasibility, but of economy. Japanese wages and salaries are lower than in many west European countries and in the United States. On the other hand imported computers are very expensive, so the break-even-point for using imported computers in Japan is higher than in Europe and in the States. Although the described case can be considered a nearly on-line-real-time system because the off-line connections have a high degree of real integration of linked EDP systems. The levels A to D as a whole represent an important part of a cybernetical system. This part of the system is characterized by the linking of production area with administration functions. The traditional boundary of EDP systems with its restrictions to business administration is erased. With other words two main function groups of the firm are linked now, the operations in the workshop and the intellectual functions of business administration.

### 3. *System Completion*

The system description has to be augmented by the handling in level A. This planning area is performed by separate centralized computers. The overhead planning has to be established mainly for selling, production and purchasing which means a fairly optimized coordination of these three areas. The integration of selling and production is most complex and shall be demonstrated now. The selling data of past periods for all articles of the programme are collected in the computers and evaluated by statistical methods for estimating future development with a certain degree of high probability. The estimated sale planning has to be corrected by experience of the sales management. The number of different articles in this plant is pretty high, it can reach 10.000s of articles. Based on this plan the automated production planning is made by the computer including material consumption and purchasing planning in a time schedule required by the production needs.

In principle production is planned with respect to order stock. Probably future orders have to be embodied and free capacity used by stock orders. For customers a full inquiry is available concerning possible delivery dates for their orders. The information is given by random access into the actual situation of selling, inventory of products, stock orders and running production.

Any changes in the stock of orders which happen quite often have consequences in the production and purchasing planning. Such changes can be evaluated by the computer, it also makes the corrections of all planning fields. A customer also can receive information on telephone call about the progress of work of his order, and his order usually is a part of an economized order unit for the workshop. He also can receive information at

once about what delivery date will occur in the case of his order changing. Very seldom the customer's order may be transferred into a separate workshop order. But in most cases the customer's order is only a part of the workshop order which is splitting up into many kinds of customer's orders. Considering the variety of 10,000 and more different products with their individual routine path in the workshop and also checking with orders in stock, this information system can be called a unique one. The delivery system is also fit for responding simultaneously to the customer's diverse requirements regarding quality, quantities, several delivery dates and technical service.

Prerequisites of this information and planning system is the permanent integration of the five levels in each direction up and down which represents the highest stage of development. (levels A to D for EDP systems are completed by top management). The system is of greatest importance for profitable business enabling a high degree of flexibility as to the situation in the sale market and consequently in the production area.

The problem of optimized planning is supported by using the Operations Research methods. The real problem is the simplicity and the elasticity of the O.R. models. The variables are used for production capacity, required raw material quantities, material costs, working costs, planned turnover and planned profit. The simulation techniques assist top management in their efficient decision making. The results can be improved with respect to the policy of the firm. For example in the case of low capacity usage the decision can be made in top management for sale promotion, reducing of capacity by removing of an old equipment or producing for stock. Alternative planning data are evaluated by the system.

The final planned data are processed in the five levels of the system as independent variables.

As to the elasticity special mention should be made that the planned data for selling and production have to be summarized ones in certain categories. They ought to be flexible enough for adaptation to the real structure of future orders. The feedback principle on all five levels makes the system fulfil the requirements for running a population firm on highest efficiency standard.

Regarding the details of the whole system there are many difficulties involved, e.g. the data for production controlling are to be compromised relating to the overhead scheme of the original planning data in level C and B. Another problem shows up with the differences between planned and collected data. The summarized results are transferred to top management for correcting the model of policy and decision making. On the other hand on the levels B and C the collected data in the workshops induce corrections of planned data periodically, so they come very close to reality in the end of the planning period.

#### **More Detailed Characteristics of the System and Summarising**

After the survey, designing and description of the system further details how it is running may be given now for demonstrating its accuracy, reliability and flexibility.

Most important is the fact that production equipment, computers and EDP systems are integrated to a cybernetic unit which embodies workshop operations as well as administration work, i.e. mechanical and intellectual routine work. Contact and communication between all parts of the system are initiated and running



permanently and automatically as demonstrated in the first chart. For conclusions and summarising consequences resulted in the following aspects:

- (1) Discharging of on-line computers of the centralized EDP system from input/output and controlling operations.
- (2) The detailed planning data for all workshop operations are optimal being based on actual data. All data are reliable and processed very fast. Deviations between planned and actual data are handled by decision rules built in the computer programmes. In the case of extraordinary data constellation or results, analysis is still performed by man and the results of exception cases are fed back into the system.
- (3) Reduction of manual interaction in the production and administration fields which enables a higher degree of accuracy.
- (4) Reduction of personnel in the production and administration fields. The release was about 400 people in the workshops and nearly 40 in the business administration. Moreover a traditional system could never realize the benefits of a cybernetic system.
- (5) Customer's service is improved by inquiry of
  - (a) actual order dates supported by a priority system;
  - (b) checking of order progress ;
  - (c) quick reacting with respect to order changes by customers. All changes will be processed automatically into detailed workshop operation indications, not regarding if caused by quantity or raw material quality, changes of delivery dates for raw material or in the production engineering. Changed operation plans are optimized within certain limitations.
- (6) The standard time for production was reduced considerably and the quality level increased. The production costs are reduced, too, of course. These advantages count in the hard competition of the steel selling market in the world.
- (7) Any system requires checking by experts and steadily improvements due to experience and important changes and development of production equipment and computer technology. In the Japanese case a group of experts called 'open programmers' is charged with these sophisticated problems of exceptional cases and future development of the system. They are all-round trained in production engineering, computer techniques, EDP systems and business organization. ●

### Sample Glut

Lever Brothers estimates that housewives received so many free samples of new laundry detergents in 1969 that the effect on purchases was the same as if every U.S. home maker had stopped doing laundry for nearly three weeks. Companies handed out enough free toothpaste to cover the nation's tooth brushing needs for a full week.

—*The Wall Street Journal*

# Establishing A Retail Chain Store Branch—A PERT Application

Nesa Labbe Wu\*

This Paper is the product of research work done by the author during the late fall of 1971. This is a true case and hence names, exact times, and network details are omitted by the author on the request of the management of the Chain Store, under study. The paper illustrates how a quantitative scheduling approach, PERT, was successfully used in the evaluation of the establishment of a retail store branch prior to its construction. Important questions such as job sequencing, critical jobs, and approximate starting time for construction were successfully answered by means of the PERT model.

THE establishment of a retail store is not a routine procedure. It is a very time-consuming and challenging responsibility for marketing experts. The degree of difficulty of this challenge depends on a host of factors, the most important of which is past experience. The specialists who are involved with the evaluation of the potential establishment of a new branch for a chain store encounter economic and time factors which are very complex and difficult to describe.

This paper illustrates how a quantitative scheduling approach, PERT, was successfully used in the evaluation of the establishment of a retail store branch prior to its construction. Important questions such as job sequencing, critical jobs, approximate starting time for construction, and others were successfully answered by means of the model. This is a true case; therefore, on request of the management of the chain store, names, exact times, and network details are omitted.

## Setting Up the PERT Network

The PERT method is a management-oriented technique for the scheduling of a series of nonrepetitive jobs so that the entire project can be completed in the shortest amount of time. The PERT method, as it relates to the establishment of a chain store branch, serves to consider a series of interrelated activities in order to determine their optimum planning and scheduling for the attainment of the desired goals. The preliminary step before executing the PERT algorithm is to develop the network model, which represents the interrelationships between activities and the general flow of these activities. (See Table 1 and Figures 1 and 2). This development is accomplished by the following four-step procedure :

*Step 1 :* Development of the logical sequence in which the activities must be performed to complete the project. An activity is the performance of a specific task and involves the effort of manpower.

*Step 2 :* Drawing the arrow-diagram network, using activities and events. An event

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is represented by a node, which is the occurrence of a checkpoint in time. The node represents the accomplishment of a task rather than the performance of a task or activity. The event represents the start of activity(s) or the completion of activity(s).

*Step 3 :* Assignment of activity times. Qualified people who had dealt in the past with the establishment of retail stores supplied three typical activity times: optimistic time (OT), most probable time (MPT), and most pessimistic time (PT).

*Step 4 :* Numbering of nodes so that (1) each job has a unique set of nodes, (2) all activities entering a node have identical followers, (3) all activities leaving a node have identical predecessors, (4) a node represents the complete relationship between all entering and existing jobs, and (5) the nodes are in ordered sequence with the beginning node smaller than the ending node.

Figures 1 and 2 represent the simplified version of the final network that was developed for the chain store. But some analysis of relations between activities is necessary. Originally the activity from node 9 to 37 (analysis of general labour conditions) was a predecessor to the activities from node 17 to node 26 (architectural analysis of space and design requirements for the entire outlet) and from node 22 to node 31 (preparation of advertising budget and strategy). After a lengthy discussion, however, it was agreed that these three activities were unrelated for the principal reason that prevailing pay scales were not part of the activity of the 'analysis of general labour conditions'. It was also agreed that the

departmental estimation of gross margins (activity from node 9 to node 14) did not depend on the analysis of number, policies, and location of wholesalers (activity from node 12 to node 14) since the demand for most of the products under consideration was fairly high and since it was known that wholesalers did not charge high prices. The company already possessed a record of the wholesalers and their policies in that location. It also seemed logical to assign selling areas to departments (activity from node 15 to node 17) only after the products to be sold were selected (activity from node 14 to node 15) because different products require both different areas and different locations in the store. For example, jewelry, candy, paperback books, and the kinds of goods conducive to impulse buying are often located near doors so that people passing in and out can be exposed to them. Because few people will buy furniture or appliances on an impulse basis, these types of goods can be buried in the heart of the department store, several floors up. A nondetailed listing (including the necessary dummy activities for Step 4) of all activities is given in Table 1.

#### **Bucket Algorithm for Generating the Critical Path**

A simple algorithm, called a "BUCKET" algorithm was devised and programmed in FORTRAN to define the critical path and the early and late starting times for the activities.<sup>1</sup> A detailed write up and listing of the programme is summarised on page 273.

Initially, the classical Beta distribution was considered for activity times, and the expected times were used for scheduling and for develop-

1. N.L. Wu, *Business Programming in Fortran IV* (Dubuque, Iowa: Wm. C. Brown Company, 1973).

**Table 1**  
PERT Activities for Establishing a Chain Store (All Dummies are Included)

Nodes		Activity	Optimistic Time (OT)	Most Probable Time (MPT)	Pessimistic Time (PT)
I	J				
1	2	Dummy	0	0	0
1	4	Dummy	0	0	0
1	5	Dummy	0	0	0
1	6	Dummy	0	0	0
1	7	Dummy	0	0	0
1	8	Dummy	0	0	0
1	9	Analysis of retail trade potential	48	64	96
1	29	Research on availability of credit investigation	8	8	8
2	29	Research on number, kinds, and practices of financial institutions of the area	8	16	32
4	9	Analysis of potential customer drawing area	48	64	96
5	9	Area population analysis	16	24	32
6	9	Analysis of area-purchasing power	24	32	48
7	9	Analysis of competitive situation	16	24	32
8	9	Analysis of area's growth trends	16	24	32
9	11	Detailed demand analysis by department or product groups	16	48	96
9	14	Estimation of gross margins by department	32	48	64
9	37	Analysis of general labour conditions	32	48	96
11	12	Detailed demand forecast by department of product groups	16	48	96
12	14	Analysis of number, policies, and location of wholesalers	0	0	0
14	15	Selection of product groups to be carried	0	0	0
15	16	Dummy	9	0	0
15	17	Assignment of selling areas to department	64	96	192
16	17	Assignment of nonselling space for administrative functions	16	32	64
17	19	Dummy	0	0	0
17	20	Dummy	0	0	0
17	22	Dummy	0	0	0
17	23	Dummy	0	0	0
17	24	Dummy	0	0	0
17	26	Architectural analysis of space and design requirements for the entire outlet	416	480	576
17	30	Preparation of merchandise budget planning	200	256	400
17	31	Obtain estimates of wages and salaries expenses	1	2	3
17	36	Setting up the organization structure	16	24	48
19	31	Estimation of delivery costs and policies	8	16	24
20	31	Setting pricing policies	0	0	0
22	31	Preparation of advertising budget and strategy	16	24	32
23	31	Design layouts for departments	128	192	256
24	31	Setting of operating hours policy	1	2	3
26	27	Dummy	0	0	0
26	28	Dummy	0	0	0
26	29	Site-location analysis	48	64	96
27	29	Estimation of construction costs	8	16	24
28	29	Estimation of equipment costs	8	16	24
29	31	Preparation of a capital-budgeting program	24	32	96
30	31	Establishment of inventory-control system	3	5	16
31	33	Estimate operating costs	24	32	96
31	37	Obtaining bids for the physical plant	8	16	24
33	35	Dummy	0	0	0
33	37	Preparation of proforma income statements for next five years	24	32	96
35	37	Preparation of first-year cash flow	24	32	96
36	37	Manpower planning	64	128	160

Activity times are assumed to be beta distributed, and their expected times are used to establish the critical path.

$$t_e = \frac{t_o + 4M + p}{6}$$

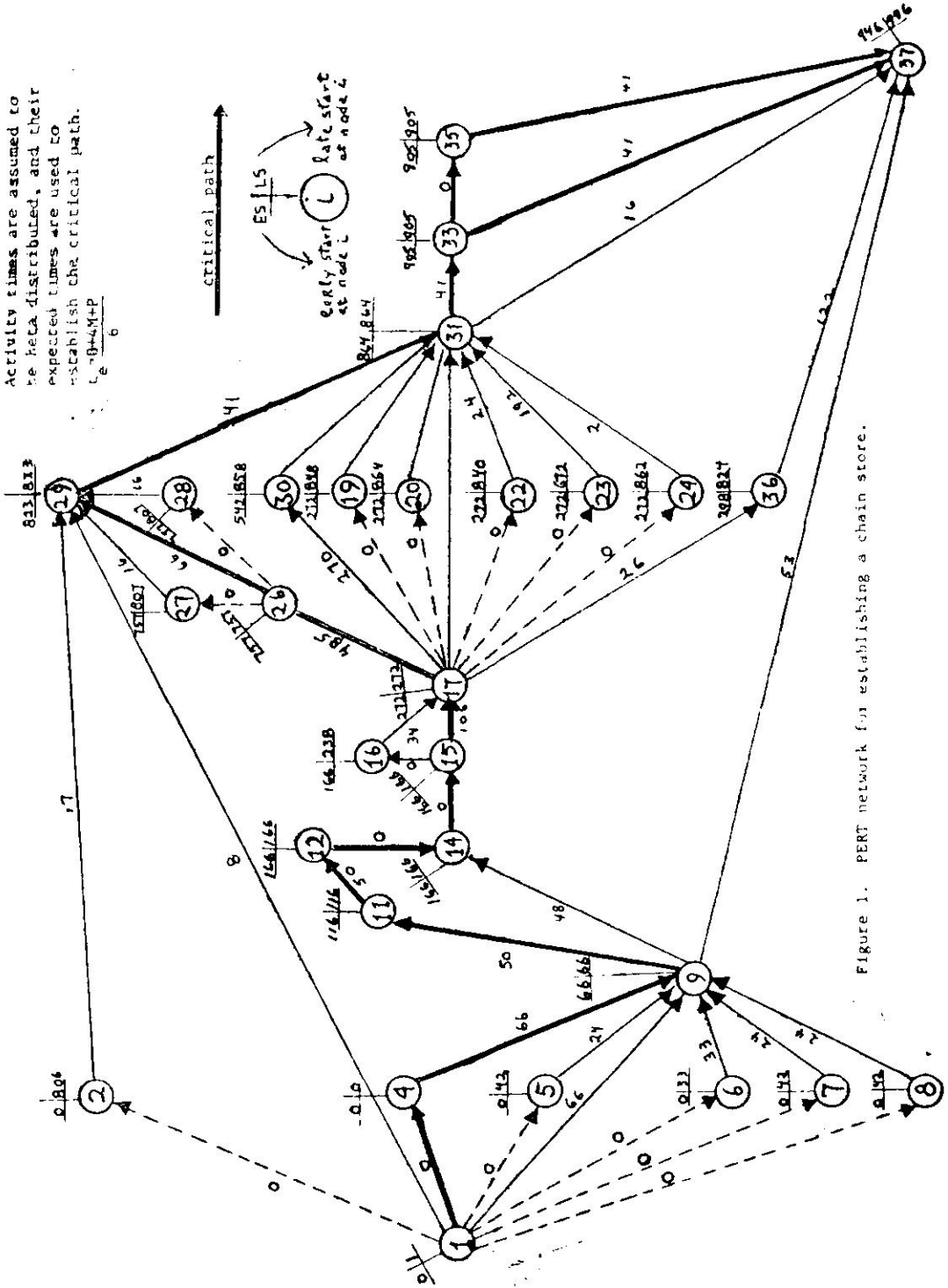
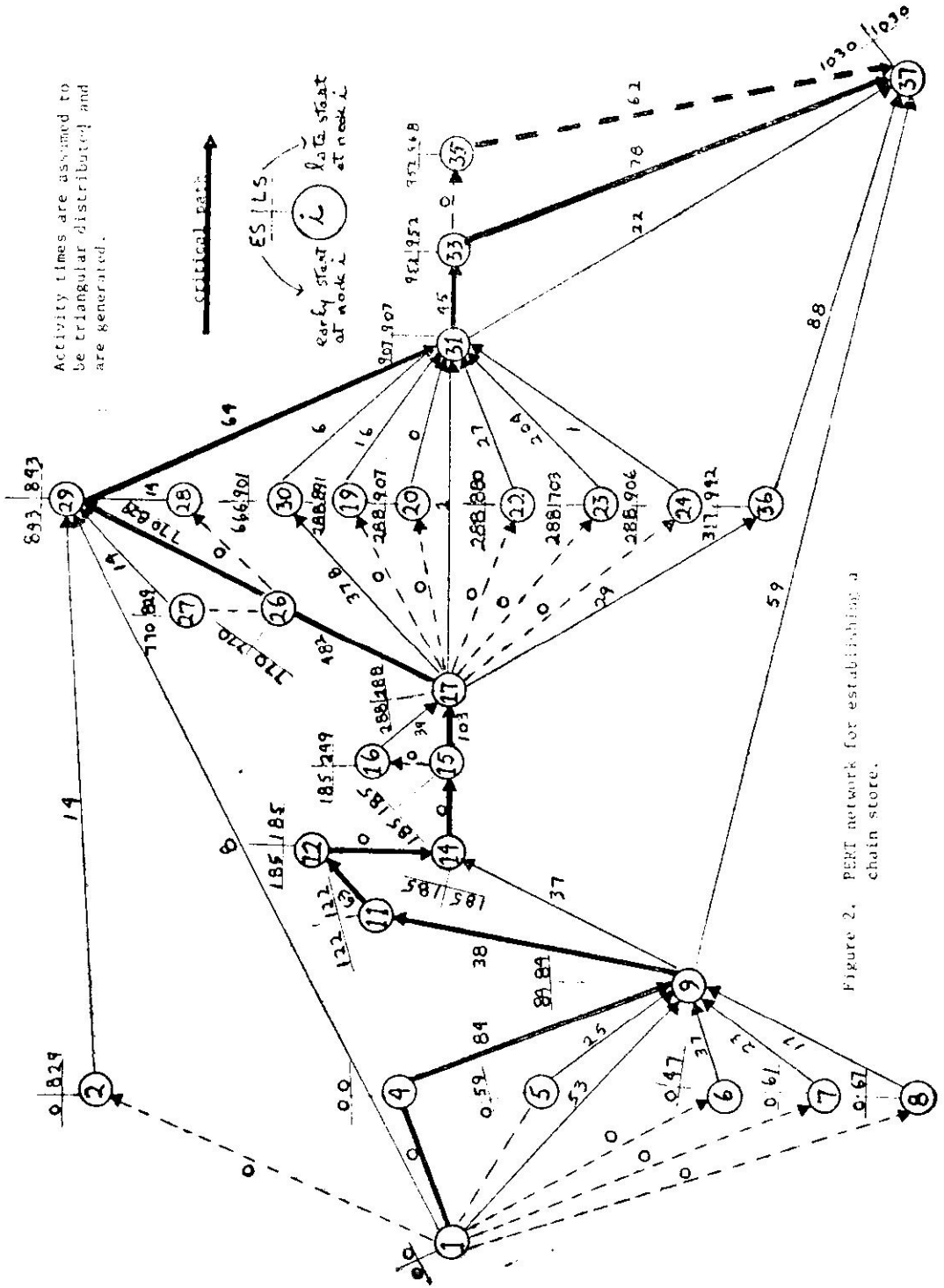
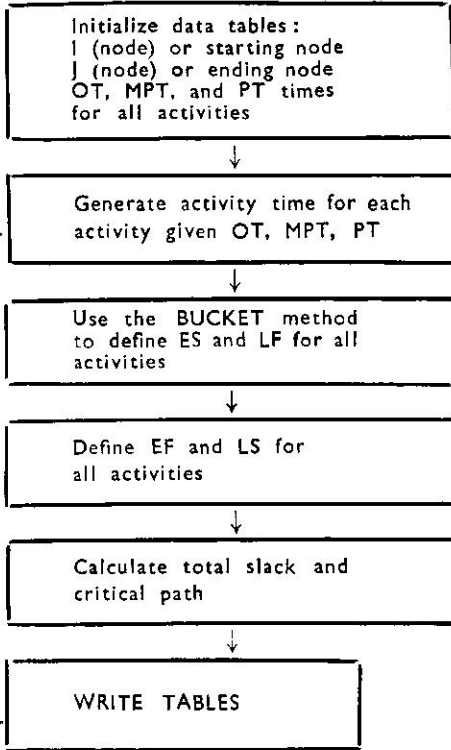


Figure 1. PERT network for establishing a chain store.

ESTABLISHING A CHAIN STORE BRANCH





ing the critical path. (Results are shown in Figure 1.) However, a statistical analysis of past data collected by the firm made it clear that this approach might lead to an underestimate of the due date. A Chi-Square test indicated that a triangular distribution better fit the activity times; therefore, 100 triangular variates were generated for each activity, given the OT, MPT, and PT times of each activity, and consequently 100 due dates and critical paths were generated. These results are summarised in Table 2.

The early start (ES) and early finish (EF) times are obtained through the BUCKET method as follows. The early start time is that time at which an event can be started if all events preceding it have been started and com-

pleted as early as possible. The Forward Scan Rule as outlined here is the simplest way of calculating the ES for all activities.

Give each node a BUCKET value:  $BUCKET(I)$

Initialize these BUCKET (I)s to zero. Now for each activity K proceed as follows:  $BUCKET(JNODE) \leftarrow BUCKET(INODE) \div TIME(INODE, JNODE)$

if and only if  $BUCKET(JNODE)' \geq BUCKET(JNODE)$

$ES(K) = BUCKET(INODE)'$

The latest finish (LF) time is that at which an event must be accomplished in order to avoid slippage in the project-completion date. For our retail store the project-completion date was determined by the early finish time of the last activity. The Reverse Scan Rule as outlined here is the simplest way of calculating the LF for all activities :

Give each node a BUCKET value :  $BUCKET(I)$

**Table 2**  
Summary of Results Using the Triangular Distribution in Generating Activity Times  
Distribution and Statistics for 100 Runs

Classes	Midclass Value	Frequency	Probability
875-905-	890	1	.01
905-935-	920	3	.03
935-965-	950	11	.11
965-995-	980	15	.15
995-1025-	1010	21	.21
1025-1055-	1040	20	.20
1055-1085-	1070	16	.16
1085-1115-	1100	11	.11
1115-1145-	1130	1	.01
1145-1175-	1160	1	.01

*Smallest* simulated duration: 881 time units  
*Largest* simulated duration: 1147 time unit  
*Mean* simulated duration: 1023.2  
*Standard deviation* of the simulated duration: 52.1  
*Suggested* (95% confidence) due date: 1095 time units  
*Actual* due date was 1084 time units.

Initialize the BUCKET(I)s to the project-completion date

Now for each activity K, starting with the last activity, proceed as follows :

$$\text{BUCKET (INODE)}' \leftarrow \text{BUCKET (JNODE)} - \text{TIME (INODE, JNODE)}$$

if and only if  $\text{BUCKET (INODE)}' \leq \text{BUCKET (INODE)}$

$$\text{LF (K)} = \text{BUCKET (JNODE)}'$$

After all early start and late finish times are calculated for each activity (K), the early finish

(EF) and late start (LS) for these activities can be obtained as follows :

$$\text{EF(K)} = \text{ES (K)} + \text{TIME (K)}$$

$$\text{LS(K)} = \text{LF (K)} - \text{TIME (K)}$$

The total slack time (TOTSL) for each activity (K) is the difference between the early start and the late start of the activity; TOTSL indicates how long an activity may be postponed without affecting the due date.

$$\text{TOTSL(K)} = \text{LS(K)} - \text{ES(K)}$$

The critical activities are those activities

Table 3

Sample Output of the PERT Analysis

Activity I	Activity J	Generated* Time	ES	EF	LS	LF	Total Slack	Crit Path
1	2	0	0	0	829	829	829	
1	4	0	0	0	0	0	0	*
1	5	0	0	0	59	59	59	
1	6	0	0	0	47	47	47	
1	7	0	0	0	61	61	61	
1	8	0	0	0	67	67	67	
1	9	53	0	53	31	84	31	
1	29	8	0	8	835	843	835	
2	29	14	0	14	829	843	829	
4	9	84	0	84	0	84	0	*
5	9	25	0	25	59	84	59	
6	9	37	0	37	47	84	47	
7	9	23	0	23	61	84	61	
8	9	17	0	17	67	84	67	
9	11	38	84	122	84	122	0	*
9	14	37	84	121	148	185	64	
9	37	59	84	143	971	1030	887	
11	12	63	122	185	122	185	0	*
12	14	0	185	185	185	185	0	*
14	15	0	185	185	185	185	0	*
15	16	0	185	185	249	249	64	
15	17	103	185	288	185	288	0	*
16	17	39	185	224	249	288	64	
17	19	0	288	288	891	891	603	
17	20	0	288	288	907	907	619	
17	22	0	288	288	880	880	592	
17	23	0	288	288	703	703	415	
17	24	0	288	288	906	906	618	
17	26	482	288	770	288	770	0	*
17	30	378	288	666	523	901	235	
17	31	1	288	289	906	907	618	
17	36	29	288	317	913	942	625	
19	31	16	288	304	891	907	603	
20	31	0	288	288	907	907	619	
22	31	27	288	315	880	907	592	



Table 3 (Continued)

Sample Output of the PERT Analysis

Activity I	Activity J	Generated* Time	ES	EF	LS	LF	Total Slack	Crit Path
23	31	204	288	492	703	907	415	
24	31	1	288	289	906	907	618	
26	27	0	770	770	829	829	59	
26	28	0	770	770	829	829	59	
26	29	73	770	843	770	843	0	*
27	29	14	770	784	829	843	59	
28	29	14	770	784	829	843	59	
29	31	64	843	907	843	907	0	*
30	31	6	666	672	901	907	235	
31	33	45	907	952	307	952	0	*
31	37	22	907	929	1008	1030	101	
33	35	0	952	952	968	968	16	
33	37	78	952	1030	952	1030	0	*
35	37	62	952	1014	968	1030	16	
36	37	88	317	405	942	1030	625	

\*Activity times are generated using the triangular distribution

Table 4

Observed Critical Activities for the Establishment of the Retail Store  
(Dummy Activities are not Included)

Activity Nodes I	Activity Nodes J	Activity Description
4	9	Analysis of potential customer drawing area
9	11	Detailed demand analysis by department or product groups
11	12	Detailed demand forecast by department or product groups
12	14	Analysis of number, policies, and locations of wholesalers
14	15	Selection of product groups to be carried
15	17	Assignment of selling areas to departments
17	26	Architectural analysis of space and design requirements for the entire outlet
26	29	Site location analysis
29	31	Preparation of a capital budgeting program
31	33	Estimate of operating costs
33	37	Preparation of proforma income statements for next five years

Alternate Critical Path:

35	37	Preparation of first-year cash flow
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which cannot be delayed in order to finish the job as soon as possible. Therefore, if the total slack of an activity is zero, that activity is a critical activity.

A sample output of the PERT analysis for the retail store is given in Table 3. The observed critical activities for the case are listed

in Table 4. The output of this analysis was used by management in determining where slack time would be available and where potential problems might develop. The activities on the critical path were carefully scheduled, and, in order to minimize delays, manpower was assigned accordingly.

# Corporate Industrial Relations Policy

P. Chadha\*

Industrial relations policy must continuously bring about goal-congruence between labour and management, i.e., it should tend to meet needs and aspirations of employees as also needs and objectives of the company: which a negotiated policy has better chances to achieve. It will then enjoy continued commitment of both parties, thereby reducing occasion for distributive interpretation and the resultant disequilibrium in industrial relations systems. A dynamic industrial relations policy will, therefore, be adaptive and take care of creating amount of variation in the context and assumptions on which it is based. A rigid policy which cannot sustain situations of a particular nature will soon crack like a dry stick. It will never grow nor provide for growth of those operating it. An industrial relations policy in particular must exude a climate of understanding rather than arrogance. It should be perceived as an instrument to promote the human element rather than govern it.

SEARCH for any policy must provide opportunity for systematic exploration of causal connection between various factors—constant and variable—which constitute the system and its environment. These include the historical factors, physical, socio-technical structure, nature of ownership and control, and the extent of inter-dependence on socio-economic context which provide the back-drop for the organisational activity. Management structure, procedures, and patterns of human interaction are some of the important variables.

Causal connection between these factors, together with processes employed to arrive thereat, is bound to bring out most the strength as well as shortcomings of the system. When not adequately supported by strengths, the shortcomings result in *problems*. Seen as embedded

in and born of essential factors constituting the system, these problems are bound to appear formidable to begin with. A systematic understanding of problems in relation to the causal connection among organisational factors and processes, together with their strength, also can provide key to the tools that professional managements must develop to overcome problems. Such tools will help find solutions conducive to harmony, growth and a healthy equilibrium of forces influencing organisational effectiveness. *Refusing to accept existence of problems, or using contextual framework of organisation to justify it, will result only in their becoming perpetual constraints on growth and development. People often tend to become slaves to the organisational culture constraints; but in organisations that have progressed as they should, managements have worked to transcend these constraints rather than conform to them.*

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### Need for a Policy

Perhaps instinctively, analytic approaches are often applied to systems responsible for readily measurable output, presumably because weaknesses in such systems can be perceived more easily and more objectively. In a production system, for example, incongruent planning will become readily apparent through unbalanced component production which will not match to yield optimum units of finished product. Such systems invariably have well-defined policies, objectives and targets.

In nebulous and subtler systems dealing with human variables such as satisfaction and motivation, however, similar incongruencies may not immediately come to surface except in hidden or pervert forms—yet disequilibria will nevertheless exist, and damage caused to the organisation may not be easily visible. Even when visible, its origin may not be related to disequilibrium in these systems. *Where, however, it is, managements have tended to take remedial action through structural changes and we see an effort to reduce human relations processes to mechanistic norms—* for example, the process of resolution of employee grievances, which requires deep understanding of the springs of human needs and motivation and keen human relations skill on the part of supervision, finds itself structured in the form of an insensate bureaucratic time-bound grievance procedure.

Such mechanistic approaches could often arise out of a lack of appreciation for human processes and behaviour, and perhaps our farther faith in technological and structured solutions. By themselves, therefore, they cannot yield the desired results. Most management problems, however, have origin in composition of man-power employed, individual or group behaviour and interaction, or in the organisa-

tional structure, procedures and processes—the very dimensions which an industrial relations system closely concerns. Research in the fields of behavioural sciences and human interaction is admittedly far behind the field of technology. Our knowledge in these fields is not only limited but also enjoys limited acceptance. It is, therefore, absolutely critical to provide all available support in functioning of systems like industrial relations, which today is perhaps the most conspicuous and indeterminate constraint on optimizing industrial performance, and creating economic surpluses with consequent increase in employment and improvement in standard of living.

### Distributive Interpretation

Quite often, approaches to Industrial relations tend not only to be mechanistic but also much too legalistic and rule-ridden. An important contributory factor to this latter phenomenon appears to be the unfortunate emphasis on *distributive interpretation*—prompted by a perception of divergent objectives, and the rather confused frame of reference governing industrial relations. No wonder then that such interpretation becomes disputed between the parties.

Judgement of parties is bound to get blurred when so many uncoordinated factors afflict industrial relations, each having limited reference. To mention a few, there are labour laws of the country—the largest for any in the world—both at the State and the Central levels with numerous sets of rules and regulations decisions and codes from Indian Labour Conference and Standing Labour Committee; conventions of International Labour Organisation; reports and recommendations of various commissions and committees set up by the government; standing orders and service rules of the company; values cherished by social in the groups organisation;

aims and objectives, contextual and environmental factors. A policy with these attributes will help locate those of the characteristics of industry and the system which need to be carefully preserved, and on which future industrial relations can be confidently built. It will also induct the much-needed 'openness in this traditionally secretive function, understood more in conflict than in harmony, and seen more as a constraint than a reservoir of energy which can be gainfully deployed in the interest of industry.

### Not a Few Problems

To bring about such a policy not a few problems will have to be faced even after the problem of resources has been successfully solved. These will, of course, vary with the organisation and its culture; but some of them will raise their head more often than others, and will certainly take a lot of effort to get across.

Because of past experience and mutual attitudes of traditional mistrust between unions and managements, either party may be extremely reluctant to make too bold and precise commitments in the first instance—even in respect of the policy currently being pursued. To begin with, therefore, the written declared policy may have to make do with rather global or vague expressions. If the parties are genuine and bonafide this should not cause any retrogression. On the contrary, it will perhaps be as well because neither party should commit itself to policies it cannot hope to meet. It is better to begin modestly and achieve optimum success in operating an agreed policy rather than embark on an ambitious policy and land up with unfulfilled expectations and greater distrust. It is, in the first instance important to create new experiences that will promote greater mutual confidence in collaborative work. However, the policy must gradually, through process of not too slow an

evolution, develop a broader base and become more specific in expression as well as content—provided always that it does not exceed capacity of the parties to live upto it. This is of utmost importance.

Another big challenge to any attempt at policy formulation is likely to stem from a sense of insecurity that most company executives as well as union officials suffer from, and which is most often related to intra-management or intra-union problems. A well-defined written policy can be perceived as a threat to the very authority which gives these individuals perhaps a superficial sense of indispensibility. Top management officials—career employees as well as the entrepreneur as also top union officials may exhibit a sort of vested interest against formalising a policy, for fear of loss of authority, indispensibility, uninhibited control or discretion.

Managements attempting policy formulation must possess keen awareness and understanding of these pitfalls, and tackle them patiently and skillfully lest they surreptitiously undermine first the efforts to policy formulation, and later the policy itself.

### Conclusion

While an industrial relations policy, carefully developed and deftly operated can add to effectiveness of any organisation, the need for a policy is critical for large widely spread out organisations, where decentralised decision-making and substantial delegation of authority are business requirements but cannot be achieved for fear of inter-unit repurcussion in the field of industrial relations. On this one score alone, the cost-benefit analysis will most definitely show the balance heavily in favour of a corporate policy as against a strict bureaucratic centralised system of controls. And this is certainly not the most important single consideration in favour of a policy!

# Problems of Production, Productivity and Industrial Relations in India

Late Satish Loomba\*

A situation marked with static or even declining trend in real wages, swelling ranks of unemployed and various bottlenecks in production like short supply of new materials, power shortage etc. is by no means conducive to higher production and productivity. Removal of these stumbling blocks must therefore be the starting point for any desire to raise productivity. Once this is done, the path is paved for a serious discussion on some outstanding issues like the extent of technological change in Indian industries, industrial harmony based on healthy industrial relations, innovating some socio-economic institutions capable of answering the needs of the hour and the like. Indeed, the basic framework and direction for effecting these changes has already been provided by the Constitution. What, however, is needed is to make a sincere move in that direction.

**E**ACH society or nation sets before itself objectives which it seeks to achieve. In India the National objectives have been broadly outlined in the Directive Principles of State Policy (Part IV of the Constitution of India). The first three clauses of Article 39 of the Constitution read as follows:

“The State shall, in particular, direct, its policy towards securing:

- (a) That the citizens, men and women equally, have the right to an adequate means of livelihood;
- (b) That the ownership and control of the material resources of the community are so distributed as best to subserve the common good;
- (c) That the Operation of the economic system does not result in the concentration of wealth and means of production to the common detriment.”

Article 43 reads thus:

“The State shall endeavour to secure, by suitable legislation or economic organisation or in any other way, to all workers, agricultural, industrial or otherwise, work, a living wage, conditions of work ensuring a decent standard of life and full enjoyment of leisure and social and cultural opportunities...”

Thus when India became free and framed a Constitution, it set before itself goals regarding production, distribution, and employment. Our efforts must be directed towards achievements of the national goals.

## Development and Problems of Production and Productivity

In the years since 1947 when India became independent, what have been the developments with regard to these national goals?

We have not succeeded in providing employment to all. In fact the back-log of unemployment goes on increasing. This emphasizes the

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\*The author was a prominent Trade Union Leader and the Secretary of the All India Trade Union Congress. He died in a plane crash recently in March 1973.

urgent and immediate necessity of an integrated manpower policy at all levels.

Regarding production, equitable distribution and a fair wage in real terms, the following analysis is made by the National Commission on Labour is relevant:

“To sum, up, we note that increases in money-wages of industrial workers since independence have not been associated with a rise in real wages nor have real wage increases been commensurate with improvements in productivity. Simultaneously, wage costs as a proportion of total costs of manufacture have registered a decline and the same is true about workers' share in value added by manufactures. Wage disputes under these conditions have continued to be the single most important cause of all industrial disputes.”

These conclusions are based on its analysis of:

- (a) *Changes in Productivity*: “Adjusting the increase in net output for price changes during the period 1952 to 1964—and in this case, it would be safe to use the index number of wholesale prices (for manufactures)—we find that production per worker has increased by about 63 per cent between 1952 and 1964. A part of it must have been contributed by labour whose real earnings have remained almost static during the period’.
- (b) *Decline in Labour Cost*: “An analysis of data in the Census of Indian Manufactures upto 1958 and its successor, the Annual Survey of Industries, for later years shows that between 1952 and 1958, money wages as a percentage of total output dropped from 13.7 to 11.4. Between 1960 and 1964 on the basis of the new series of the Annual Survey of Industries, the drop was from 10.9 to 9.7. The

decline varies from industry to industry but has been registered in all cases, except in the case of some units in match industry where wage costs as a proportion of the cost of reproduction have gone up. Even after adjusting the gross output in 1964 for prices (1952=100) and working out the share of wages to the output, so adjusted, there is a fall between 1952 and 1964.”

- (c) *Share of Wage*: “Finally, one has to take into account the share of workers in the value added by manufacture. And in this indicator, only two shares count: (i) of employers and those who have provided capital in the expectation of dividend (ii) of workers. The percentage of wages to the value added by manufacture, on the basis of the CMI Data, shows a decline from about 50 per cent in the period 1949-50 to about 40 per cent in 1958. This trend seems to have continued in the subsequent years as revealed by the data from the ASI. For instance, wages as a percentage of value added declined from about 40 per cent in 1960 to 36.5 per cent in 1964, the latest year for which information is available. Even if the money value of benefits and privileges is taken into account, the conclusion remains the same, though the decline then becomes less sharp.”

In the opinion of the NCL: “The net effect of the operations of the industrial disputes machinery on wages of factory workers has been that in 1965, the industrial workers at the lowest levels were earning hardly a real wage corresponding to that of the year 1952.

In the current year the growth rate of industrial production has shown alarming

decline even on the extremely low figures of the previous years. From 6.4% in 1968, 7.1% in 1969 and 4.8% in 1970, it has come down to the negligible figure of 1.08% during the first half of 1971. Indeed, except in some consumer goods industries, there is an overall decline.

The Federation of Indian Chambers of Commerce and Industry recently undertook a survey of utilization of installed capacity in about 200 units. This survey reveals that "Number of industries utilizing 50% or less of their capacities rose from 71 in 1969 (36% of the total) to 78 in 1970 (39% of the total)". Among the reasons advanced by the industrialists themselves out of 50 units surveyed, the break up was: raw material shortage: 30; fall in offtake: 11; power failures and shortage: 6; transport bottlenecks: 5; paucity of working capital: 5 and labour troubles: 4.

In the textile industry 87 mills out of a total of 668 are closed. The number of workers effected is nearly 10% of the total workers in the textile industry. In other industries also a number of factories are closed.

It is necessary to go into this background because in each country, at any particular time, the concrete situation and therefore the tasks differ. In India the brief analysis above shows that:

- (a) Unemployment is increasing
- (b) Rate of growth of production is falling mainly due to underutilization of installed capacity and closures.
- (c) Wages are stationary while value added in relation to wages is increasing and the share of wages in the total cost of production is falling.

There have been many drawn out struggles in various industries against the attempt to

impose rationalization. In the 15th ILC (1957) a "Model Agreement to Guide Employers in Regard to Rationalization" was adopted. This is the so-called formula for "Rationalization without Tears".

However, the trade unions are unanimous in their appraisal that the formula has been a failure. First of all it is too vague and general. Secondly there is no sanction for enforcement. Even the various labour courts and industrial tribunals have refused to be guided by it.

Rationalization has, therefore, gone on much in the same way after this Model Agreement as before it. And resistance from workers has also gone on in the same way. In most places this resistance and struggle has not succeeded in staying off rationalization. It has only succeeded in giving workers some shares of the saving accruing to the employer. Of course no share of the benefits passed on to the consumers in the shape of reduced prices or improved quality.

The allied issue of automation has attracted heated opposition from all shades of the trade union movements. Automation in India is mostly in the shape of computers for table work, and has not yet become significant in production. For example in the textile industry, the percentage of automatic looms is only 17.3 as compared with the world average of 59.2. The bitter opposition and struggles against introduction of computers led to the convening of a special session of the SLC (May 1967). The issue was again discussed at the ILC (April 1968) and the SLC (July 1968).

As a result of all these discussions the Government of India had appointed a Committee to go into the entire question of the feasibility and necessity for automation, and for laying down conditions under which it should

if found necessary and permissible, in certain areas of work. But employers are going ahead with computerisation without even waiting for the conclusions of the Committee. The issue of automation cannot be viewed as merely a technological issue. It has serious sociological implications. In a country like India, where there is huge and growing unemployment, where capital formation is low, the introduction of automation which results in labour saving and reduces existing potential employment has many aspects for consideration. The issue cannot be disposed off simply as one of "technological advance", "capacity to compete" in export-oriented industries or of "increasing productivity". The whole gamut of social, political and economic condition has to be kept in mind.

The trade unions have raised several points which are relevant to the question of automation: (a) Conditions in India are totally different from those in the developed capitalist country. Here the rate of capital formation is low; the labour is surplus and comparatively cheap. (b) There is a large amount of unemployment and at the same time exists considerable idle capacity and a very low rate of utilization of installed capacity. (c) Despite the rise in production and productivity during the last two and half decades, real wages have remained stationary. Prices have gone up and the quality has not improved *vis-a-vis* rise in prices. Neither the worker nor the consumer has received any share of the gains of the rise in productivity. (d) there is considerable and growing concentration of wealth in the growth of monopoly capital.

All these factors call for a new look into the problem which takes into account the prevailing conditions. No academic discussion which ignores these harsh realities is going to be of the least relevance.

There are still other factors which are of equal importance. For example, there is no standardization of jobs, materials or machines. There is no minimum fall back wage for piece-rated production workers. Wage rates differ from industry to industry for the same job, from area to area in the same industry, and even from one unit to another of the same enterprise. There is great paucity of facilities for retraining both outside and in-plant. There is no unemployment relief even for those who were once employed and lose their jobs.

In such a situation, no system of sharing the gains of productivity or any incentive scheme can work effectively and smoothly. Increase in productivity is not an end in itself. It can be a means to secure better level of living and working for all. To be able to be of use for this, the social and economic conditions under which the workers work and the enterprises operate are very material. A discussion apart from these conditions will reduce itself merely to a technical discussion and will not take into account either the existing social conditions or the goals which the nation has set before itself.

#### INDUSTRIAL RELATIONS

*Recognition of Trade Union:* In India there is no law which provides for statutory recognition of a trade union. In Maharashtra, Gujarat, and Madhya Pradesh there is a law which provides for recognition of a representative union on the basis of verification by the Government of rolls of paid membership of the union. The Code of Discipline provides for voluntary recognition of trade unions in the country through verification of membership rolls. But recognition under the code has hardly been granted; and in any case the verification method whether in the state laws or in the code has been rejected by all National Trade Union Centres except one. It is essential that there



should be an obligation on the employers to recognise the union. This is all the more so because of the great multiplicity of unions. This raises the problem of laying down the criteria for recognition of a union. Although on this question wide differences still persist, the best appears to be the secret ballot for determining the bargaining agent and its recognition. Nevertheless smaller unions must also be associated with the collective bargaining process. It must be understood that in the absence of a recognised union, acting as the agent for collective bargaining on behalf of the workers, and specially in view of the great multiplicity of unions, it is not possible to have stable industrial relations. It must, all the same, be recognised that the only sanction behind collective bargaining is the right to strike. Workers must have the unfettered and unconditional right to strike in all industries and services. Any restriction on this right in the name of increasing production, or regulating industrial relations etc., cannot in fact work and is an attempt to deny to the workers the most effective weapon to defend their interests.

*Workers' Participation:* There has been some experimentation with workers' participation in management through Joint Management Council and so on. The Second Five Year Plan (1956) stated that "for the successful implementation of the Plan, increased association of labour with management is necessary." The Third Five Year Plan (1961) said that "workers participation in management should be accepted as a fundamental principle and an urgent need." The matter was discussed at the ILC in 1957 and it was decided to try the experiment of workers' participation in management in 50 selected units. However by 1960, JMCs had been introduced only in 7 public sector and 17 private sector undertakings. The common consensus is that the experiment has failed.

Now the Government of India has come out with the proposal to appoint workers' directors to the Boards of various public sector undertakings. All the trade union centres are critical of this proposal. A joint meeting of representatives of INTUC, AITUC and HMS held on August 5, 1971 had this to say about the proposals:

"The participants also discussed Government's proposals for labour participation in management by appointing an elected representative on the Board of Directors of Public Sector companies and felt that such a step will not really amount to labour participation in management. On the other hand, there was unanimous view that labour participation in management should be at all levels starting from the shop floor level to the highest policy-making body, viz., the Board of Directors...."

In this context the question cannot be limited only to acceptance or non-acceptance of worker-directorship in concerns; but has to be viewed as a whole. The real step forward must be in the direction of workers' control as a whole in partnership with the bourgeoisie in the present stage of developments in India.

The main principle must be that the representation of the worker must be at two levels—one at the level of the floor of the shop, office or service and second, at the level of the management above. Both these representations or participations must be based on the elective principle of the workers' choice. And it must carry with it the necessary authority. The various level of participation could be as follows:

- (i) On the floor-level workers should be represented by the elected works committee whose subordinate or basic floor part should be the shop committee. The

works committee should be the shop committee. The works committee should consist of the representatives of workers only and should be directly elected by workers. The shop committees as parts of the works committees should have the power of supervision, endorsement and implementation of collective agreements arrived at by the recognised unions. Further, where these committees feel that an item of the agreement pertaining to their sphere and relating to conditions therein, e.g. norms of production, efficiency, supply of standard materials, lay-out of machines, supply of tools, etc. is not in accordance with the conditions actually obtaining and requires revision, they shall take up the matter first with the shop-floor part of the management. Failing that, they will take it up to the works committee, who if the problem is not resolved will take it through the union. These committees shall also handle all matters pertaining to discipline raised by the management, and individual grievance raised by the workers, within their respective spheres.

- (ii) The second unit of workers' control or participation in management is the recognised union.
- (iii) The third unit is the workers' director in the Board of Directors who will be nominated by the recognised union.

Such should be the basic features of the scheme of workers' participation in management both in the public and the private sector.

#### To Summarise and Conclude:

- (a) There is complete agreement among all trade unions for a legislation providing for compulsory recognition, of a trade union by the employers.
- (b) The question of workers' participation in management in the private sector is ruled out.
- (c) The workers' participation in the management of public sector enterprises can only be on the basis of a complete scheme which ensures such participation at all levels of management from the shop floor to the top.
- (d) Obviously, the first field to tackle is that of industrial relations. For, without providing for a system which ensures recognition of a union, and guarantees full trade union rights, there can be no advance based on co-operation from the workers.
- (e) In the specific condition of India, such cooperation can only be sought and given in the public sector on the clear basis of defence of workers' rights and a betterment of their wages, working and living conditions.
- (f) Only on this basis, and within the framework of a complete and democratic scheme of workers' participation and management as outlined above, can there be the possibility of seeking workers' cooperation.
- (g) The method to be adopted must be commensurate with the national objectives of maximising employment, securing a fair wage and preventing concentration of wealth in the hands of a few. ●

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Experience shows that a suitably trained and healthy Indian artisan is in no way less efficient than an American or European workman. Due importance, unfortunately is not always given to possession by the managers of a thorough knowledge of human relations, particularly emotions and psychology, displayed by the workers, individually and collectively.

# A General Manager Looks at the Industrial Relations Scene

B. R. Tulpule\*

There exists a state of ambivalence in public policy relating to industrial relations wherein, on the one hand, free collective bargaining is regarded as the most effective system for developing sound industrial relations and, on the other, a deep rooted reluctance to recognise that work stoppage either through strike or lockout is the ultimate sanction in collective bargaining and that devoid of this ultimate sanction, collective bargaining becomes unreal. How to resolve this paradox and what should be the future strategy in the field of industrial relations is the central theme of this paper. The author is among those few who have not only deep understanding of management science but also vast experience in trade unionism, being himself a prominent trade union leader before assuming office as the General Manager of Durgapur Steel Plant.

**A**N essential pre-requisite of sound industrial relations based on effective collective bargaining is a degree of parity in bargaining strength on the two sides. If there is a preponderance of bargaining strength on one side in relation to the other, that side can, and therefore normally will, impose its will upon the other side on every issue in dispute. This disparity, moreover, will feed upon itself, each instance of imposition of the will of one side upon the other making the latter less able to resist such imposition in subsequent disputes.

## Bargaining A Pressure Process

Effective collective bargaining is basically a pressure process. It is true that this pressure may not take the actual form of a work-stoppage at each stage or on every issue in bargaining. It is also true that pressures other

than work-stoppage—such as reasoning, precedent, established norms or principles accepted as public policy by society—also have a certain amount of efficacy in the bargaining process. But the ultimate form of pressure when other kinds prove ineffective in clinching a bargain, i.e., resolving a dispute, is the possibility of work-stoppage. The ability of either side to exert pressure at the bargaining table is, therefore, in the ultimate analysis, its ability to face a work-stoppage. Even at the stages of bargaining prior to a work-stoppage, the very possibility of it if the parties cannot reach a bargain, and their perception of their relative ability to face it, influence their behaviour during bargaining.

## Painful Ambivalence

In our country there has been a well-recognized ambivalence in public policy in the field of industrial relations and collective bargaining. There is, on the one hand, professed

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\*General Manager, Durgapur Steel Plant

faith in collective bargaining as the most effective system for developing sound industrial relations. There is, on the other hand, a deep-rooted reluctance to recognize that work-stoppage by either side is the ultimate sanction in collective bargaining and that devoid of this ultimate sanction, collective bargaining becomes unreal. This reluctance to recognize the essential nature of the bargaining process has given rise to elaborate legislative and administrative devices to restrict the freedom of the parties to resort to the ultimate pressure. There are no doubt various cogent arguments in favour of thus restricting the parties' freedom to resort to work-stoppage. The fact, however, remains that these restrictions do not help promote effective collective bargaining.

The real ambivalence of present policies in this area lies not so much in these restrictions upon the freedom of work-stoppages, as in the reluctance to enforce them for fear that they may inhibit collective bargaining. Thus, we neither get the benefits of a self-reliant system based on free collective bargaining, nor those of a regulated system based on prompt and effective State intervention and suppression of overt conflict—dubious as the latter benefits may be.

This ambivalence of approach affects industrial relations in the public sector more than in the private sector, because the managements in the private sector can, at least so far as their own policies are concerned, make a choice between these alternatives and plan their own behaviour *vis-a-vis* their employees accordingly. They can either accept, by and large, a collective bargaining approach and build up their own bargaining strength adequately to make it effective, or they can mainly depend upon Government intervention, conciliation, adjudication, etc. They cannot thereby completely

opt out of the ambivalence since the administrative processes of the Government which themselves suffer from this ambivalence do enter into their industrial relations processes and style. All the same, they can at least build their own approach and style on a deliberate choice. Public Sector managements, however, find this ambivalence built in their industrial relations systems. They dare not push the collective bargaining process to its logical extreme of work-stoppage even on issues on which they are convinced that they have made more than fair offers in good faith for a settlement. On the other hand, they cannot lean much on the legal and administrative processes for fear of being branded as anti-collective bargaining.

Lest this thinking about industrial relations is misunderstood to be a plea for a 'free-for-all' between labour and management, I would hasten to add that industrial conflict is not minimized by constant leaning on law and State nor by either side showing a tender-minded anxiety to avoid conflict at all costs. Experience in our country as elsewhere is that conflict is minimum and industrial relations are sound where each side is aware of and has a healthy respect for the bargaining strength of the other side as indicated by its ability to withstand the ultimate pressure, the pressure of a work-stoppage. This is also the best guarantee against the management not imposing gross inequities on the workers as also against the workers and their organizations not holding the management to ransom over exorbitant claims.

#### **Industrial Relations in DSP**

Industrial relations at the Durgapur Steel Plant are far from healthy. Work-stoppages in pockets are common; worse forms of coercion

like *gherao* and physical threats of violence are not uncommon; agreements over disputed issues are long and difficult to arrive at and are not fully honoured after they are concluded. Elementary discipline in matters like attendance hours and absence without leave is often disregarded; there have even been occasions when groups of workers have been found to cook meals inside the shops, work performance standards are generally poor and management instructions regarding work are often defied; there is continuous pressure for increased manning, upgradation, overtime, and higher incentive payments even at the present level of output; no objective norms or yardsticks exist or are accepted for resolving disputes over these issues. Inter-union rivalries are acute and aggravated by party political factionalism and hostilities. Labour laws, standing orders, even agreements are difficult, if not impossible, to enforce; inter-group relations are fraught with distrust; changes, technological or organizational, are very difficult if not impossible to introduce regardless of their merits; sense of belonging is conspicuously absent; last, but not least, managers individually and management collectively often feel helpless to deal with these ills and abuses.

### Diagnosis

A closer study of this situation would reveal the following salient features:

- \* There is no effective framework for collective bargaining since no one union can effectively represent the large majority of workers, negotiate and enter into agreements and ensure that workers will honour such agreements.
- \* Management adopted the approach of trying to find ad hoc solutions to various demands put forward by the unions without

getting the unions to agree to any objective system of yardsticks or measurement, on manning, upgradation, incentives, etc.

- \* Because of the two features mentioned above, the process of negotiations and discussions has become exceedingly slow causing frustration and irritation all round. This is sometimes aggravated by the less-than adequate understanding, and consultation between personnel department and the line managers.
- \* There is an impression that the only way to draw serious and prompt attention to a problem is to precipitate a crisis over it.
- \* Middle and even senior managers are usually reluctant to take a firm stand in the face of unjustified pressures by workers for enforcing work-norms or discipline. This is due to:
  - \* An attitude of non-involvement and play-safe,
  - \* A feeling that top-management will not back up a firm stand if it leads to industrial conflict and causes loss of production,
  - \* Fear of damage to plant and equipment due to wild-cat work-stoppages.
  - \* Fear of physical violence.
  - \* Ignorance of laws, rules, their own powers basic concepts and skills of personnel management, etc.
- \* There is very little effort to look out for emerging problems, anticipate them, maintain communications with known floor level leaders of workers and find solutions to problems before they escalate to the pitch of crises. There is, in fact, no formal framework for continuous and earnest floor-level consultation with workers.

- \*Aversion on the part of unions to get involved in and play a role in any positive devices like grievance procedures, floor-level committees, suggestion schemes, safety committees, etc.
- \*Workers have been accustomed to forcing various kinds of concessions from management by resorting to pressure action on the shopfloor and hence, have no use or patience for the supposedly slower processes of collective bargaining. Since floor level pressure has yielded concessions in the past, there is no sanctity attached to collective agreement.
- \*There is perhaps also a feeling on the part of management that unless we continuously go on extending higher and higher benefits to workers, we may be called reactionary and anti-labour.

### Unions' Strategy

Let us try to look at the picture from the side of the unions. There was perhaps a stage many years ago when the workers felt that the right of the workers to determine their own bargaining union was denied to them. Rigid rules and procedures and lack of collective bargaining traditions in the public sector in the early years may also have been irksome to workers. Later, in a political climate which gave a more-than free play to the aggressive urges of politically involved trade unionism, the workers found that they could generate various kinds of pressures, both industrial and physical, not to speak of political, against management. They found, further, that management had no clear convictions or strategy to counter such pressures and tried to deal with them on an ad hoc basis instead of evolving a comprehensive institutional and normative framework of collective bargaining. It is noteworthy that no major confrontations between management and workers took place over major

issues like wages, hours of work, retirement benefits, incentive principles and so on. On the other hand, in ad hoc, sporadic confrontations over issues like manning, upgradation and overtime, workers found that they could usually force concessions from management by threatened or actual work-stoppages and physical duress in the form of *gherao*, etc. In this climate workers naturally keep on pressing the unions for more and more concessions. Under these pressures and in the face of the known weakness of management to resist sporadic work-stoppages on the shop floor, it is difficult for unions to behave with responsibility.

### Let Us Set Our House in Order

To reduce the whole problem to the single question of parity of bargaining strength would, of course, be an oversimplification. Other problems which are internal to management have also to be recognized. There is a widespread feeling that the management has no definite and consistent industrial relations policy at all. The HSL emphasis on inter-plant uniformity and on a highly intricate incentive system developed by outside consultants has also hampered the initiative and manoeuvrability of the management in dealing with the specific claims of workers. The effectiveness of Personnel Department and its relation with the line management as a whole are also to be further improved. The administrative process within the organization as a whole depends excessively on paper work and not enough on inter-personnel communications and consultation among different departments or at different levels in the same department. There is a general inclination to look the other way when some improper or undesirable practices are known to exist in some areas. The time factor in processing of all problems is unquestionably

long. This organizational environment is not conducive to the development of a healthy industrial relations climate.

### Parity of Strength a Must

All the same, it must be asserted that whatever is done on the above points will by itself be wholly ineffective unless the basic disparity, real or perceived, in the bargaining strength of the two sides is rectified. Unless the management is able to show that it has the strength to withstand pressures of various kinds intended to force unjustified concessions, that it has the ability as well as the will to enforce at least the basic discipline within the organization and to take and implement decisions in the best interest of the organization, it will not be able to prevail upon the unions to take a genuine problem-solving attitude. Whatever streamlining the management does internally will not by itself materially influence the attitude of the workers or the unions. The critical factor in the total situation, therefore, is the parties' perception of their relative bargaining strength.

### A Ray of Hope

It is fashionable today to blame poor industrial relations on "management lapses", whatever that may be; nor may it be denied that certain errors and omissions in the early stages may have contributed to a general situation of distrust, confrontation and semi-anarchy. However, there is today a genuine willingness among the management to accept and operate an effective collective bargaining system and to give a fair deal to employees judged by any objective norms. The management would even want to involve the workers and the unions in a more direct and extensive way in all the aspects of the operation of the organization provided the basic readiness to get so involved in a positive way is forthcoming from the unions.

There is no reason for the management to be apologetic, for it accepts without reservation all the present-day precepts and standards of fair labour practices. But all these cannot become meaningful unless the management also has the strength to withstand illegitimate pressures.

### Strategy for the Future

Based on this analysis of the situation, the directions in which the management can act are clear enough. In the positive direction the management has to work for an institutional framework in which it can carry on the dialogue with all the organizations of workers over issues not only involving disputes but also involving the operation of the plant itself. The management has also to streamline its own policies and practices so as to make such institutional framework operationally effective. To help achieve this, the management has to insist upon the formulation and acceptance of some objective yardsticks or measurement systems to deal with disputes regarding upgradation, manning, incentive, overtime, promotion, etc. The recent tripartite agreement creating a three-tier framework for such continued consultation is intended to serve this purpose.

On the negative side, to make the above-mentioned institutional and normative framework effective the management has to refuse to submit to sporadic pressures through work-stoppages, *gheraoes*, etc. intended to force concessions from the management without processing the issue through the institutional framework.

For some time past the management has been trying to follow this strategy with determination and with some success. It, of course, needs support from the HSL as a whole, the State Government as well as the Central Govern-

ment to enable it to stick to this strategy. Further, since this strategy, to begin with, will have to break down long established attitudes and habits of behaviour both among the workers and the unions on the one hand and the managers on the other, it will only make slow progress and will involve occasional conflicts on the shop-floor, resulting in loss of production. This has to be accepted as part of the price to be paid for bringing about the change in the total industrial relations climate. Even without this strategy production losses will still take place as has been the experience of the past leading only to greater anarchy. Accepted as part of a deliberate strategy, we could at least hope for a healthier and more equal relationship in the future as compensation for the immediate loss of production. The DSP management will, however, not be able to stick to this strategy if because of the immediate loss of production, pressures start building up upon it to go back to the old style of ad hoc compensation and compromises to give the appearance of continuity of operation of the plant.

### One Last Point

What has been outlined above is in no way a 'get-tough' style or an anti-labour attitude. It is no part of genuine trade-unionism to con-

tinuously keep up a climate of industrial conflict and low productivity; nor is it any part of genuine trade unionism to enter into agreements without having the intention of honouring them. What is more, these tactics by the workers and the unions might appear to make some immediate gains for some groups of workers who are strategically placed inside the plant. They, however, do not do any good to the totality of employees in the organization. If anything, they do harm through continued low productivity and a stagnant plant. Through sporadic pressures the unions are perhaps able to force the management to upgrade a few hundred workers or to recruit a couple of hundred additional persons; however by creating a condition of stagnancy these tactics preempt the employment of several thousand persons in the steel-consuming industries, the earlier policy of management and the style of the trade-union behaviour has spelt only disaster and ignominy. By following a more consistent firm and fair policy, the management will be breaking the present stagnation and opening up the ways for expansion of the plant, for a fairer deal to the non-strategically placed employees and also to the industrial growth and larger employment opportunities in the community as a whole. ●

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Even the Chairman's Pencil has an eraser on it. We all make mistakes. That is why they put erasers on pencils—even the Chairman's. Don't be afraid of admitting mistakes. We cannot be right all the time. The man who is right only 60 per cent of the time can be a howling success if he is quick to correct his mistakes the rest of the time. The funny thing is, people really respect a man who admits his mistakes quickly. It's the mark of a big man.

—*Business is People*, TELCO Publication.



# Organised Labour in Singapore —Past, Present and Future

C. V. Devan Nair\*

The organised labour cannot be a significant power in any society without burgeoning areas of employment created by economic development. The "right to work" and the "right to organise" and all the other sacred cows of trade unions in the developed countries are the RESULT and not the CAUSE of economic growth and progress. And yet, as far as third world nations are concerned it is generally assumed that these 'sacred cows' can exist and thrive without even the grass i.e. economic development to feed them. But what, it may be asked, is the utility of the "right to work" when there are no jobs to crow about? And what use and to what purpose, is the "right to organise" when there is precious little to organise in any case?" These are some of the key questions that not only confront the Island Republic but, in equal measure, if not more, to all the developing world. The trade union movement in Singapore under the able guidance of the author of this article is striving to provide answers to these questions by launching a movement, come to be known as the "Modernisation of Trade Union Movement". The dynamics of this movement rests on the conviction of Singapore workers and their leaders that wealth before being distributed must be created and that labour must accept its responsibility in creation of distributable wealth. In essence, they have realised that it is better to deserve first rather than desire first. The experiment that the SNTUC is carrying out in 'modernising' its Structure and Functions in order to keep pace with the existing socio-economic realities of Singapore, has great relevance to other developing Asian countries as well and in fact the *raison d'être* for publishing it in the **PRODUCTIVITY**.

UR past is an inheritance, a good deal of which was far from admirable, and had to be discarded. The present is largely our own creation. The future might be even more so.

Little enlightenment regarding the role of organised labour in a developing country is to be derived from the modern West, for the good reason that western trade unions are the products of a quite different evolutionary process, and they operate today in the milieu of the most affluent societies in the modern world.

Trade unions in several developing countries have, to their own serious detriment, uncritically echoed the slogans of their western

counterparts like, "the right to work", "fundamental trade union rights" and so on. Nothing objectionable about these rights! Only, it is not realised that the right to work, for example, is unrealizable in a developing country plagued by mass unemployment. And talk about "trade union rights" is only of academic interest in a society in which the gainfully employed portion of the population is a meagre minority. *Only slowly and painfully are trade unions in the developing countries discovering that the aspirations and the priorities of organised labour in a situation of abundance are irrelevant in situations of scarcity.*

The brute fact is that organized labour cannot be a significant power in any society without burgeoning areas of employment created by economic development. "The right to work"

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\*-General, Singapore National Trade Union  
Press.

and "the right to organise" and all the other sacred cows of trade unions in the developed countries are the **RESULT**, and not the **CAUSE** of economic growth and progress. And yet, as far as Third World nations are concerned, it is generally assumed in the developed countries that these sacred cows can exist and thrive without even the grass i. e. economic development, to feed them. But what, it may be asked, is the utility of "the right to work" when there are no jobs to crow about? And of what use, and to what purpose, is "the right to organise" when there is precious little to organise in any case?

History bears copious testimony to the fact that the finer things of life do not thrive on empty bellies in impoverished societies. The rights and liberties, justly valued by civilized humanity, can only flourish on the fertile soil of economic development and the social and material well-being which it engenders. But historical testimony notwithstanding, the more superficial observers of the Third World, in the advanced societies of the West, insist on putting the cart before the horse.

### Singapore—Past and Present

A little more than a dozen years ago, Singapore was just like any other developing country. We were notorious for our depleted Treasury, growing unemployment, slogan-shouting and strike-happy trade unions, riot-prone students, and widespread social indiscipline. In fact, Singapore was then regarded as one of the riskiest places in the world for investment. The experts, both local and foreign, predicted all kinds of calamities for us, like growing social unrest, and, at worst, a communist take-over.

Then, in the wake of political turbulence, there was the short-lived merger with Malaysia, followed by eviction from the Federation. A

punch-drunk Singapore then reeled under the announcement of impending British withdrawal and the threat of massive unemployment.

And yet, today, Singapore has become an international by-word for rapid economic development, a model of political stability, of social discipline and cohesion, and of development-oriented social and educational programmes, which other developing countries seek to emulate. What role did the trade unions play in this transformation? What were they like before, what are they like now, and what might they be in future?

We might distinguish three broad phases in the development of our trade unions:

- (a) The colonial era and the communist domination of organised labour;
- (b) The immediate post-colonial era which saw the emergence of the NTUC; and
- (c) The current phase of the modernisation movement.

### The Colonial Era

After World War II and the British re-occupation, trade unions were, for the first time, allowed by the British colonial authorities. Most of the trade unions in the private sector were quickly dominated by the communists and their allies. Between 1945 and 1948, the Singapore Federation of Trade Unions (SFTU), which worked closely with the Pan-Malayan Federation of Trade Unions (PMFTU), acted as an open political vehicle of the Malayan Communist Party. But with the start of armed insurrection by the MCP and the declaration of the Emergency in June 1948, this militant phase came to end. Leaders of the SFTU and the PMFTU either went underground, or were arrested and banished.

Between 1948 and 1954, with the communists operating only from the underground, there wa

a period of passivity on the trade union scene in the private sector. Only in the public sector were the trade unions relatively active. The most vigorous trade union in the public sector was the Singapore Teachers' Union, and this too, because the leadership was in the hands of communist sympathisers who were arrested and detained in early 1951, after which the Singapore Teachers' Union also lapsed into a relative quiescence.

With the emergence of the People's Action Party as the forum of the anti-colonial struggle in 1954, there was a revival of militant anti-colonial trade unionism. This was not peculiar to Singapore, for organised labour provided a natural vehicle for the anti-colonial independence struggles in nearly all the colonial territories of Africa and Asia. Gandhi and Nehru in India, Nkrumah and Nyerere in Africa, as well as Lee Kuan Yew in Singapore, worked in close association with trade unions in their own countries for the common political objective of freedom from colonial rule, shared alike by communists as well as non-communists.

However, this phase of militant trade union activity proved to be brief in duration. In October, 1956, the colonial authorities cracked down heavily on the trade unions, arresting and detaining all the major trade union leaders.

Once again, apart from the public sector unions, which remained untouched by communist influence, trade unions in the private sector entered another period of quiescence until May, 1959, when the P won a majority of the seats in the Legislative Assembly, under the Rendel Constitution, which provided full internal self-government for Singapore.

### The Post-Colonial Era

Colonialism was on the way out with the achievement of full internal self-government.

The common cause against colonialism now gave way to a crucial political battle within the ruling party, between the communists and the non-communists, for the support and confidence of the population.

A communist take-over would have meant, among other things, massive repression by the combined forces of the British and Malaysians, who would not have tolerated Singapore as a springboard for communist encroachments into the Peninsula.

The political struggle between the communists and the non-communists was naturally reflected within the Singapore Trade Union Congress (STUC), between pro-communist and non-communist elements of the trade union leadership. When the pro-communists left the P.A.P. in 1961, to found the Barisan Sosialis, the STUC also dissolved, with the pro-communist elements forming the Singapore Association of Trade Unions (SATU), while the non-communists joined together to form the National Trades Union Congress (NTUC).

### The Growth of the NTUC 1961—1965

When the NTUC was born, it represented only a minority of the organised workers in the Republic. Its transformation, from a minority group into a majority movement, representative of the great majority of organised labour in Singapore by 1965, ran parallel to the clear political ascendancy achieved, over the same period, by the non-communist leadership of the democratic left. This political history is told elsewhere. We will concentrate here on the NTUC's growth, although it must be borne in mind that the NTUC's success would not have been possible if the wider political battles against the communists had not been won in a decisive manner by the non-communist Left represented by the P.A.P.

Once this wider context is understood, the more immediate reasons for the progress registered by the NTUC between 1961 to 1965 might be discussed. This progress is directly traceable to two major factors. First, the NTUC's concentration on the economic aspirations of the workers for better wages and working conditions. The pro-communist elements, on the other hand, made the mistake of flogging the same old horses of colonialism and imperialism, without regard for the fact that, as far as the general run of the population was concerned, the anti-colonial struggle was over, for all practical purposes. Full internal self-government had already been achieved, and Singapore was ruled by a fully elected government.

The workers quickly saw that the NTUC was more successful in delivering the economic goods, while the pro-communist unions offered them only stale political slogans and political strikes, which left them the poorer, and often enough, without jobs. For a number of factories felt obliged to close down in the face of unreasonable strikes.

The second factor was that the NTUC leadership placed as rigorous an insistence as the communists themselves did, on high standards of personal integrity and conduct among trade union leadership and officials. The image of non-communist unions in the colonial era, with some exceptions, had been badly tarnished by corruption and incompetence. The NTUC succeeded in erasing this image, and in creating a labour movement which showed as much dedication to the cause of labour, as the communists had successfully pretended to in the past. Equally important, the NTUC displayed greater intelligence than the communists in the pursuit of the economic aspirations of the workers.

### Post-Independence Decline of Trade Unions in the Third World

Notwithstanding the relative success achieved by the NTUC up to 1965, and the trouncing the communists received in the political field as well as in the trade unions, the NTUC had yet to come of age. It was not until 1969 that out-moded concepts, which conceived of trade unions purely as bargaining institutions, with no other social or educational functions or objectives, were decisively discarded. Indeed, between 1965 and 1969, the trade union movement declined in terms of membership, revenues, morale, public prestige and worker-acceptance. The communists had been decisively defeated, but the non-communist trade union movement led by the NTUC continued, as it were, to hobble along on crutches.

Marginally, at least, this decline was due to the economic stringency which the Republic faced after its eviction from Malaysia in 1965, the announcement of the British pull-out, fears of massive unemployment as a consequence, and the passage of the Employment Act as part of the investment promotion efforts of the government.

However, most trade union leaders were conscious of the overriding need to exercise wage restraint, stricter work discipline, and for a general tightening of belts all round, as the price that had to be paid for rapid industrialisation. The major reasons for the decline in trade union membership and morale had therefore to be looked for elsewhere. For it was also observed that trade union membership and influence had declined in all developing countries during the post-independence period.

The reasons were not far to seek. In all developing countries, trade unions, representing as they did the relatively better organised urban

workers, had been in the fore-front of the independence struggles in the colonial era. They had, therefore, possessed a social and political influence in their societies out of all proportion to their actual numbers, for they enjoyed the popular status and prestige of being among the major national vehicles of anti-colonial independence movements in their societies. In the public mind, trade unions were identified with the highest aspirations of their nations and peoples for freedom and national independence. After the achievement of independence, however, national aspirations in the developing countries naturally underwent a change. Freedom from colonial rule was no longer a national objective. The major pre-occupation became the question of what to make of national independence. The national priorities were modernisation and social and economic development. But the trade unions failed to identify themselves in any significant way with these post-independence aspirations and objectives. On the contrary, they regarded themselves as having no more a national role to play. They saw their task as being confined to collective bargaining and to taking on employers as well as the political leadership, in the pursuit of purely sectional interests. But massive problems of social change and economic development had to be grappled within newly independent developing countries. And the trade unions tended to insulate themselves from these pressing national concerns. They occupied themselves, not so much with contributing towards nation-building and the making of the national cake, as with being present at the distribution of the cake. This attitude proved near fatal to the status, influence and prestige of trade unions in most developing societies.

The negative approach to economic development, which has thus far been displayed by

trade unions in developing countries, was in no small part due to an uncritical adulation of the attitudes, values and slogans of labour movements in the developed societies of Western Europe and North America. In addition, they received from their Western counterparts a good deal of wrong advice on the priorities of commitment and action which should engage their attention. For these suggested priorities did not include any full-blooded trade union commitment to national economic and social progress as the essential basis for the growth of the labour movement in a developing society.

In trying to imitate their Western counterparts, trade unionists in the developing countries ignored the fact that, unlike the advanced industrialised societies of the West, urban industrial workers in most developing countries constitute a negligible minority of the working population. The overwhelming majority of the populations of developing countries are engaged in agricultural pursuits. It is only lately that Asian labour leaders have come to appreciate the importance of extending their representation to the rural areas, if they are to avoid being permanent minority movements in their own countries. The example they now seek to emulate is that of Israel's influential labour organisation, the Histadrut, which covers both the rural and industrial sectors in its operations.

#### **Pre-Conditions for Progress—the Singapore Solution**

Unlike the generality of developing countries, however, Singapore does not have an agricultural base. As a compact urban society, the compulsions on Singapore for rapid industrial development were, if anything, even greater. These compulsions became especially acute after the eviction from Malaysia, when Singapore

found herself a small urban Republic, with no natural resources to speak of.

The gist of the Singapore solution, as Lee Kuan Yew and his co-workers in the political field saw and formulated it, was plain and straightforward — Industrialise or Bust ! Most people thought Singapore would bust. We did not. And thereby hangs the tale of a many-sided and multi-pronged social, educational, economic and cultural effort, which inspired the confidence and the disciplined response of a hard working people.

Basic to Singapore's successful performance were the following ingredients :

- (a) An intelligent and incorruptible political leadership with :
  - (i) A multiracial approach to the problems of nation-building in a heterogeneous society.
  - (ii) Secular political and social values which were essentially democratic-socialist in orientation.
  - (iii) A hard-headed, pragmatic and no nonsense approach with regard to the observance of the political, economic, social, educational and cultural priorities deemed essential for national progress.
- (b) A population of immigrant stock, unhampered by religious and cultural taboos and shibboleths which inhibit the social and technological innovations necessary for modernisation and economic growth.
- (c) An industrious working population which accepted the bonafides of the political leadership, and responded to the call for hard work and the social and work discipline required for the development effort.

### **The Status of Organized Labour in Singapore and the Practice of Tri-Partism**

South Korea, Taiwan and Hongkong have shown that economic growth is possible without the involvement and participation of organized labour. In these societies, trade unions as we know them, are not encouraged. If at all they exist, they are merely suffered, and more often kicked about.

Singapore, however, subscribes to different values. The attitude to trade unionism is exemplified in the following words of Lee Kuan Yew :

“It is the consciousness of our being co-owners of the new society we are creating that provides the drive for fulfilment. In multiracial countries like ours, trade unions have a special role in building up this spirit of camaraderie amongst the workers. Developing the economy, increasing productivity, increasing returns, these make sense only when fair play and fair shares make it worth everyone's while to put in his share of effort for group survival and group prosperity.”

Now, in the nature of things, people who are regarded as co-owners are not inclined to be at perpetual war with other co-owners. We have, of course, our aberrations in Singapore, both among employers as well as trade unions, who are prone to offend against the principles of tripartism as the basis of a rational industrial relations system. Government ministries and departments occasionally tend to go off the rails themselves. By and large, however, it would be true to assert that it is the conscious and deliberate policy of the political leadership, and of the trade union movement, to promote the principles and practice of tripartism in the Republic.

Trade union representatives sit on all Statutory Boards, e.g., The Economic Development Board, the Port of Singapore Authority, the Public Utilities Board, the Telephone Board, Industrial Training Board, Adult Education Board, National Productivity Board and Central Provident Fund Board.

### **The Modernization Movement—The Emergence of the Co-operative Commonwealth**

Reference was made earlier to the decline in trade union membership and activities between 1965 and 1969. This decline was related to the general decline in the social influence and status of organised labour throughout the developing world, stemming from negative and restrictive concepts relating to the role and functions of organised labour.

Today, it is becoming internationally recognised that the trade union movement in Singapore has pioneered the emergence of a deeper and larger vision of the role of labour in a developing society. It is a vision which continues to be vigorously translated into practical endeavours in a variety of fields.

Trade unions in Singapore are no longer exclusively concerned with collective bargaining functions. These functions remain important, of course, for a trade union loses its *raison d'être* without collective bargaining on behalf of its members. But there is a growing awareness of, and pre-occupation with, the performance of the economy in general, and of the links between earning-power, on the one hand, and economic growth on the other. This in turn has led to greater sophistication in the approach to the collective bargaining process itself.

Next, more tangibly and visibly in evidence, are trade union initiatives in launching a series of highly successful co-operative ventures with trade union capital.

The structure of trade union co-operatives in Singapore constitutes a unique departure from conventional notions. Although they admit individual shareholders, who need not necessarily be trade union members themselves, the constitutions of the NTUC Co-operatives provide for ultimate control being in the hands of the NTUC and its affiliated unions, who are institutional shareholders in all the co-operatives. This unique structural innovation ensures that trade unions and co-operatives do not travel their separate and sometimes rival roads, as has happened in other developing countries. On the contrary, trade unions, as social institutions, are able in Singapore to develop a direct stake in the launching and management of co-operatives, and thereby to ensure for organised labour a distinct and notable contribution to economic activity and entrepreneurship in the Republic.

Within the short span of three years, the NTUC and its affiliate unions have launched four co-operative undertakings. First came the Co-operative Insurance Society, INCOME. Under capable management, and with the active support of trade unions and existing co-operatives, INCOME has registered a degree of success which has earned world-wide tributes.

Next came the NTUC's Transport Co-operative, COMFORT, which will enable taxi drivers and drivers of school buses in the Republic, to become owners of their own vehicles.

Third was the Dental Co-operative, DENTICARE, which seeks to provide cheap dental treatment for workers and their families.

Recently, there was opened in Singapore the first Co-operative Supermarket WELCOME which promises to be the first of a series of co-operative supermarkets in the Republic.

The next major ventures will be a Housing Co-operative, which will aim to bring home

ownership within the means of the middle-income group, who are now precluded from owning homes as a result of prohibitive land prices and building costs.

On present trends, it is expected that by 1975 the number and the performance of trade union co-operatives would be sufficient to justify the initiation of a Workers' Bank in the Republic.

### Conclusion

Singaporeans can be justly proud of many things. But one of the penalties of success is to take things for granted, and to forget the road we had to travel, in order to arrive at where we are today. It is a road we must continue to travel if we are to maintain what we have already created, and to build a future of expanded opportunities and of deeper individual and collective fulfilment,

The essential ingredients which went into the making of modern Singapore will remain essential for the Singapore of the future. The cooks in charge of the Singapore broth must, of course, change with the effluxion of time. But if we tamper with the essential ingredients of success in our compact urban society—secularism, multi-racialism, pragmatism, incorruptibility and high standards of public life and social discipline—we will gravely imperil the future for everybody in our Republic.

The trade union movement in Singapore, along with other groups in our society, must continue to forego the dubious luxury of the kind of empty-headed posturing which is too often mistaken for leadership in the developing societies of the Third World. The spread of social justice will always demand a price in terms of an unremitting effort to sustain and improve individual skills, social discipline and collective effort.

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## Slowdown in World Industrial Output

World industrial production recorded a marked slowdown in the first 21 months of the 1970s, according to the February 1972 issue of *Monthly Bulletin of Statistics* released by the United Nations.

After nearly doubling in the 1960s, production rose only 3.9 per cent in 1970, and at an annual rate of 3.8 per cent in the first nine months of 1971. By comparison, global industrial output expanded 7.8 per cent in 1969, and 3.9 per cent in the nine months to September 1970.

The index numbers of industrial production indicate that during the first 21 months of the 1970s the Soviet Union and Eastern Europe maintained their pace of growth by realizing an 8.6 per cent growth rate in 1970 and equivalent of 10.7 per cent in the first nine months of 1971 compared with a 7.2 per cent and 8.0 per cent in the corresponding periods of a year earlier.

During the same period, the developed regions achieved a rate of growth of only 1.4 per cent in 1970 and at an annual rate of 0.7 per cent in the first nine months of 1971. The sharp decline in those rates was mainly caused by the set-back of industrial production in the North American region where industrial production actually declined during the 21 months in question. The slowdown in the rate of growth of industrial production was also evidenced in the developing regions where industrial production increased by 7.1 per cent in 1970, as opposed to 9.9 per cent during the preceding year.

Among all regions, Asia was the one which registered in 1970 and the first nine months of 1971 (an annual rate of 10.7 per cent for the 21 months) the highest rate of growth in total industrial production as well as in the individual branches of industry. This high rate of growth is apparently attributed to the high-ranking performance of Japan, which recorded the equivalent of 10.8 per cent a year for the period.



# What Makes an Effective Manager —A Practical Approach

G. Lobo\*

Professional management has come to be increasingly accepted by relatively enlightened sectors of Indian business. Wherever it has been introduced, it has by and large proved its efficacy. However, there is a large segment of business where its need has not yet been realised, but sooner or later a change has to take place since the very existence of the enterprise will depend on such a change. However, reluctance to delegate the power, defective communication system, lack of leadership qualities, outmoded concepts of management, improper utilization of professional competence etc. are some of the major weaker points with which an Indian manager suffers at the moment. The author, in this paper makes an effort to outline a practical approach which the managers in India could follow, to become an 'effective manager' and come up to the expectation of employers, workers, and above all, the community.

OF late there has been a lot of talk in the country about the necessity of effective management for maximising the efficiency of every enterprise, both in public and private sectors. There was a time when it was widely said that the managers are born and not made. While it is conceded that there are certain personality traits and abilities which contribute more to effective management, few will subscribe to the view today that birth and business connections are the determinants of managerial competence. There is also a general feeling of frustration among the qualified, professional men that there is a hurdle at every step, often involving the human element. Let us briefly analyse why our managers are not able to manage effectively.

Without going into the technicalities of the

business management, a manager ought to know as to what he is managing and the basic concepts of management. The main objective of every enterprise is 'profit maximisation' and to achieve this objective, every manager has to manage effectively the 3 Ms viz., men, money and material. Efficient utilisation of one and neglect of other will create imbalance and jeopardise the working of the entire enterprise. An enterprise whether under public or private sector owes its existence to the society which creates and supports it. In return, it is expected to meet society's demand for goods and services as efficiently as possible and for which it is allowed a profit. Profit enables an enterprise to grow and like other organisms, if it does not grow, it is bound to die.

As most of the companies in India were initially in a sellers' market (and some of the basic industries still are), our managers had

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and plan and go about on that basis; and the work will be completed not only efficiently but also on schedule. If, however, the work is not properly organised, there will be a chaos and tension at all the levels and everything will end in failures. This will affect the health of the company and also of the manager. Sooner or later the company cannot but go out of business and the manager will start getting insomnia, ulcer and blood pressure on account of constant failures.

*Overtime Managers* : Some of the old timers still believe that they essentially are required to stay late in their offices whether such late sitting warrants or not. What is achieved during such overtime work is often insignificant and could have been achieved during normal working hours with a little more concentration, perseverance and diligence. Habitual late sitting would imply that the manager is either incompetent or is saddled with work beyond his capacity or is incapable of delegating. It is also possible that this type of manager wants to create an impression that he is hard-working and pains-taking and draw upon sympathy. This class of managers do not go on leave for years together since they are afraid that their mistakes will be known and their subordinates will get trained to get the work done during the leave period.

One will invariably find such overtime managers sitting late only as long as the bosses are there in the office, mostly chit-chatting with other colleagues and the moment the bosses are out, their overtime work stops abruptly, because this is only an attendance without any additional remuneration. One would also not be surprised not to find such honorary overtime managers sitting late whenever the bosses are out of station or on tour abroad, but the moment the bosses are back, their late sitting will once

again commence. Moreover, one would also not be shocked to find such so-called sincere and hard-working managers criticising and downgrading their enterprise in a group meeting with outsiders instead of defending their enterprise and thus damage the image of the enterprise.

The yard-stick for judging the efficiency of the manager is not the additional hours of work he is putting in but the results achieved by him.

*Sense of Belongingness* : How efficient and highly paid a manager may be, he cannot become a successful and effective manager as long as his attitudes are not changed. Once Mr. T.A. Pai, our former Railway Minister, when questioned by a reporter about his opinion on nationalisation, said that "nationalisation as it is, is not bad, but the greatest misfortune in our country is that the attitudes of our employees at all the levels are also nationalised with the nationalisation of the Undertaking". The first and the most important requisite for the effective manager is his attitude towards his enterprise and a sense of belongingness. His attitudes and thinking must conform to the thinking and the policies of the enterprise and this belongingness, attitudes and thinking must trickle down the layers of the management hierarchy so that the entire set up thinks alike and functions like a pyramid.

Finally, like individuals, every business enterprise also requires a sense of direction during the time of change and uncertainty. The past decade or so has indeed undergone a succession of major changes and innovations in technology, markets and organisation theory and also the concepts of managements. It is not easy to keep a track amidst the complex interactions of these elements which are themselves in flux. A continuous re-examination of busi-

ness objectives becomes indispensable for satisfying the ultimate goal of the majority of the enterprises—survival and growth. The entire pattern of business has to change if it wants to survive. The Indian industry is witnessing today the rapid emergence of what Prof. J. K. Galbraith calls the technostructure. A professional class of managers (effective managers) is entrenching itself in the corporate

sector. “Professional management has come to be increasingly accepted by relatively enlightened sectors of Indian business. Wherever it has been introduced, it has by and large proved its efficacy. However, there is a large segment of business where its need has not yet been realised, but sooner or later a change has to take place since the very existence of the enterprise will depend on such a change.” ●

## Idle Chatter Can Sell Products

Not enough attention is paid to word-of-mouth communication—the deliberate spreading of good news about a product through such people as taxi drivers and shop assistants. This is a view expounded in a new book, *Winkler on Marketing Planning*, published by Associated Business Programmes Ltd. of London.

The author, John Winkler, is a writer and marketing consultant. He points out that “informal conversation is probably the oldest mechanism by which opinions on products are developed, expressed and spread.” But he admits that it isn’t so easy to recommend a standard formula for getting a positive product sales message on its rounds.

Some manufacturers whose goods are sold in retail shops employ “mystery shoppers.” They visit shops where they know their goods are not stocked and ask for them, as an ordinary housewife would, until the retailer begins to feel he can no longer afford to neglect those items.

The favourite technique for encouraging public word-of-mouth recommendation is to concentrate TV advertising on the theme “here is good news, pass it on.”

Some advertisers have adjusted their entire distribution campaigns to the word-of-mouth comments their products will receive. Thus, in the cinema industry, a bad film is distributed rapidly, building up to saturation quickly, with cinemas showing the film simultaneously. But if the film is a good one, the distribution slows to creeping pace, allowing favourable word-of-mouth to build up.

Winkler says that particularly with fad products sold to younger age groups, the influence of word-of-mouth is terrifyingly clear. Slimming foods, personal products, drugs and do-it-yourself markets are all highly sensitive to word-of-mouth, not to speak of trendy clothes and “pop” records.

“In a US study of the purchasing behaviour of buyers of small electrical appliances,” Winkler writes. “It was discovered that word-of-mouth was more frequently mentioned than any other external source. Another study, of industrial buyers, showed that word-of-mouth tended to be more important at the later stages of the adoption process.”

The chief disadvantages of word-of-mouth is lack of control once a message has been sent on its rounds. But it seems that many more companies could consider this technique and get talking.

— *International Management*

# Integrating Individuals with the Organisation—Foreign Concepts and Indian Management

Dr. J. L. Rastogi\*

A modern enterprise is a socio-technical system and as such the attainment of its goals, irrespective of their nature, depends on proper integration of the technical and human sides. Those have to be balanced in such a manner that they serve the technological demands of the organisation simultaneously satisfying the needs and inchoate aspirations of the MAN involved. In the western world various theories have been propounded to provide the theoretical basis for such an integration. While these theories are good illustrations, they cannot and must not be transplanted in the Indian soil since the 'climate' is different. The author, therefore, rightly highlights the need to develop an indigenous approach to the problem. And in this endeavour, management education and development can play a vital role.

AS in the case of modern technology, there is a tendency in the country to import managerial concepts from the western developed countries irrespective of the fact whether they have relevance in Indian context or not. There are historical reasons for this trend. Since the beginning of industrialization in India, management has been the most neglected aspect. Instead of developing our own organizational and managerial concepts, we tried to draw on those, developed and adapted in the West particularly till the end of the first quarter of the 20th century. Thus management in India has not kept pace with the changing managerial needs of our growing industries. While the management in the West is planning to meet the new challenges created by increas-

ing complexities of production and emerging organizations and by internal and external pressures, its counter-part in India has not so far discarded its outdated and obsolete attitudes about its own role, and in relation to work, workers and their organizations.

The management in India has been more concerned with the technical side of production and with the operating efficiency, and has largely ignored the human side of the enterprise. No effort has been made in the country to integrate the needs and aspirations of the employees and the goals of their organizations with the objectives of the enterprise. Thus, industrial leadership and techniques adopted by Indian management are more traditional than progressive. Relations between subordinates and superiors are still paternalistic in many enterprises. There is still too great

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a reluctance to delegate authority and a consequent over-centralization of decision-making at the top, even where there are competent subordinates. There is still too little readiness to accept responsibility at lower levels.<sup>1</sup>

No doubt, we cannot import Western organizational and managerial theories and concepts and apply them as ready-made solutions to various problems in our industry. Still these can provide us with a framework to better understand and analyse our own problems and to arrive at appropriate solutions taking into account our own political, economic and social climate.

One of the basic problems of modern industries is that of integrating employees with the organization they work for, i.e., generating a degree of commitment and responsibility in them towards their work, workshop and the organization so that they can achieve their own goals by directing their efforts towards the goals of the organization. It is both one of the goals of an enterprise as well as a means to attain other organizational goals.

### Enterprise Objectives

A modern enterprise has multiple objectives to attain. Besides achieving the institutional objective of survival and growth, it has to protect the interests of various constituents of industry and also to promote the welfare of the community of which it is a part. However, the institutional objective is the most important and all other objectives depend on economical and effective performance of its primary task, i.e., the task which it is created to perform—creation and distribution of goods and/or services. But this is not enough. It has also to sense the changes in the environ-

ment and adapt its primary task to the changing needs in order to grow.

Equally important objective of an enterprise is integration of various constituents of the organization by satisfying their personal goals. According to Ralph C. Davis, these goals are ensuring (a) profits for owners, (b) salaries and other compensation for executives, (c) wages and other compensation for employees and (d) psychic income for all, including (i) pride in work, (ii) security, (iii) recognition, and (iv) acceptance<sup>2</sup> As the enterprise coordinates the contributions of various constituents of production, it has a special responsibility. It has not only to promote the welfare of the absentee shareholders, but also protect the interests of the other groups, viz., the management, employees and the consumers. Thus profit maximization is no more the sole objective of any productive enterprise.

The social objectives of the enterprise arise out of its obligations towards the society. These are related to furtherance of the national goals and acceleration of the processes of growth and development. The national goals of a country are determined by her political doctrine, social values and cultural heritage. In a democracy these are, generally, liberty, justice and equality. The process of growth and development, on the other hand, are essential for a country's survival and independence. The former refers narrowly to increasing income or output per capita, while the latter relates more broadly to the emergence in society of the attitudes, values, skills and knowledge essential for sustained growth. Where the one stresses the quantitative output performance of an economic system, the other focuses attention on its qualitative output characteristics.<sup>3</sup> Thus, the process of growth

implies continuous economic development, full employment and maximum utilization of natural resources, while the process of development aims at creation of environment and institutions needed for the fuller life in the community by providing healthy surroundings and educational and recreational facilities.

These objectives of an enterprise relate to various levels of the organization and its relation to its external environment. However, these are not competitive, and supplement each other, e.g., attainment of institutional objectives of any organization directly depends on effective integration of the interests of various constituents of production, i.e., shareholders, managers, employees and consumers, and on the support it could muster in society by integrating itself with social interests and welfare. Similarly sectional objectives of an enterprise can only be attained on successful attainment of the institutional objective in an environment of justice, peace and cooperation.

### **Integration—the Core of Success**

The attainment of organizational goals—institutional, sectional or social—depends on proper integration of the technical and human sides of the enterprise on the one hand, and on the integration of the needs and aspirations of workers with the goals of the organization on the other.

A modern enterprise is a socio-technical system. It 'requires both a technological organization—equipment and process layout—and a work organization relating to each other those who carry out the necessary task. The technological demands place limits upon the type of work organization possible, but a work organization has social and psychological properties of its own that are independent of technology.'<sup>4</sup>

No doubt, the technical factor, very often, has an important bearing on over-all productivity of the organization, but it is the human side of the enterprise which plays more active a part in leading the enterprise and the associated technology to success. 'All the activities of any enterprise are initiated and determined by the persons who make up that institution. Plants, offices, computers, automated equipments, and all else that a modern firm uses are unproductive except for human effort and direction. Human beings design or order the equipment; they decide where and how to use computers; they modernize or fail to modernize the technology employed; they secure the capital needed and decide on the accounting and fiscal procedures to be used. Every aspect of a firm's activities is determined by the competence, motivation, and general effectiveness of its human organization.'<sup>5</sup> Thus, the enterprise has to balance its technical and human sides in such a way that while serving the technological demands of the organization, it also satisfies the needs and aspirations of the people involved.

However, integration of workers' needs and aspirations with the objectives of the organization requires a correct perception of the nature of man, motivational impact of his various types of needs, the role of extrinsic and intrinsic rewards and punishment, and the leadership which is both supportive and goal-oriented.

### **McGregor's Theories 'X' and 'Y'**

Assumptions about the nature of man are generally identified with Prof. McGregor's assumptions in his Theories 'X' and 'Y'. These depend on the degree of commitment on the part of workers to the industrial way of life, their training and development to handle the changing needs of the industry and the general environment providing various traits—undesir-

able like 'antagonism, hostility, resistance, defiance, uncooperative attitudes and unrealistic points of views', or desirable like 'loyalty, enthusiasm, drive, commitment, acceptance of responsibility and self-confidence'.

Theory 'X' assumptions about the nature of man, which are widely prevalent amongst managers, are:

1. The average human being has an inherent dislike of work and will avoid it if he can.
2. Because of this human characteristic of dislike of work most people must be coerced, controlled, directed or threatened with punishment to get them to put forth adequate effort toward the achievement of organizational objectives.
3. The average human being prefers to be directed, wishes to avoid responsibility, has relatively little ambition, and wants security above all'.

On the other hand, Theory 'Y' assumptions about the nature of man, which are based on current behavioural science knowledge, are:

1. The expenditure of physical and mental effort in work is as natural as play or rest. The average human being does not inherently dislike work. Depending upon controllable conditions, work may be a source of satisfaction (and will be voluntarily performed) or a source of punishment (and will be avoided if possible).
2. External control and the threat of punishment are not the only means for bringing about efforts toward organizational objectives to which he is committed.
3. Commitment to objectives is a (result) of the rewards associated with their

achievement. The most significant of such rewards, e.g., the satisfaction of ego and self-actualisation needs, can be direct products of effort directed toward organizational objectives.

4. The average human being learns, under proper conditions not only to accept but to seek responsibility. Avoidance of responsibility, lack of ambition, and emphasis on security are generally consequences of experience, not in human characteristics.
5. The capacity to exercise a relatively high degree of imagination, ingenuity and creativity in the solution of organisational problems is widely, not narrowly, distributed in the population.
6. Under conditions of modern industrial life, the intellectual potentialities of the average human being are only partially utilized.'

According to McGregor these theories, being based on different cosmologies, are qualitatively different, and therefore, do not lie on a continuous scale. He also agrees that there can be any number of theories like the above two depending on varying sets of beliefs about the nature of man.

However, theories 'X' and 'Y' have their own limitations. Theory 'X' does not reflect man's inherent nature; rather such behaviour on his part is partly the result of managers' own philosophy and practices. 'Organizations, in striving toward their objectives, have been greatly influenced by the results of specialisation, standardization, and mass production techniques. Skilled jobs have been sub-divided into many smaller parts; individual performance on these minute tasks has been programmed; initiative and discretion have been reduced; conformity, obedi-

ence, and dependence have been demanded from organization members. Pressures through the use of rewards and the threat of punishment has been used to achieve these ends. In the process many individuals have come to feel alienated from their work. Pressure has bred counter-pressure, and subordinates have reacted in ways detrimental to organisational efficiency. To achieve the desired behaviour, management has had to impose still more restrictions, a vicious circle has been set up, and the assumptions of theory 'X' seem to have been confirmed. Management has regarded employees as indolent, without ambition, and resistant to change and responsibility<sup>6</sup>. On the other hand, theory 'Y' has put extreme emphasis on autonomy, self-direction, individual freedom and inner-direction. It is not, however, correct in all situations; usually people want freedom, but within defined limits.

### Maslow's Need Hierarchy

According to Abraham Maslow, human needs are organized in a series of levels—a hierarchy of importance:

1. Physiological needs: for food, clothing, rest, shelter, etc.
2. Safety needs: for protection against danger, threat and deprivation.
3. Social needs: for belonging, for association, for acceptance by one's fellows and for giving love and affection.
4. Egoistic needs:
  - (a) relating to self-esteem: for self-respect, self-confidence, for autonomy, for achievement, for competence, for knowledge, etc.
  - (b) relating to one's reputation: for status, for recognition, for appre-

ciation, for respect from one's fellows, etc.;

5. Self-fulfilment needs: for realizing one's potentialities, for continuous self-development.<sup>7</sup>

However, the motivating effect of these human needs should be analysed in the light of the following points:

(i) Although it is usually said that as soon as one need is satisfied, need at the next higher level begins to dominate man's behaviour, but in actual practice various levels of needs do not exist in isolation. An individual whose physiological and safety needs are not satisfied may also have, to a certain extent, social and egoistic needs. 'Even in circumstances of severe deprivation, many may rebel against social and political restrictions in the interests of their higher needs. However less energy is available if most of it must be used for sheer survival'.<sup>1</sup>

(ii) Satisfaction of lower level needs—physiological, safety and social—not only motivates workers to perform their jobs, their non-satisfaction has an adverse effect on their attitudes and instigates them to, individually or/and collectively, defeat the organizational objectives.

(iii) The lower level needs cease to be motivators of behaviour as soon as they are satisfied.

(iv) The higher level needs—egoistic and self-fulfilment—are rarely satisfied and workers try to satisfy them indefinitely once they become important to them. But they do not appear in any significant way until physiological, safety and social needs are reasonably satisfied. However, reasonable satisfaction of various types of needs is culturally determined.

(v) 'Severe deprivation of lower level needs in early life may warp the individual's



adjustment in a variety of ways and accentuate their importance for him permanently. Thus we find people with fixations on money, for example, or security, or power.<sup>7</sup>

### Herzberg's Hygiene Factors and Motivators

According to Herzberg, man has two sets of needs—his need as an animal to avoid pain and his need as a human being to grow psychologically. Consistent with this classification, in relation to work of engineers and accountants, he identified two sets of factors affecting job attitudes—dissatisfiers and satisfiers. The former related to job context, e.g., company policy and administration supervision, salary, interpersonal relations and working conditions, while the latter related to job content, e.g., achievement recognition, work itself, responsibility and advancement. 'Since the dissatisfier factors essentially describe the environment and serve primarily to prevent job dissatisfaction, while having little effect on positive job attitudes, they have been named the hygiene factors. This is an analogy to the medical use of the term meaning 'preventive and environmental'. Another term for these factors in current use is maintenance factors . . . . The satisfier factors were named the motivators, as they are effective in motivating the individual to superior performance and efforts.'<sup>8</sup>

Thus, Herzberg gives two types of separate and distinct needs which lead to job satisfaction and job dissatisfaction respectively. These are not obverse of each other. 'The opposite of job satisfaction would not be job dissatisfaction, but rather no job satisfaction; similarly, the opposite of job dissatisfaction is no job dissatisfaction, not satisfaction with one's job.'<sup>9</sup> Analysing in this context, 'a hygiene environment prevents discontent with a job, but such an environment cannot lead the individual beyond a minimal

adjustment consisting of the absence of dissatisfaction. A positive happiness seems to require some attainment of psychological growth.'<sup>10</sup>

In traditional management thinking focus has been solely on hygiene factors and the role of motivators has not been recognised. The actual response of workers to hygiene factors and motivators would depend on their orientation towards these. 'There may be individuals who because of their training and because of the things that have happened to them have learned to react positively to the factors associated with the context of their jobs. The hygiene factors are primarily attracted to things that usually serve only to prevent dissatisfaction, not to be a source of positive feelings. The hygiene seekers have not reached a stage of personality development at which self actualization needs are active. From this point of view they are fixed at a less mature level of personal adjustment.'<sup>11</sup>

However, hygiene needs are only temporarily satisfied 'for their effects soon wear off and the hygiene seeker is left chronically dissatisfied'.<sup>12</sup>

Except that Maslow's need hierarchy deals with the human needs in general and Herzberg's need classification relates to sophisticated groups of workers in a developed country, there is not much of difference between their approaches. Maslow's lower level needs—physiological, safety and social—interpreted in the context of industrial work in a developed country are the same as the hygiene or maintenance needs as described by Herzberg. Similarly Maslow's higher level needs—egoistic and self-fulfilment—are like Herzberg's motivator needs. In American culture where the lower level needs have been satisfied to a large degree, workers usually direct their efforts towards the satisfaction of higher level needs. Whenever a disbalance is created in

satisfaction of lower level needs—physiological, safety and social—it is only temporary and leads to dissatisfaction. However, their motivators or higher level needs remain activated and they try to attain something worthwhile which would give them egoistic and/or achievement satisfaction.

Both Maslow and Herzberg accept that non-satisfaction of a particular need for a long time lowers the level of aspirations. In such cases lower level needs or hygiene factors become more prominent than the higher level motivator needs. 'In certain people the level of aspiration may be permanently deadened or lowered. That is to say, the less prepotent goals may simply be lost and may disappear forever, so that the person who has experienced life at a very low level, i.e., chronic unemployment, may continue to be satisfied for the rest of his life if only he can get enough food.'<sup>13</sup>

#### **Extrinsic and Intrinsic Rewards and Punishment**

A discussion of human needs would not be complete without an analysis of extrinsic and intrinsic rewards and punishment. Extrinsic rewards and punishment 'exist as characteristics of the environment and their relationship to behaviour is relatively direct. Money is the most obvious of them, but fringe benefits, promotion, praise, recognition, criticism, and social acceptance and rejection are other examples. Intrinsic rewards, on the other hand, are inherent in the activity itself: the reward is the achievement of the goal. Intrinsic rewards cannot be directly controlled externally, although characteristics of the environment can enhance or limit the individual's opportunities to obtain them. Thus, achievement of knowledge or skill, of autonomy, of self-respect, of solution to problems, are examples'.<sup>14</sup> Thus, both of these are essential not only to remove dissatisfaction but

also to promote maximum self-development and achievement. While extrinsic rewards help satisfy Maslow's lower level needs or remove Herzberg's dissatisfiers or hygiene factors, intrinsic rewards satisfy Maslow's higher level needs or act as Herzberg's positive satisfiers or motivators.

However, because of their nature—directly measurable relationship with actual performance—extrinsic rewards and punishment are by far the most recognized and utilized today. But in spite of the contribution of intrinsic rewards in satisfaction of higher level needs, their role has not been, generally, appreciated and accepted. Usually it is difficult to establish a direct link between these rewards and actual performance. 'One can give money as a promotion for superior performance. The casual linkage is obvious to the recipient, as is the source of the reward. But one cannot give the sense of accomplishment that accompanies the individual's or groups' recognition of having found a solution to a difficult and important problem. (It is quite different from the extrinsic reward of praise for the achievement.) In short, management cannot so easily or directly control intrinsic rewards.<sup>15</sup> But 'the individual can be prevented from obtaining such rewards for example, by close supervision that gives him no opportunity to solve problems on his own. It is interesting and significant, however, that under such circumstances people will often obtain this reward by ingenious solutions that involve a kind of sabotage of management's control system. "Beating the system" is a widely played game in which intrinsic rewards are highly motivational.'<sup>16</sup>

With respect to lower level needs, the management should not only provide extrinsic rewards *on an equitable basis* for all kinds of contributions to the success of the enterprise, but also ensure

an equitable administration of extrinsic punishment for negative contributions. 'With respect to higher level ego needs (and some middle level social needs) management's task is to provide opportunities for members of the organization to obtain intrinsic rewards from contributions to the success of the enterprise. Since the management does not directly control such rewards, the problem of equity in their administration does not arise. The task is to provide an appropriate environment—one that will permit and encourage employees to seek intrinsic rewards at work. Its performance will involve managers at every level in an examination of the way the work is organized; the nature and administration of managerial controls; the way responsibilities are assigned and supervised; the way goals are set, policies established, planning done—in-short, almost every aspect of managerial practices'.<sup>17</sup>

### Task Organization and Supportive Leadership

Thus, in order to get workers intrinsic reward from work, the task has to be designed in a way that it not only satisfies the technological requirements but also takes care of their needs and aspirations. According to Rice, 'the task must be one that is recognizable and meaningful for those who perform it. Its performance must be felt as something for which responsibility has been taken. The relationships it provides must be satisfactory'.<sup>18</sup>

Accordingly he makes three assumptions about task organization:

1. A task should be so organized that those engaged on it can experience, so far as is practicable, the completion of a whole task.
2. A task should be so organized that, so far as possible, those engaged upon it can control their own activities.

3. Related tasks should be so organized that those performing them can have satisfactory relationships.<sup>19</sup>

Highly relevant to this aspect is Likert's principle of supportive leadership. According to him, 'the leaderships and other processes of the organization must be such as to ensure a maximum probability that in all interactions and in all relationships within the organization, each member, in the light of his background, values, desires, and expectations, will view the experience as supportive and one which builds and maintains his sense of personal worth and importance'.<sup>20</sup> In support of his argument he further comments that 'in applying this principle, it is essential to keep in mind that the interactions between the leader and the subordinates must be viewed in the light of the subordinate's background, values and expectations. The subordinate's perception of the situation, rather than the superior's, determines whether or not the experience is supportive. Both the behaviour of the superior and the employee's perceptions of the situation must be such that the subordinate, in the light of his background, values and expectations, sees the experience as one which contributes to his sense of personal worth and importance, one which increases and maintains his sense of significance and human dignity'.<sup>21</sup>

### Reasons for Limited Scope in India

In spite of beneficial effects of these concepts in integrating individual's goals with the organizational objectives, managers in India have failed to recognize and adapt these to motivate workers to put forth their best. The basic reason for this has been that while integrating principles are based on modern management theories, management practices in our country are based on traditional concepts. The commo-

dity concept of labour still prevails in most of the enterprises in India and managers in general subscribe to management by direction and control. 'Vast majority of managers in India as elsewhere believe that the subordinate employees are a good deal irresponsible and that their horizon being narrow and limited, they are opposed to progressive change and good practices. The strategy that springs from these assumptions is usually one of devising controls and procedures which will seek to keep employees in their proper place; they are sought to be motivated by appropriate mixture of reward and punishment system'.<sup>22</sup>

Because of rigid and obsolete attitude of managers in India, little attention has been paid to workers' needs and aspirations. Their lower level needs—physiological, safety and social are inadequately satisfied while motivational impact of higher level needs—egoistic and self-actualization—is not recognized. Thus, most workers in our country are living a below subsistence life. A very large number of them is either casual or temporary and lack security of employment. Moreover, the constructive role of informal groups has not been accepted while trade unions in most of the cases are still regarded as opposed to the interests of the enterprise. Due to inadequate satisfaction of lower level needs, their level of aspirations is at the lowest ebb and extrinsic reward and punishment even today serve as the most powerful incentive to our workers. Thus, generally they are unwilling to assume responsibility and take initiative, and look towards their bosses for proper direction and reward.

In the prevailing managerial environment even managers who have been exposed to modern management concepts and trained in application of modern techniques in solving managerial

problems, generally fail to make any significant impact on the management system. Because, in order to satisfy their own needs particularly lower level, they have to abide by the wishes and attitudes of their own bosses. 'Incumbents in the managerial hierarchy seek as new recruits those they can rely upon and trust. They demand that the new comers be loyal, that they accept authority (of the family, the government, or the professional superior, as the case may be), and that they conform to a prescribed pattern of behaviour'.<sup>23</sup> Even where managers have tried to introduce certain modern management concepts they have not only failed to bring about the desired results but have led to suspicion and distrust on the part of the workers. For example, labour participation schemes—both statutory and voluntary failed in India to generate in workers a spirit of self-confidence and self-esteem and encourage them to achieve self-actualization, because, these being higher level needs, could not motivate them until their lower level needs were reasonably satisfied. Such examples can be multiplied. In fact, because 'of inadequate appreciation of the nature of management systems, isolated steps taken in this regard fail to realize its full potential both in magnitude and direction'. 'The nature of this shift is generally not recognized and the particular step taken is usually not accompanied or followed by the other kinds of changes required to yield an integrated, consistent management system. As a consequence, the improvement in the results achieved by the change is significantly less than that which is potentially possible, and often the improvement which does occur may last only for a relatively short time'.<sup>24</sup>

### **Appropriate Managerial Strategy Needed**

Thus, effective utilization of integrating principles and concepts in India, calls for a planned

transition from the traditional to the modern management system. It needs an environment which is conducive to healthy development, and also ability of managers at various levels to comprehend those concepts and their motivation to adopt these in dealing with the human side of the enterprise. Organizational environment is largely determined by the accepted philosophy and culture of the enterprise. On the other hand, managers' ability to use these concepts depends on their knowledge of the structure, objectives, functions and operations of a modern organization and also of various relevant concepts which help them to take a comprehensive and realistic view of the state of affairs and of their own role in relation to these. Besides, it calls for the necessary skills to use pertinent knowledge. Thus, managers at various levels must have requisite degrees of administrative and human relations skills. Administrative skill 'refers to the ability of the (managers) to think and act in terms of the total organizational system within which it operates— in terms of the organization as a system of people and physical objects, with its own image, structure, and process which functions as a complex problem-solving arrangement for the purpose of attaining particular objectives. The emphasis here is on understanding and acting according to the total organizational systems, rather than on the basis of the goals and needs of one's immediate work group only . . . . Administrative skills include such things as planning, programming and organizing work; assigning the right task to the right people; giving people the right amount of responsibility and authority; and coordinating the efforts and activities of different organizational members, levels and departments.<sup>25</sup> Human relations skill, on the other hand, 'refers to the ability to use pertinent knowledge and methods of working with people or through people. It includes an understanding of general

principles of human behaviour, particularly those principles which involve the regulation of interpersonal relations and human motivation, and skillful utilization of this understanding in day-to-day interaction with others in the work situation.'<sup>26</sup>

However, managers' motivation to adopt and use these integrating principles and concepts depends on their own background, conviction and attitudes, their confidence in subordinates and their perception of superiors' behaviour. If managers in a particular undertaking are convinced of the constructive aspects of human nature and creative role of intrinsic rewards, they are likely to have greater confidence in their subordinates; and to put these concepts into practice. However, the success in doing so would largely depend on the perceived behaviour of their own superiors in this regard.

#### **The Role of Management Education and Development**

Thus, the use of above-mentioned foreign concepts in India needs not only a change in the environment but also ability and motivation on the part of the managers concerned to put these into practice. Appropriate environment in this regard can be created by defining clearly the basic philosophy and objectives of the organization and accepting these concepts as an integral part of these. It would encourage managers at various levels to adapt themselves to the organizational needs. However, management education and development has to play a very important role in increasing ability and motivation on the part of managers to understand and use integrating principles. It would not only provide managerial competence to participants by imparting the appropriate background and knowledge of concepts, principles and practices of management, and various

skills necessary to use knowledge thus acquired, but also managerial attitudes which would 'enable one to look beyond his own narrow interests; inculcate a sense of social responsibility and a high standard of business ethics; and be more favourable to change and create a capacity for long-term thinking'.

In order to be effective management education and development must be based on the systems approach. Likert identifies four systems of management and their respective operative components like 'leadership, decision-making, communication, coordination, evaluation, supervision, compensation, organization structure, motivation, etc. His systems 1 and 2 are based on traditional organization theory and its assumptions, while systems 3 and 4 are based on

modern organization theory and its associated assumptions. Any management education and development programme aiming at better integration in an organisation must emphasize Likert's system 4 characteristics. The participants, however, must also be exposed to the conflicting points of view. 'This is intellectually stimulating and valuable and contributes to innovative thinking. When this is done, two conditions should prevail. First, it should be made clear to all who participate that the material is intended to stimulate thinking and discussion and that there is no intention that immediate, direct application will be made. Second, all those managers who are exposed to such stimulation should be given an opportunity, considered adequate by them to influence the character of the management systems of their own companies.'<sup>27</sup>

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# Solving Assembly Line Problems

Chander Bal\*

The Assembly line as a production system has been dominating the industrial scene since the turn of this century. It has been one of the prime movers of the rapid mechanisation of manufacturing processes and over the years has attained a fair amount of sophistication. In this paper the author presents 'a dynamic programming model' of the Assembly Line for solving Assembly Line balancing problems.

ASSEMBLY consists essentially of putting the component parts together. The sequence of assembly is, to a large extent, determined at the design stage. In a progressive organisation, the marketing and service departments' experience is utilised and evaluated at the design stage, in order to make the product readily serviceable. Assembly sequence is controlled by product design only to the extent that certain components such as gears in transmission, must be assembled before other components such as retainers, can be added. This indicates therefore, the existence of parts that are dependent, and parts independent or at least less dependent on the sequence.

Assembly lines must be designed in a manner which would permit a range in the productive output, in order to contend with the wide fluctuations in demand. Finished components from the manufacturing process or outside vendors, must be stored at the point of assembly, in quantities adequate for operation until the stock can be replenished. Some of the larger, difficult to store or cumbersome to handle

components must be delivered to the line at the point of assembly.

There are, therefore, two sets of constraints imposed on the assembly line, i.e. (1) the limitations imposed by the product design on the assembly sequence, and (2) the limitation imposed by the physical location of the feeder or sub-systems. The feeder systems cannot be readily relocated, without a prolonged shut down and interruption of productions. Assembly line planning must recognise these limitations.

Each component part which is added to the assembly constitutes a work task element which is finite regardless of the assembly sequence. This task of assembling each component can be evaluated in terms of time, and the work station assignment is the summation of the individual tasks allocated to the station. As in most work-study assignments, the assembly line evaluation must recognise the importance of skill and effort as well as the work place arrangements in meeting the time objectives. The sum of all the individual work tasks is the time required to process one complete unit.

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Line balancing has become an important problem for the line management of any pro-

duction organisation. Idle time included in the assembly represents extra cost of production. Insufficient time for proper execution of each task may result in a quality-deficient unit, requiring subsequent correction, at an added cost, or a loss of the production unit.

According to dynamic programming model presented here the assembly line is viewed as :

### Serial Line

Each unit is processed at the work-stations in a definite order and no two work-stations operate on the same unit simultaneously. Thus, the total assembly line is considered to be serial with no "feeder" or parallel sub-assembly lines.

### Precedence Relations

All restrictions on the order of execution of jobs may be expressed by precedence relations of the form: job "i" must precede job "J", for which the notation "i" < "J" is used.

### Cycle Time

The interval of time between the completion of successive units is a constant "T", called the cycle time. Thus each work station must be capable of completing its assigned jobs per unit within the time 'T'.

### Execution Times and Work Stations

Each elementary job is performed exactly once for each unit produced. The execution time of a job is definite, known, and independent of the work station at which it is performed and of the preceding or following jobs. In particular, it is assumed that any job can be assigned by any work station, provided the precedence relation are satisfied. The set of jobs assigned to a work station is the same for each unit produced, the execution time of the set is

the sum of the individual execution times and may not exceed the cycle time. Thus, it treats all work stations as interchangeable and all units produced as identical, and excludes consideration of set-up times.

A mathematical model can be constructed to represent the assembly line in this "serial" concept, as under :

1. A set of jobs characterised by  $J_1, J_2, J_3 \dots J_n$ .
2. Time to complete each task  $T_1, T_2, T_3 \dots T_n$ .
3. Cycle time = T
4. Partial ordering < expressing precedence relations among the jobs.

Some tasks may be executed in some order without prior execution of other jobs. These jobs may form a sequence as follows :

$$= J_{i_1}, J_{i_2}, J_{i_3} \dots \dots J_{i_n} (\delta)$$

Other existing job relationships may be expressed as sequence, the total thus combining sequences into sets. The jobs forming a sequence can be assigned to work stations, in a number which will produce a minimum number of work stations. The total assignment to any work station cannot exceed the cycle time T.

The cost of completing a sequence  $\delta = C\delta$ . If another task  $J_i$  can be added to set  $\delta$  and produce a feasible sequence  $\delta$ , then cost of new set = cost of previous set + incremental cost of performing the added task.

Through mathematical methods, this reasoning can be extended to other feasible sequences, and later to feasible sets. With feasible sets the cost relationship would include all jobs, hence  $C(J_1, J_2, \dots, J_n)$ . The assignment for  $\delta = (J_{i_1}, J_{i_2}, \dots, J_{i_n})$  will be optimal when  $C\delta = C(J_1, J_2, \dots, J_n)$ . From this relationship in an assembly line



problem, the general relationship can be derived as follows :

$$C(J_{i_1}, J_{i_2} \dots J_{i_p}) = C(J_{i_1}, J_{i_2} \dots J_{i_{p-1}}) + \Delta(C(J_{i_1}, J_{i_2}, \dots, J_{i_{p-1}})) \quad \text{tip} \quad )$$

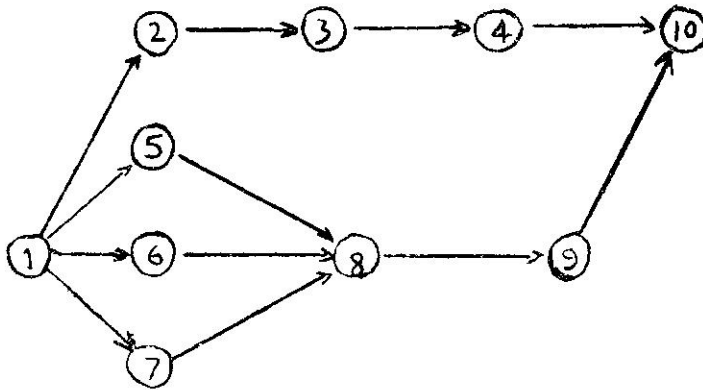
( 2 = P = N )

The above relationship states that the cost performing an assembly set is equal to the cost of assembly less the last set plus the incremental cost of adding the last set.

The dynamic programming model makes possible an exact solution of a balancing line problem, taking into account all possible arrangements of the job sequence, and minimising the cost associated with any feasible sequence. This model is useful for solution of

as reproduced in the following figure, where the theorem of "successive approximations" is applied to determine the number of feasible sets.

The theoretical derivation of feasible sets may be a necessity for a completely new problem. The feasible sets are known in a practical assembly line problem, having been established at the design stage of the product. The problem is then to derive a closely balanced line, with minimum of work station and idle time. Here the readers will draw a similarity between the network planning precedence and the partially ordered assembly line (see Figure). The net work planning problem could be handled by matrix solution as well as the



problems of limited size. A thirty-six job problem having thirteen-thousand possible sets of solution, was handled in twenty seconds on a computer. In order to apply this model to practical size problems, supplementary procedures have been developed for use with this model. These procedures involve the use of successive approximation and permit computer solution of a six hundred and twelve job-problems in twenty four minutes.

This procedure can also be demonstrated

computer. This precedence relationship in network planning is known and chartered prior to the analyses, whereas the partial ordering is introduced into the assembly line problem as an expedient to deal with computer capacity.

The observation leads to a belief that instead of discussing two separate techniques and two separate problems, we were really dealing with a general problem and a specific problem as outlined by the originators of network planning. The techniques outlined for network plan-

ning could then be employed for balancing line analysis where the precedence relationship is known. In a practical production problem, this relationship is established at the time of product design or at the time of process planning at the latest.

Conversely, the general model for the assembly line could be applied to solution of network planning problems where the precedence sequence is not established but where the relationship for calculating the sequence can be established, as for minimum cost, or shortest cycle duration.

The analogy between development and assembly line work is more readily understood if the task concept is considered. The task in development is the performance of a specific amount of original work, in a certain required sequence, which is restricted by availability of

information on the starting and limited by programme timing objectives on the completion end. It is also possible to visualise work performed concurrently in other areas, dependent upon the specific development task for completion. In the assembly line work the task becomes that of adding another component or other components to the unit at a given stage of completion.

### Conclusion

The model presented above for solving assembly line balancing problems is equally applicable to considerations of current manufacturing problems in particular and production problems in general. Understanding and judicious applications of this model to broad solutions may generate additional profits through reduced costs and higher productivity. ●

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## Heavy-duty Plunge Router

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# Problems of Steel Forging Industry in India

V. V. N. Somayajulu\*

For industrial planning and development, industry studies are often suggested to bring out its importance and specific development problems of the industry. This paper attempts to briefly review the development of steel forgings industry in India, bringing out the approximate optimum level of operation as well as structure of the steel forgings industry, development of public sector projects, demand pattern of steel forgings and development problems of the steel forgings industry in India. For planning and development of steel forgings industry, it is emphasized in this paper that there is need for collection of detailed data on economic variables and product multi-dimensions of steel forgings so that the techno-economic analysis is meaningful and fruitful to the industry and/or to the economy. An illustrative process analysis of steel forgings industry in India is attempted in the author's other works.<sup>1</sup>

**T**HE art of forging process may be defined<sup>1</sup> as the plastic deformation of metals and alloys into some predetermined size or shape generally at elevated temperatures. by a compressive force exerted by a hammer, press or upsetting machine. Parts produced in such a manner are called forgings. Depending on the requirements of size, shape, mechanical properties and many other product dimensions, different forging methods with different time requirements of activities in die shop, saw and shear, heat treatment, machining, finishing facilities, etc., are made available. All these facilities form part of and are ancillary to forging process.

A full-fledged commercial independent forge unit consists of all these ancillary shops so that it can produce forgings to the specifications of

customers' orders. They are in general large-scale units providing employment to hundreds of persons and producing illimitable range of forgings with varied product dimensions.

However, the age-old procedures of hand forging on an anvil are still followed by small units, especially for repairs and maintenance works of large units to upkeep latter's equipment. Some other forge shops are captive units of the large establishments, such as steel plants and heavy engineering plants, as their products require forgings of such captive forge shops. Next, there are many an unaccountable list of small household blacksmithy type forge units as ancillary shops to meet the requirements of local large establishments. Thus the levels of operation range from a small blacksmithy shop to the large independent commercial forge units.

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But, there are no reliable estimates of production statistics of all these levels of operation to analyse the economics of different levels of operation with respect to any optimum size.<sup>2</sup>

### Structure of the Industry in Private Sector with respect to Model Type Size as an Approximation to Optimum Size and Structure over States in India

While it is often not possible to discover the optimum size by factual investigation, the existence of a model type size associated with a large proportion of the total number of firms may be taken as a first approximation and as empirical evidence to identify the optimum size of a firm.<sup>3</sup> In what follows, the model type sizes are computed from the structure of firms distributed over plant capacity ranges. For this purpose, licensed capacities of the firms in private sector of steel forgings industry in India during the years 1963-1966 are taken and the structure with respect to model type size is examined.

Actual installed capacities of the firms are required to be taken for this purpose of analysis. Such data are not available from any source. Similar data for public sector units are also not available. The period, 1963-1966 is the latter half of the Third Five Year Plan period, during which this industry attained peak levels of production (implying capacity levels of production). For the period prior to 1963 and later to 1966, similar data are not available and it is also understood that steel forgings industry did not develop as much as in latter half of Third Plan as in any other period. Steel forgings industry was affected by recession in demand during 1967. For these reasons, it is assumed that the structure of the firms based on tonnage licensed capacities in private sector, as presented in Tables 1, 2 and

3 may provide an approximation to the structure of firms based on installed capacities. It implicitly assumes that the percentage of utilized to licensed capacities may serve as an approximation to the percentage of utilized to installed capacities. Percentage utilization of licensed capacities presented in Table 3 are under-estimates to the extent of divergence of installed to licensed capacities. These production/licensed capacities include those of captive capacities and of small scale units. The contribution of captive and/or small scale units to total intermediate demand of steel forgings is estimated as 65.46 per cent.<sup>4</sup>

While there is not much change in the structure of firms and of tonnage licensed from 1963-64 to 1964-65, there is quite a drastic change during the year 1966 as observed from respective percentages against tonnage capacity ranges in Table 1 and from the model sizes in Table 2. The negative quantities in Table 1 are due to either (i) revoking of the licences or (ii) actual reductions in the number of firms or (iii) increases in plant capacities leading to a shift of those firms from one capacity range to the succeeding capacity range over the years 1963-1966. While there is no evidence to justify the case (i) and (ii), the case (iii) can be deduced from Table 1 (especially columns (6) to (9)).

For Statewise analysis of the structure of licensed and utilised capacities, licensed tonnage and actual production are presented in Table 3 for an average of the calendar years 1964-1965. While there was an increase in the actual number of units and licensed tonnage in West Bengal, Maharashtra and Madras, there was no change in the number of units and in the licensed tonnage capacities of the steel forgings industry in the rest of States as observed from Table 3. Historically the concentration of

forging units in West Bengal was to meet the Railway's requirements. Maharashtra and Madras developed recently quality forging units to meet the requirements of automobiles, diesel engines, tractors, earthmoving machinery and other heavy engineering equipments.<sup>5</sup>

The actual production structure was closely similar to that of licensed capacities. In seven States the percentage utilization of licensed capacities was higher than that of all-India in private sector of steel forgings industry (61.38 per cent). The other three States, viz., Punjab, Rajasthan and Gujarat were far below the average percentage utilization of licensed capacities in private sector of Indian steel forgings.

#### **Development of Steel Forgings Industry Since the Inception of Five-Year Plans**

Prior to the First Five-Year Plan (1950-55) the forging industry was consisting of captive small-scale units and household units under the shadow of the major using industries of steel forgings. Such small ancillary shops continued to be unaccounted for difficulties of estimation of their contribution to the total industry. Though industrial programmes in general and steel plants in particular were launched during the Second Five-Year Plan (1955-60), steel forgings industry did not grow along with them. Tata Iron and Steel plants' (TISCO) yearly production of wheels, axles and tyres for railways from 1948 to 1962 remained stagnant around 21,000 tons. The Durgapur Steel Plant (DSP) started producing wheels, axles and tyres from 1962-63 onwards. The total production from these two plants rose to 32,000 tons in 1962-63; 52,000 tons in 1963-64; 60,000 tons in 1964-65 with a small fall to 58,000 tons in 1965-66.

Similarly, the railway sleepers production

remained stagnant around 7000 tons per annum during 1957-1960-61; rose to 16,000 tons in 1961-62; 32,000 tons in 1962-63; 41,000 tons in 1963-64; 68,000 tons in 1964-65; and to 69,000 tons in 1965-66<sup>6</sup>.

By the end of Third Plan, Indian Railway's demand for sleepers was as much as 75,000 tons per year. The original capacity of 60,000 tons per year of sleepers plant was expanded to 75,000 tons per year by 1967. Similarly, the wheel sets plant capacity of 57,000 tons per year at DSP is likely to expand to 93,000 tons per year. Thus it is only after the development of iron and steel plants and of railways that wheel sets and sleeper plants entered into production since Third Plan period. Though the wheel sets and sleepers are manufactured by the basic forging process, these have been treated as products of iron and steel industry in Indian official statistics (say in Annual Survey of Industries reports) but they should have been distinguished as production of forgings industry.<sup>7</sup>

#### **Growth of Private Sector in Steel Forging Industry**

In private sector, there were 28 firms licensed to produce 35,000 tons per year by 1960-61; 30 firms to produce 47,752 tons in 1961-62; 38 firms to produce 56,590 tons in 1963-64; 45 firms with a capacity of 1,30,424 tons per annum by 1966. Due to recession in demand during 1967, the licensed capacity and output of steel forgings industry were lowered to 83,740 tons and 40,500 tons respectively. During 1968, licensed capacity reached 1,00,800 tons and actual production 94,000 tons of 44 licensed firms in private sector. Utilization of licensed capacity was 48.36 per cent in 1967; 43.65 per cent in 1968; whereas it was 61.38 per cent in 1965.<sup>8</sup>

### Recent Public Sector Projects and their Features in Steel Forgings Industry

Foundry Forge Project (FFP) at Ranchi, Mining and Allied Machinery Corporation (MAMC) and a forge shop at Alloy Steel Project at Durgapur were launched during Third Plan period. But FFP may take up to 1975-76 to reach its capacity of 50,000 tons per year according to their estimates. MAMC forge shop could not reach its 8,000 tons per year capacity. ASP forge shop started production from 1966-67 onwards but has yet to attain its yearly capacity of 4000 tons of finished forgings. These three plants are expected to reach a potential capacity of 62,000 tons per year by 1975-76 to meet the demand of steel plants, heavy machine building plants (HMBP) and Heavy Machine Tools Plant (HMTP) but the actual production has not yet reached even one tenth of the potential capacity.<sup>9</sup>

Two more projects, one at Hardwar and another at Wardha are proposed to be set up, during Fourth Plan period, with capacities of 15,000 tons per year and 8,300 tons per year respectively to meet the demand of heavy electricals and engineering industries.<sup>10</sup>

If these two projects are also realised, there will be a potential capacity of 85,300 tons per year in public sector by 1975-76. Taking both public and private sectors together, production in steel forgings industry might be of order of 50,000 tons per year, while the demand for iron and steel forgings by 1973-74 is estimated as 2.75 lakh tons.<sup>11</sup>

### Demand Pattern of Iron and Steel Forgings

Whenever production falls short of the demand, any country has to draw upon imports but at least to pay for those imports, it has to raise its exports. For this, we may examine the

nature of published import and export statistics.

The statistics of imports and exports of iron and steel castings and forgings are published in "Monthly statistics of Foreign Trade of India" from 1957 onwards, while those of iron and steel forgings are distinguished in the same reports from 1966 onwards. The imports and exports of iron and steel forgings for the period 1957 through 1965 are required to be estimated by apportionment on the basis of their composition of forgings and castings in 1966.

A look at the estimated and published imports and exports of iron and steel forgings did not indicate any trend for any period covering second plan, third plan and latter annual plan periods. Exports are relatively negligible compared to imports or to total supply, while re-exports are absolutely negligible.

As total demand is equivalent to total supply, we may derive the total intermediate demand = indigenous production + imports - exports = supply for internal demand for iron and steel forgings. Changes in stocks are assumed to be zero. The statistics of indigenous production of iron and steel forgings are obtained from Annual Survey of industries (ASI) reports.<sup>12</sup> Each using industry's consumption of steel forgings as material inputs are also obtained from ASI reports. To know the demand pattern using industrywise, percentage shares of 13 using industry groups' consumption demand out of the total intermediate demand during 1960-1964 are computed and presented in Table 4. As said earlier, this period was characterized by the growth of steel forgings industry in India.

The major consumers of iron and steel forgings are (1) Motor vehicles, (2) Earthmov-

ing equipment, (3) Diesel engines, (4) Ship-building and repairs and (5) All non-electrical machinery goods like tractors, machine tools, pumps, compressors etc. The value percentages presented in Table 4 are approximately the same as those of tonnage consumption of iron and steel forgings (not presented here for the same reason). A few limitations implicit in the above analysis of demand pattern may also be noted as follows.

To the extent that the estimates of total intermediate demand of iron and steel forgings do not cover the contribution of small scale and captive forge shops, they are under-estimates and the percentage share of using industries presented in Table 4 are over-estimates. No statistics of production of small scale and captive forge shops are available from any source. The percentages of indigenous production of large units to the estimated intermediate demand of iron and steel forgings are 4.78 per cent in 1960, 4.38 per cent in 1961, 13.24 per cent in 1962, 37.27 per cent in 1963 and 36.83 per cent in 1964, which may also be considered as over-estimates.

The demand pattern presented in Table 4 does not contain Railway's requirements of wheel sets and sleepers as in ASI reports the wheel sets and sleepers were shown as products of iron and steel industry. This may also under-estimate the total intermediate demand of iron and steel forgings and over-estimate the percentage share of using industries presented in Table 4.

However the relative ranks of the users of the iron and steel forgings may not be different from that depicted by the demand pattern presented in Table 4. Railways would dominate over all other users when their require-

ments of wheel-sets and sleepers are also taken into account.<sup>13</sup>

### Development Problems of Steel Forgings Industry in India

*1. Nature of market imperfections and project cost estimates :* When project cost estimates have been prepared the usual practice is to make financial projections for a particular tonnage capacity of the project by the prospective entrepreneurs. The public sector projects are expected to produce heavy forgings of 3 ton piece weight and above as they operate on huge capital goods like heavy presses, upsetters and high power hammers. Similar equipments in the private sector projects can turn out a maximum piece weight of 3 tons only.

It is also important to know the demand potentialities, existing capacities, actual production with respect to many product dimensions of the variety of forgings and the possible range of prices and cost or input structures for the discrete ranges of product dimensions.<sup>14</sup>

The nature of the market for numerous types of forgings is imperfect because of price discriminations of all kinds, e.g., charging different prices for a homogeneous commodity for different customers at the same time and place and for different times and places. The prices for homogeneous goods are not uniform between firms of steel forgings industry for all reasons of imperfections in factor market and in product markets. As the very nature of steel forging process demands complete specifications of various product dimensions on each and every order of the customer, it is imperative for producers to have knowledge of the range of prices and of cost on input structures for different ranges of product dimensions, so that their project cost estimates will be reliable.



Nomenclatures of iron and steel forgings merely indicate the broad shape of the parts but won't represent different quantitative and qualitative features of product dimensions being specified by customers. Nor the nomenclatures are meaningful for any project cost estimates. In fact the same nomenclature of a forging process can have varied product dimensions which would influence the cost structures of a firm. On the other hand, autos and trucks contain over 250 separate types of forgings. Aircrafts require about 450 types of structural forgings (exclusive of the hundreds of forged parts comprising the engine). Heavy tanks in Defence contain over 550 different types of forgings.<sup>15</sup> Thus the numerous list of types of forgings cannot be taken as finite but some discrete and finite product groups of them are required to be formed for a given technology, with respect to homogeneity of product dimensions.<sup>16</sup>

*Growth of unutilized licensed capacities and nature published demand and supply estimates of steel forgings in India*

Growth of licensed capacity in steel forgings industry has been so fast that the main problem facing the industry today is unutilization of the licensed capacities. The captive capacities in production are estimated to the tune of 32,000 tonnes and capacities for which letters of intent of licences have been issued to the order of 2,58,000 tonnes. It has become all the more imperative to take cognizance of this situation while reviewing the present status and future programmes of the industry especially with special reference to product dimensions and to users of steel forgings.

The published demand estimates by different organizations are very aggregative. No extensive market survey is conducted on scientific

lines to specify the demand pattern of product dimensions of steel forgings required by different using industries. Targets are published many a time for castings and forgings together but hardly there is any publication bringing out the intricate developments of steel forgings industry in India, which would serve for entrepreneurs and research workers. Indigenous production, imports and exports statistics are also very aggregative. Steel forgings industry is not shown as a separate industry group in ASI reports. For this reason, it is difficult to get cost or input structures of steel forgings industry from ASI reports, which are the main source of information for construction of input output tables.

**Summary and Main Findings of this Study**

The forging process is as old as antiquity and as new as tomorrow, developing its level of operation in India from household blacksmithy to large scale manufacturing. The model type optimum size of iron and steel forgings industry in private sector is around 1551 tons per year by 1966. There is a drastic change in the structure of firms with respect to tonnage licensed capacities in private sector from 1963 to 1966. West Bengal, Maharashtra and Madras dominate the structure of iron and steel forgings industry in India.

Development of this industry started after the steel mills and railways were established in Indian industry. The public sector projects are still in infant stage even during third plan and later period, while private sector improved the growth of this industry especially around 1964. Imports were phenomenally high while exports were negligible during 1957-69. Simultaneously, unutilized licensed capacities of this industry were growing especially since 1966-67 due to general recession in demand.

TABLE I  
Structure of the firms licensed upto 1963-64, during 1964-65 (average of two years) and 1966 (calendar year) in private sector, according to their licensed capacity ranges

Plant capacity ranges in tons per year	Upto 1963-64 (financial year)			During 1964-65			During 1966			Upto 1966-65			Upto 1966 Dec.				
	No. of units	Per-centage (2) to total	Total tonnage licensed	No. of units licensed	Per-centage (4) to total tonnage	Tonnage capacity licensed	No. of units	Per-centage of capacity licensed	Tonnage capacity licensed	Per-centage of capacity under	No. of units	Per-centage of capacity under	Tonnage capacity under	Per-centage of capacity under	No. of units	Per-centage of capacity under	Tonnage capacity under
1	2	3	4	5	6	7	8	9	10	11	12	13					
0-1000	21	55	9638	17.03	5	2920	-15	-6263	57	17.01	23	4.83					
1000-2000	13	35	20312	35.90	-2	-2500	2	4000	25	24.14	27	16.79					
2000-5000	2	5	8400	14.84	3	10800	13	41672	11	26.01	38	46.61					
5000-12000	2	5	18240	32.23	1	6000	3	17185	7	32.84	12	31.77					
Total	38	100	56590	100.00	7	17220	3	56614	100	100.00	100	100.00					

TABLE 3  
Statewise structure of licensed and utilised licensed capacities of firms in private sector

Year	1963-64 (March ending)										1964-65 (Average of two years)		
	No. of units	Per-centage (2)	Licensed tonnage capacity	Per-centage (4)	No. of units	Per-centage (6)	Licensed tonnage capacity	Per-centage (8)	Actual tonnage production	Per-centage (10)	% of utilised to licensed capacity (10)/(8)		
1	2	3	4	5	6	7	8	9	10	11	12		
West Bengal	16	42	37260	65.84	19	42	41920	56.79	26304	58.06	62.75		
Maharashtra	5	13	2618	4.64	7	16	9078	12.30	6393	14.11	70.42		
Madras	4	11	3500	6.18	5	11	7600	10.30	4732	10.44	62.26		
Uttar Pradesh	5	13	5880	10.39	5	11	5880	7.97	3828	8.45	65.10		
Delhi	2	5	1500	2.65	2	4	1500	2.03	984	2.17	65.60		
E. Punjab	3	8	2040	3.60	3	7	2040	2.76	333	0.74	16.32		
Andhra Pradesh	1	2.67	1092	1.93	1	2.25	1092	1.48	851	1.88	77.93		
Kerala	1	2.67	900	1.59	1	2.25	900	1.22	787	1.74	87.44		
Rajasthan	1	2.66	1800	3.18	1	2.25	1800	2.44	371	0.81	20.61		
Gujarat	1	2.66	1800	3.18	1	2.25	2000	2.71	723	1.60	36.15		
All India Total	38	100.00	56590	100.00	45	100.00	73810	100.00	45306	100.00	61.38		

Sources to prepare Tables 1, 2 and 3 are both official and non-official data collected from (1) the annual reports of (a) Directorate General of Technical Development (DGTD), New Delhi and of (b) the Association of Indian Drop Forging and Stamping Industries, Bombay. Identification of the figures with the sources is not possible as the tables are processed for uniformity and presentation purposes from the original data. The modal sizes presented in Table 2 are based on a more detailed distribution. (—) values refer to reduction in capacity.

TABLE 2

**Model Sizes and Mean Sizes of plant capacity (licensed) in private sector upto 1963-64****1964-65 and upto 1966***(all in tons per year)**Upto 1963-64**Upto 1964-65**Upto 1966*

	<i>Upto 1963-64</i>	<i>Upto 1964-65</i>	<i>Upto 1966</i>
(a) Model size	334	396	1551
(b) Mean size	1489	1640	2717
(c) Mean-Mode	1155	1244	1166

TABLE 4

**Using industrywise demand pattern of steel forgings over 1960-64***(All in percentages of rupee values consumed)*

<i>Rank</i>	<i>Using Industry</i>	<i>Average Percentage during 1960-1964</i>	<i>Ranges of Percentage During 1960-1964</i>
1	2	3	4
1.	Motor vehicles	46.26	40.85 to 50.16
2.	Earthmoving equipment	16.34	12.91 to 24.48
3.	Diesel engines	14.94	10.59 to 18.36
4.	Others of non-electrical machinery	9.54	8.28 to 11.27
5.	Shipbuilding and repairs	5.28	1.40 to 9.75
6.	Machine tools	1.91	0.00 to 5.14
7.	Power driven pumps, air and gas compressors, vacuum pumps, refrigeration plants, speed reduction units	1.86	0.52 to 3.10
8.	Sugar and tea machinery	1.67	0.00 to 2.40
9.	Textile and jute machinery	1.07	0.01 to 3.69
10.	Agricultural implements	0.48	0.00 to 0.99
11.	Conveying equipment like buckets, elevators, strip hoists, cranes etc.	0.43	0.00 to 0.90
12.	Tractors, harvestors etc.	0.16	0.00 to 0.74
13.	Paper M/c, construction M/c and oil mill machinery	0.06	0.00 to 0.19
Total		100.00	

to the urban areas and buy their requirements, the marketing organisations could not probably afford to spend a lot of money in penetration of the rural area.

The total national market estimated for 1970-71 (at 1970-71 prices) by the Indian Institute of Public Opinion was Rs. 30,550 crores which is expected to increase to Rs. 42,300 crores in 1975-76 and Rs. 58,000 crores in 1980-81. The share of the rural and urban market was estimated to be in the ratio of 73:27 in 1970-71; 72:28 in 1975-76 and 71:29 in 1980-81. A slight decline in the share of rural income is shown in the years to come which will take place because of the expected high rate of urbanisation.

Findings of National Sample Survey revealed that the expenditure on non-food items are 30 and 40 percent for the rural and urban areas respectively. The non-food markets for rural and urban areas should look like this:

	Non-food Markets (In Rupee Crores)		
	<u>1970-71</u>	<u>1975-76</u>	<u>1980-81</u>
Rural	6,690	9,150	12,480
Urban	3,300	4,720	6,800
<b>Total</b>	<b>9,990</b>	<b>13,870</b>	<b>19,280</b>

(Source: Estimates based on IIPPO's figures reported above)

Obviously the rural market is still nearly double the size of the urban market.

Geographical distribution of our Indian market comprising of 547 million people is very peculiar. Against 20% population living in 2,921 urban locations the rural sector with

80% of the population is spread in more than 5 lakh villages. Within the urban population, 25% is in the 9 metropolitan cities only and less than 5% of towns account for over 52% population. Among the villages, 17% contain nearly 56% of the population.

While this large market looks extremely attractive superficially, the marketing organisations must take into account the problems and constraints that exist in servicing them. Some of the problems and constraints are:

### Problems of Marketing

After knowing the size, potential and nature of Indian markets which provide vast opportunities, the question arises, how to reach these millions. Railways and roads are the means of transportation. Their progress in the last few years is given below:

	Railway Route Length (Million Kilometres)		
	<u>1960-61</u>	<u>1969-70</u>	<u>Increase</u>
	57	60	3
	Roads (Million Kilometres)		
	<u>1961</u>	<u>1971</u>	<u>Increase Planned 1974-75</u>
Surfaced	236	349	113
Unsurfaced	473	686	213
<b>Total</b>	<b>709</b>	<b>1,035</b>	<b>326</b>

The demand is widely dispersed over the entire country with road links and railways either non-existent or at best poor. This naturally makes current assessment of the demand also rather sketchy or insufficient.

### Communication Constraints

With 24% literates in rural and 52% in urban areas communication with all the people of India becomes practically an unsurmountable problem. Direct media of press, film and radio has its limitations in coverage and reach to people for effectiveness. With few cinemas dissemination of knowledge can possibly be best done by broadcasts through radio. Commercial programmes are restricted to 18 stations only. Vividh Bharati programmes are broadcast only over medium wave with maximum reach of 112 kilometres. Their message can hardly reach the small towns and villages. Marketers in India will therefore be forced to use the secondary media at great expense to reach the rural area if they want to market products.

### Linguistic Barriers

With 16 major languages spoken in our country it becomes expensive for the marketing companies to reach the total population of the country.

### Regional Differences

Demand for products varies for people living in different areas with different climatic conditions, occupations, level of literacy, outlook towards life and living and exposure to modern sophisticated things. The income difference between the wealthy few and common masses also create differences in the demand. The degree and effect of the Green Revolution on generating additional incomes varies widely in different States.

### Current Year

Both agricultural and industrial sectors recorded poor performance affecting adversely

the growth of the economy. Recent spiralling of prices of essential commodities have caused serious concern particularly due to drought in many parts of the country. The consumer has been left with hardly any disposable income for non-essential goods. However the outlook for future seems to be quite optimistic. Government is keen on increasing industrial production and checking the inflationary trends of essential commodities. Various development programmes which are in progress should generate additional employment and thus additional disposable income.

There has been marked change in the marketing policy of almost all consumer goods companies. Companies like Britannia Biscuits, Hindustan Lever, India Tobacco and Union Carbide are reaching rural areas through vans to make their products available to rural population at their door-steps. These efforts are being intensified particularly after an extremely encouraging performance in the field of agricultural production during the recent years. The Green Revolution in India has far-reaching marketing implications. Generation of substantial additional incomes in the agricultural sector has made much more money available to the rural population than ever before. This has obviously led to more sales of bicycles and terylene shirts. We should however keep in mind the fact that the pattern of consumption cannot be correlated to income directly. The fact remains that the growth in radios has been much faster than in bicycles.

### Progress

While various constraints have been mentioned above it is heartening to note that all efforts are being made by the Government to remove these constraints. Railways and roads

taking the rural areas to urban centres are opening out every year and all steps are being taken to connect feeder markets and towns to the immediate surrounding areas for transportation of food grains and raw materials. The marketers in India should take full advantage of these roads to transfer their goods from the feeder markets to the rural areas.

The growth of literacy in rural areas is becoming evident. The proportion of illiterates to literates in these areas improved from 3.1:1 in 1961 to 2.5:1 in 1971. School enrolment of children of the age group of 4 to 11 years has also gone up from 62% in 1961 to 78% in 1971.

There is a definite change in the outlook of farmers who have accepted new concepts like High Yielding Variety Farming, chemical fertilisers, pesticides and tractors.

Facilities of banking are being extended to more and more areas in the rural areas. The total number of branches of 14 major commercial banks went up from 8,262 in June 1969 to 13,620 in June 1972. While this increase is 65%, increase in the case of rural areas was 188%. As regards deposit mobilisation the ratio of rural deposits to the total with banks has gone up to 7% in May 1971 from 1.2% in December 1961.

#### Future

Indian Institute of Public Opinion has esti-

imated that additional rural income to the extent of Rs. 1,500 crores representing half the rural additional income could be available for non-food items in 1974/75. The Institute further added that if these incomes are not absorbed in non-traditional goods it would be spent on traditional items of rural consumption such as ornaments and weddings. It is upto industries and the marketing organisations to motivate the rural population to buy modern goods and services by disseminating knowledge and benefits of these. They must also make the products and service available at the door-steps in the rural areas.

The approach to the rural marketing has to be selective and not mere extension of products available to urban consumers. There is a need to undertake studies to find out the exact requirements of the rural consumer and modify products accordingly.

Initial entry may be difficult and not self-supporting as is evident from the experience of about 13 large companies who practice rural marketing by use of vans. The operations are expensive today but should pay high dividend later when the product is suitable and accepted for mass consumption. Competition is increasing slowly in our country and the manufacturers are finding themselves squeezed in the urban market. Earlier a marketing company captures a rural market, better it will be for the industry and the country. ●

## Record Sale of Farm Machines

Sales of British-made farm machines to other countries reached a record £ 130,000,000 during the first six months of 1973. Tractors, tractor parts and spares accounted for the £ 8,000,000 increase over the same period in 1972.

The agricultural engineering industry sold £ 233,000,000 worth of products overseas in 1972, making it Britain's sixth largest exporter.

—British Information

# On-the-Job Training

## —Some Approaches and Problems

A. P. Saxena\*

Among other things, two fundamental questions must be asked while evolving an On-the-Job Training Scheme : (i) What should be the approach to make on-the-Job training a meaningful instrument of training? (ii) What can be the approach of a Training Director in an organisation to insure that on-the-job training really becomes an inherent process of development? Again, if on-the-job training is as continuing throughout the working span of an individual's capability? And if on-the-job training is inherent, what are the other supporting premises? In this article, the author attempts to provide meaningful answers to these basic questions on the basis of his vast experience in the field.

ON-THE-JOB training as an instrument for improved performance and change is being increasingly discussed. With growing appreciation of training as a medium for promoting organizational effectiveness, on-the-job training is being considered as an important part of the process of training and development. Yet it is not infrequent to note that the concept, and some of the inherent problems of on-the-job training are not often adequately appreciated. In fact an impression is sometimes created as if on-the-job training as an external instrument, could be applied in isolation as a training strategy. This and similar impressions tend to create difficulties in an appreciation of the role and purpose of on-the-job training.

First and foremost it needs to be appreciated that on-the-job training is an almost continuing, inherent process during any span of job performance. In a way it permeates continuously in a tangible and an intangible form in any learning or training situation. It is a matter of detail if the training situation will involve training directed towards knowledge, skills or attitudes. Viewed in this context it becomes clear that on-the-job training can be a powerful instrument for employee development and thus, organizational development.

### Job and the Individual

A few questions at this stage appear necessary. If on-the-job training is perceived as continuing throughout the working span of an individual, does it amount to a simple subtractive variance between requirements of the job

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and the individual's capability? Frequently, on-the-job training is blandly equated as training *needed* by an employee, which assumption is obviously based on the gap between the 'job' and the 'individual'. Again, if on-the-job training is inherent what are the other supporting premises? The explanation can be somewhat along the following lines. Man as an intelligent, rational homo sapiens works and performs tasks needing a mix of knowledge, skills and attitudes. He needs to act and interact with individuals and groups. In this dynamic work process certain imbalances in the *available* and *required* inputs for a job or a task, are thrown up. These imbalances point toward the need for training. A part at least of this training can be induced through on-the-job training so that it, in essence, becomes an external intervention leading to improved job performance. As an extension of this elaboration can it therefore be stated that on-the-job training can be formally introduced and a claim made that it is possible to plan for on-the-job training *per se* in an organization.

At least a part of the issues in the conceptual understanding of on-the-job training will become clear if the two basic parameters of on-the-job training, namely, the 'job' and the 'individual' are understood. In this context there can be a mix of at least three alternative situations. Firstly, the job requirements may be clearly more or exceed the individual's background pointing toward a situation where on-the-job training becomes a 'must'. In the next variation which may be something like a perfect equilibrium, the job requirement may match the individual's background. In this somewhat ideal situation, on-the-job training can only be conceived as a desirable exercise for further improvement of performance because there is always room for improvement and

efficiency. In the third parametric variation, the individual's background may be clearly far more than the stipulated or desirable job requirements. In this situation, on-the-job training becomes somewhat secondary and a proper approach may be to resort to job rotation or job enlargement. It is interesting to mention that this variation may be a consequence of 'over-training' also.

### The Boundaries/Levels

It is also important to evaluate the environment of the individual beyond the domain of his job. This analysis will indicate the boundaries of on-the-job training vis-a-vis the individual for whom on-the-job training is being evolved. Here three distinct levels emerge involving the interactive role of the individual. These are as under:

- (a) Individual level: In this level the boundary is the individual's interaction with his 'boss' which in a way indicates an individual to individual level.
- (b) Individual/Group Level: In this category, the individual interacts with groups which may include his superiors, his peers and his subordinates. The group level facing the individual can thus consist of three varying patterns establishing the boundary of interaction.
- (c) Group Level: Here the individual's boundary is the organization at large including its various component functions which demarcate the boundary as far as this level is concerned.

The three levels indicated become crucial determinants for an appreciation of the environment of on-the-job training and the individual. In a way they can be even described as stimulus centres or sources. It is difficult to stipulate



the relative priority or importance of the three different levels. It may depend on the basic make-up and the stock of knowledge, skills and attitudes, with which an individual faces the three levels. It may even be a dynamic situation so that at a point of time during an individual's job span a particular level may become critical or over-riding. In fact more than one level at a point of time, could become a critical factor for purposes of on-the-job training. Additionally the response secured by the individual from the three levels during interaction may also determine the validity of on-the-job training. To illustrate, in one situation the 'boss' and the organization may feel that the individual is well suited for his tasks thus de-emphasizing the requirement for any fresh training input. In another situation the boss, and because of him largely the organization, may feel differently whether the external intervention of training is called for, and if so, to what extent and detail.

### Level Constraints

The boundaries of on-the-job training will be incomplete without a reference to the inherent constraints implicit in this approach. The individual level is clearly constrained by the capabilities of the donor as far as the individual is concerned. The concomitant factor is the limitation of receptivity and assimilation of the recipient. The donor-recipient axis is again further dependent on the components of knowledge, skills or attitudes that may constitute the training mix. The donor as an individual worker, supervisor or manager may be an excellent performer but his ability to train via on-the-job training may be almost poor. Conversely the donor may be an outstanding individual trainer but the limitations of the recipient's background may make the training

incoherent and ineffective. These are common situations in organizations which a perceptive 'trainer' can always identify. The final constraining factor is the larger human factor or the human relations factor which in a way holds the key to the interaction at the three levels mentioned earlier. An individual's ability, or lack of it, to adjust himself to possible situations arising out of the three levels may well indicate the potential of on-the-job training. According to more than one authority, we as individuals tend to like subordinates but find it difficult to work with our peers. Occasionally, the dimensions of relationships with the boss can get entangled with a host of intangible attitudinal factors. While a detailed discussion of these matters is beyond the scope of discussion here, it is worth realising the determining influence of the constraining factors as far as the boundaries of on-the-job training are concerned.

### Some Limitations

At this stage one can visualize the limitations and the criticism of on-the-job training. It is often stated that by merely relying on on-the-job training it may become impossible to determine the wider training needs of an individual. Overconcern and excessive faith in on-the-job training may even lead to a neglect of formal training, which may be necessary for specific 'needs'. It is also argued that eventually at the micro level, on-the-job training depends on the superior, his knowledge, skills and attitudes and his interest and faith in training. In case he lacks faith in training and thereby negativates the implications of on-the-job training, very little can be done. On the other hand, too much of looking up to the superior may create such a situation that may well lead to paralleling the boss with the organization, directly or indirectly. On-the-job training may in these situations

produce 'stereo-types' or even 'elites'. Is it because on-the-job training is imitative and has eventually a very limited level of achievement? These and many other observations on the limitations of on-the-job training provoke another question. Can we plan on-the-job training? This approach in a way means as if it is possible to generate an ideal mix or a perfect amalgam of the three boundary levels indicated earlier. This may well nigh be an impossible task. These criticisms notwithstanding, we can certainly manipulate on-the-job training to the extent possible or even supplement it by other training or devices. For example, job placement and job rotation can be very powerful support to any on-the-job effort.

### Conclusions

What then should be the approach to make on-the-job training a meaningful instrument of training? What can be the approach of a Training Director in an organization to ensure that on-the-job training really becomes an inherent process of development? In terms of training responsibilities in the organization as a whole, the Training Director will have to be an astute observer before he can identify and appraise the on-the-job training patterns. There are certain limitations in terms of the three boundary levels mentioned earlier. Obviously, he cannot go to individuals at the top who may not be useful party to the two-way dialogue. But may be, a Training Director occasionally has to intervene if he conceives on-the-job training as part of the development process initially originating at the individual

level in the organization. But the task of the Training Director again gets limited because of the absence of measurement yardsticks or criteria concerning on-the-job training. The yearly performance report of an individual in any organization can at best provide a partial answer. If an annual report rates an individual as a "good worker" or "outstanding worker", how far is the reported performance a function of on-the-job training? Or similarly, how far is a bad performance report indicative of lack of on-the-job training. Finally, how far can the Training Director initiate consequential measures that may appear necessary after an analysis of performance reports in an organization. The entire fabric of inter-functional relationships and dependencies may as well see the Training Director in a corner where he is precluded from exercising any influence on the post-performance results as viewed in the light of on-the-job training. The truth of the entire matter perhaps lies entangled in the environment of the organization and the training process. If on-the-job training is a continuing process, may be the final arbiter is the individual who alone can testify the extent of lasting influence of on-the-job training. But yet in the background of increasing size and complexity of organizations and the stress on timely achievement of goals, on-the-job training needs to be studied, pursued and even monitored. It cannot be left to the level of individuals. It is indeed complex but it is so because adult learning is itself a complex phenomena. An analysis of the concept and the problems is the only surest answer to an understanding of the potential, and role of on-the-job training. ●

# Relating Learning Theory to Behavioural Change in Organisations

Thomas H. Patten\*

The academic study of learning theory has concerned itself historically more with the learning of lower animals than with how man learns. Consequently, managers of training and development in industrial and other work organisations have benefited very little from such studies: and the theoretical base from which they drew their insights on how adults learn was never very clear or well articulated. The result is that we probably know more about maze-bright rats than organizational-bright humans or skill-bright tradesmen. But instead of bemoaning the knowledge gap, the author discusses in very able manner some key questions in learning theory to behaviour change in organizations and suggests a position on the subject.

LET us begin by stating that learning cannot be observed directly. This is part of the reason why training directors have had trouble getting their minds around the concept of learning.

Learning can be *observed indirectly* only before or after behaviour under controlled conditions is shown. Therefore, the mechanisms and results of learning can be described only by subsequent inference from observed facts.

The problem is complicated further. Many different kinds of inferences will adequately explain various parts of the observed facts. One composite of inferences will explain all the facts. For these reasons, considerable disagreement exists regarding the exact nature

of the learning process. Yet learning is precisely what training and development is all about.

Training exists to bring about learning on the part of the trainee. Training is an overt process, a sequence of experiences, a related series of opportunities to learn, in which the trainee is exposed to certain materials or events. The trainee's behaviour is supposed to be modified by means of this process so that after it is completed, he behaves differently from the way he behaved before training.

Learning is, by contrast, a process that takes place "within" the trainee. Learning may be the result of the application of the training. Or it may be the result of the occurrence of those conditions that take place outside of a formal training programme, such as maturation, fatigue, or habituation. Our efforts to assess learning are often confounded by the occurrence of such non-controlled factors.

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The only way we can know that learning has occurred is by detecting consistent differences in trainee behaviour at two different times. This consistent change in behaviour is what is defined as "learning having occurred" between the two measured samples of behaviour.

Learning thus is manifested in changes in behaviour. And behaviour in a work organization can be defined as the response of the individual to his environment. For example, given a certain set of circumstances, the trainee responds to them in some patterned way. In other words he behaves.

Training is a process by which the training and development specialist expects to bring about a change in the trainee's response to a given environment or set of circumstances. When such a change has occurred, we infer learning has taken place. The training and development specialist thus has the task of determining whether learning took place and measuring and reporting on how much was learned. This task is what requires him to examine the total context of learning and to consider such prior, ancillary, and subsequent matters as: what is the training or development need? what content is needed? What methods should be used? How can the training best be done administratively? and, finally, how can it be evaluated?

### Learning Theories

Learning theories can be categorized into two major families: stimulus-response (or S-R) theories and cognitive theories, although not all theories belong to these two families.<sup>2</sup> The S-R theories include those of such persons as Edward L. Thorndike, Ivan Pavlov, Edwin R. Guthrie, B.F. Skinner, and Clark L. Hull. The cognitive theories include those of Edward

C. Tolman and the classical gestalt psychologists such as Max Wertheimer, Wolfgang Kohler, and Kurt Koffka. Not easily classified in either of these two families are the theories of functionalism, psychodynamics, and the probabilistic theories of the model builders.

This is not the place to elaborate on the details of all these theories because such has been done well elsewhere.<sup>3</sup> Also, training and development practitioners probably are more interested in the broad significance of these theories than the niceties of scientific distinctions. Accordingly, I proceed to examine how S-R theorists tend to differ from cognitive theorists.

First, ever since leading behaviourists promulgated the theory that thinking was merely the carrying out of subvocal speech movements, S-R theorists have preferred to find response or movement intermediaries to serve as integrators of behaviour sequences. For example, S-R theorists tend to believe that some kind of chained muscular responses, linked perhaps by fractional goal responses, keep a rat running to a distant food box. On the other hand, the cognitive theorist more freely infers central brain processes, such as memories or expectations, are integrators of goal-seeking behaviour. The differences in perspective survive in this case because both kinds of theorists depend upon inferences drawn from observed behaviour; and the inferences cannot be directly verified, as I previously stated.

Second, S-R theorists and cognitive theorists differ in their concepts of what is learned. S-R theorists believe people learn "habits" whereas cognitive experts believe people learn cognitive structures. The S-R theorist's view appeals to common sense: we believe we learn skills by practice; what we learn are *responses*

The cognitive theorist's view is we learn *facts*. Inasmuch as people also learn how to handle the non-habitual, the cognitive theorist feels comfortable that his inferences from behaviour are supportable. I come back to this idea when I discuss problem-solving learning.

Third, S-R theorists believe that a novel problem is solved by the learner's assembling his habits from the past appropriate to the problem and applying them (or by a process of trial and error, if there is no past to draw upon). The cognitive theorist believes that perceptual "insight" into the essential relationships involved solves the problem.<sup>4</sup>

According to the S-R theorist, an effective training effort must perform the basic training functions. They are: (1) stimulus generation, (2) stimulus presentation to the trainee, (3) response acceptance, (4) response comparison, and (5) feedback presentation to the trainee. When these functions are adequately performed, the conditions required for learning to occur are satisfied. What stimuli to present, responses to require, and feedback to give are determined by the training objectives set. The total training effort is identified by first determining the behavioural requirements of the job. From these requirements are subtracted the capabilities already possessed by the trainees prior to training. Some estimates of the trainees' motivation are also factored in. Finally, the effectiveness of the training is evaluated by an achievement test; and the efficiency of the training effort is determined by financial criteria.<sup>5</sup>

The cognitive theorist would probably accept the same general mode of evaluation but devise achievement tests of cognitive structures rather than of behaviourally demonstrable skills. He would probably be more

interested in what is in the trainee's head and subsequently verbalized than in other kinds of displays of the trainee's behaviour.

### Hierarchy of Learning

There are other issues in learning theory that lie outside of the conflict between stimulus-response and cognitive theory. But these issues are more germane to recondite aspects of learning than to effecting behavioural change in work organizations. Hence, I do not elaborate on them here. On the other hand, I do want to refer to a relatively new and controversial model of eight types of learning set forth by Robert Gagne because I believe it is a helpful way of viewing the hierarchy of learning from the most simple or elemental to the most complex.

Figure 1 shows the hierarchical model and explains it to some extent.

In this figure an ordering is provided of learning ranges from relatively simple signal and stimulus response learning to complex problem solving. Increasing complexity is shown to reside not so much in what is learned as in the nature of what is presumed to have existed in order for various types of learning to occur. Thus, increasing complexity is seen to reside in what has to be preavailable in order for various types of subsequent learning to occur rather than in what is to be learned.<sup>6</sup>

The main purpose underlying Figure 1 is to present the idea—and I want to emphasize it is a controversial one—that the more complex forms of learning depend upon processes which have been previously acquired in the simpler forms in a hierarchical fashion. Thus, as one proceeds to observe more and more complex forms of learning, he is led to search for vari-

Fig. 1

## HIERARCHY OF HUMAN LEARNING

1. Signal learning	Individual learns to make a general <i>diffuse</i> response to a signal. (Pavlov's conditioned response)
2. Stimulus- Response (S-R) learning	Person acquires a precise response to a discriminated stimulus.
3. Chaining	Learner acquires a chain of 2 or more S-R connections.
4. Verbal associations	Individual learns chains that are verbal. The conditions resemble those for motor chains but make use of the human's repertoire of language.
5. Multiple discrimination	Person learns to make a variety of identifying responses to as many different <i>stimuli</i> , which tend to <i>resemble</i> each other in <i>physical</i> appearance.
6. Concept learning	Learner acquires the ability to make a common response to a class of <i>stimuli differing</i> from each other widely in <i>physical</i> appearance. He makes a response based on classifying a set of objects or events.
7. Principle learning	Person chains together two or more <i>concepts</i> to establish a process which functions as: if A, then B. The result is a process resulting in rule-making.
8. Problem-solving	Individual chains <i>principles</i> together in a kind of learning requiring the internal events usually called thinking. The result is a process of combining two or more previously learned rules in a "higher order" rule.

Source: Adapted from Robert M. Gagne, *The Conditions of Learning* (New York: Holt, Rinehart, and Winston, 1965), pp. 569-573.

ables which are further and further removed from the stimulus situation and which tend increasingly to exist as previously acquired capabilities of the learner. From the standpoint of inference, as we move from the bottom to the top of the hierarchy of learning, we become further and further removed from concrete behaviour.

To illustrate, we begin with signal learning and elementary stimulus-response learning and move next to chaining. Verbal paired-associate learning in its pure form occurs next when the responses (or response connections)

are readily available, originally made so, presumably, by previous learning and the acquisition of language. Multiple discrimination learning follows in hierarchical order.

Concept learning is, in turn, based on the assumption or actual establishment of preavailable verbal labels which have been previously acquired in the same manner verbal associations were. In other words, concept learning as shown in the figure is presented as a form of learning in which a number of physically different stimuli are put into a single class by the subject whereas multiple discrimi-

mination focusses upon physically similar stimuli. It is assumed that the subject has previously acquired a variety of verbal labels for the stimulus objects which are presented.

The table also shows a form of learning which can be identified as more complex than concept learning yet simpler than some forms of problem-solving. This is called "principle learning" (or "rule learning") and may be viewed as a simple form of problem solving where the individual chains together two or more concepts.

The most complex form of learning, problem-solving, depends upon the preavailability of capabilities acquired in all the other forms of learning and is exhibited in the last line of the figure. Problem-solving begins with the assumption (or the establishment) of preavailable rules, and it ends with the demonstration that the individual has acquired a new "higher order rule" or, in other words, the capability of solving a new kind of problem.<sup>7</sup>

To summarize, Figure 1 is not an exhaustive or definitive listing of the various forms of learning and simply depicts what is learned rather than the learning situation which leads to this result. Gagne has presumably identified eight types or categories of learning, each with its own rules and arranged in a hierarchy from the simple to the complex, on the assumption that each higher order of learning depends upon mastery of the one below it. This thought is reminiscent of Abraham H. Maslow's concept of the hierarchical prepotency of needs.

Gagne also stresses the structure of knowledge in his analysis, which is an important supplement to the principles of learning whenever a practical instructional task is under consideration.<sup>8</sup> The training and develop-

ment specialist in the industrial environment is obviously concerned with all these types of learning and even forms that may be sub-types of the eight listed in Figure 1.

The example in Figure 1 is built essentially upon the stimulus response theory of learning but at the higher levels of the hierarchy includes cognitive learning. This conceptual visualization of the types of human learning should, therefore, suggest to the training and development specialist that what we have called training as it bears upon developing semi-skilled hourly employees can be differentiated in learning level from education involving decision-making and problem-solving as required in executive work. In other words, as we move from the lower to the higher orders in the types of human learning, there are different implications for the establishment of training and educational programmes. The training and development specialist must be certain that trainees possess the preavailable learning needed to continue learning at the higher levels.

This brief discussion of learning theory and the hierarchy of learning suggests, of course, that the training and development specialist should be acquainted with learning theory but he cannot expect that field at the present state of research and development to provide him with a bagful of tricks and final answers to his problems in planning programmes for the development of employees. He will probably be required to develop on his own a way of thinking about learning and industrial training and educational programmes that gives him a frame of reference for thinking about the development of human resources. How should he do this?

The training and development specialist should be concerned primarily with knowledge

of processes governing the acquisition and maintenance of desired behaviour performed by individuals of various perceptions, motives, and capacities. He should have an understanding of what kind of learning is a prelude to subsequent learning. He must recognize that not all persons have the capacity to acquire behaviour which organizations desire that they display and that they should not be forced to do what they cannot do. He must also recognize that some people will learn best under one arrangement for education and training and that others will learn best under alternative arrangements.

The prior discussion amounts to saying that the backgrounds, motives, and perceptions of persons as they come to a learning situation require flexibility in educational and training programmes. Latitude is needed to permit each person to attach meaning to the task involved, achieve a desired end which is salient for him, and to learn to perform the task in a manner which is suitable for him.

In many fields of work there are numerous paths to success, and any attempt to force everyone into the same mold through educational and training programmes because the training and development manager is wedded solely to one learning theory would be both wasteful and foolish.

And, lastly but importantly, regardless of whether the educational and training activities are conducted in groups or with individuals, the training and development specialist must recognize that he is concerned with bringing individuals up to a certain standard of performance as concurred in by management and must adjust the educational and training activities to meet the continuing and changing needs of the individual.<sup>9</sup>

### Social and Emotional Factors in Learning

In the United States since the end of World War II, there has been a growing recognition and acceptance of the place of social and emotional factors in human learning and work performance and how these affect the needs of individuals. The stream of events would encompass the introduction of the T-group and laboratory training<sup>10</sup>, the subsequent proliferation of experiential learning programme designs<sup>11</sup>, the founding of the human potentials movement<sup>12</sup> and the establishment of organizational development concepts and intervention technologies.<sup>13</sup>

Cognitive learning and skill training based upon S-R theory were by no means ignored in this period. Indeed, there was a continued emphasis and growth in skilled trades apprenticeship training and in vocational programmes of training and retraining for the unemployed and disadvantaged. Subsequent to the passage of the Manpower Development and Training Act (1962), Vocational Education Act (1963), and Economic Opportunity Act (1964), and their various amendments, there was probably the greatest growth in training in traditional and new substantive content and skills, as well as in affective learning, that the United States has ever experienced.

I have been interested in and participated in the growth of both social-emotional (affective) and cognitive learning and skill training. For example, I argued almost a decade ago that many of the advocates of social-emotional learning and applied behavioural science at that time were uttering rhetoric that had hollow echoes as far as the personnel manager or training director in work organizations were concerned because they were not pointing out clearly what these meant for developing em-