Increase Productivity Through Motivation

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The investigation of motivation theories and their direct and indirect effects on productions has been the subject of intensive and numerous studies during the last decade. As a result of these studies, many different theories concerning motivation and their relationship to productivity have been evolved. However, even with difference of opinions, there seems to be a general agreement on

1. that motivation will effect productivity significantly in various industrial environments ;

2. a technique can be designed to achieve this motivation factor ; and

3. a method can be designed to evaluate the effectiveness of these motivating factors.

Motivation can be viewed in terms of human needs as one of the main objectives of characterising the behaviour and performance of an individual worker. In general, the motivation of employees has two main characteristics :

1. that aspect which is concerned with the formal reward system, such as salaries, benefits, pensions, etc ; and

2. the personal desire for status, security, participation, personal worth, achievement and group recognition.

A review of the literature has shown that many industrial and business managers have failed to create a motivating climate necessary for satisfying these needs. A mere attempt to meet the employee's financial needs is not sufficient to generate self–motivation in today's production environment.

The managerial responsibility to motivate workers should go beyond providing working conditions where these financial requirements can be satisfied. Managers also need to be responsible for identifying areas of personal needs and satisfaction, and for bringing about new concepts

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and methods to improve present conditions of motivation. One method to identify and improve on employee motivation is to be able to isolate and identify motivating elements which comprise a specific job. These motivating elements should not be confined to a specific area of the employee's environment with which the employee comes in contact but should cover the total manufacturing system or operation.

The current literature seems to shed some light on the most preferred or motivating characteristic of the work situation. Studies seem to emphasise and focus primarily on the employee's relation to his supervisor. Also, studies on motivation factors were directed at the worker's desire to achieve personal goals, advancement in the job, and personal responsibility. Working conditions and factors related to the formal reward system (salary, benefits, compensation, etc.) were found to be essential for job satisfaction, but were not part of the most preferred or motivating factors of the work situation. The motivatable workers seem to always possess, either or both, motivation and maintenance factors.

The objective of this study is two-fold. First, it is directed towards finding the motivatable workers ; and second, it is directed to determine the actual events and circumstances leading to favourable or unfavourable motivation on the job. These actual events of circumstances are identified as *first level factors.*

In identifying the motivatable workers, Herzberg's [8] study indicates that the role of individual personality in determining the potency of these first level factors is of paramount importance. People for whom motivation strengths are derived from such factors as achievement, responsibility, growth, advancement, and some others, are called *motivation seekers.* They are motivated primarily by the nature of the task and have a high tolerance of poor environmental factors. On the other hand, *maintenance seekers,* are motivated primarily by the nature of their environment and tend to avoid motivation opportunities.

Productivity : Employee and Management Relationship

A study was conducted in a local metal working plant, which employs approximately 1,000 persons, to ascertain what *effects motivation had on productivity.* During the study, it was found that numerous problems

developed between management and workers when the former attempted to increase productivity. Management generally found, from experience, that workers generally resist the will to work and will generally offer opposition to production improvement !

In this study, workers voiced concern for the welfare of their employer and its ability to stay in business, but when confronted by daily issues, they retrogressed on their subjective interests. The plant management found out later from bitter experience that demonstrating with hard facts to their employees that competitors are way out in front brought no improvement in productivity. It was also determined at the bargaining table that pleas of poverty during renewal of the labour agreement fell on deaf ears in the company's effort to increase productivity. In spite of this, the plant management continued to review means of increasing productivity, and to hold the line against the erosion of management's prerogatives.

A questionnaire survey was distributed randomly throughout the said plant, and contained only one statement which needed brief responses, and did not require the employee to write his name or clock number thereon. The statement was :

> "Our plant is experiencing difficulties in increasing its productivity quota. Please discuss why you would not want to increase the productivity level requested in your department."

The general response from the fifty people who responded, out of a sample of two hundred, was clear and to the point. The workers felt that if they did anything to raise productivity, some of them would be automatically penalised. Other employees felt that if they increased production, reduced delays and waiting time, reduced crew sizes, or cooperated in any way, less overtime would be available to them and some employees would be laid off. A truck driver felt that if he stopped for fewer coffee breaks during his trip, he might bring his truck back within eight hours and lose overtime. The men in the material department felt that if they did not permit goods to pile up on the shipping dock until late in the afternoon, they would lose their overtime. The typists in the clerical pool felt that if they increase their output, some would be released. All employees felt that if they raised their productivity, the plant would require *fewer* employees. They would not

be persuaded that increased company profits would benefit them now and in the future with increased financial benefits. The survey also brought out that workers felt that the executives, administrators, professionals and salesmen never worked themselves out of a job by superior performance. Those employees, according to the workers surveyed, can usually anticipate rewards for their creativity and effectiveness.

At this plant, it appears that when workers excel and raise productivity the company benefits and management is pleased, but the workers feel they do not benefit. To the contrary, in the short term, these workers feel that their economic interests are threatened. Employees in the plant feel, when upper management and professional employees are more effective, that they cover themselves with glory ; their economic security is enhanced, not threatened, as that of plant workers. Ironically, the current relationship between workers and management actually provides workers with the incentive not to cooperate in productivity improvement.

Motivation Through Communication

During this study, some of the characteristics of the *communications* process were used to motivate employees and increase their productivity. Communication has been described as the process of transmitting and receiving information. The following represents one viewpoint of communication in relation to management goals :

> "Without proper communication, management would be unable to achieve its objectives through employees. Employees on their part have certain information needs that can only be fulfilled through mangement's communication. Furthermore, without communications, it becomes impossible to motivate employees to improve their work performance." [2].

Initial research at this plant indicated that no effective employee orientations had been implemented to obtain the maximum potential productivity from a new work group. Also, at this plant, the newly hired workers received either only a scant amount of information and guidance relating to his or her new job assignment and environment, or such a heavy dose of written material, films, and talks at the outset that the new employees forgot everything they experienced.

It was stressed in the new programme that the most crucial period for orientation was soon after the new employees entered the production environment. It was at this time when the employees needed skilled guidance and support to bolster their morale through this frightening and frustrating adjustment period. In order to improve the orientation for new employees, a questionnaire was designed to determine what supervisors might perceive in their responsibility to new employees thus increasing their motivation and ultimately, their productivity. A procedure was developed which consists of the following steps :

1. New personnel shall be given a "welcome to the department and the company" packet which includes :
   a. factory history
   b. plant pictures and descriptions
   c. product pictures
   d. orientation check list
   e. an emergency message centre telephone number
2. The new employee shall be introduced to other production personnel at the initial meeting, who will help answer questions and then escort the new employee to his work area.
3. The supervisor's first day responsibilities shall be :
   a. to introduce the new employee to the general management
   b. to show the employee the time clock, coat rack. first aid, tool crib, locker space, supervisor's office, etc.
4. The supervisor shall have a dialogue with the new employee on :
   a. pass procedure
   b. first-aid pass procedure
   c. name of product part or assembly he will be working on
   d. when his first cheque will be issued
   e. relief time and other policies
5. The supervisor shall :
   a. emphasise good employee attendance
   b. explain the various departments and company rules
   c. answer questions that the new employee might have at that time, and any other time during the employee's affiliation with the company.

6. The supervisor will introduce the employee to other workers in the vicinity of his work area and shall assign one hourly worker to show the new employee other facility details.
7. The supervisor will instruct the new employee on his responsibilities and will introduce him to maintenance and utility personnel.
8. The supervisor shall return to see how the new employee is progressing periodically.
9. The supervisor shall check frequently during the early phase of his employment to determine if any further questions have developed.
10. The supervisor shall congratulate the employee, encourage superior performance, and make the new employee feel that he is being recognised.
11. The supervisor after approximately 30 days, should review the various subjects discussed during the initial hiring of the employee.
12. Supervisor should, at a later date, call the employee in for his opinions on the orientation and introduce procedures to determine how they can improve or correct this initial phase of employment.

The development of this orientation/induction programme involved not only an awareness of the new employee's needs and attitudes necessary to be motivated to increase productivity, but also was deeply involved with developing an important link to the labour force. This study became obvious when the results were plotted as shown in Fig. 1. Two groups of five employees were used in the study ; one group utilised the new method of communication, and the second, or control group, used the old method during the initial stages of employment. The group using the old method for five weeks achieved more production than those using the new method. The old method did not make provisions for supervisors to take time out to communicate with the new employees; it quickly immersed the new employees in their job environment without much communication. After six weeks, the new method, which utilised communications, began to show signs of increased worker productivity over those that were employed using traditional methods of employment. Within ten weeks, the new employees who were exposed to the formal orientation programme were far more productive and more easily motivated, their production was nearly twice that of employees who did not undergo a formal orientation programme.

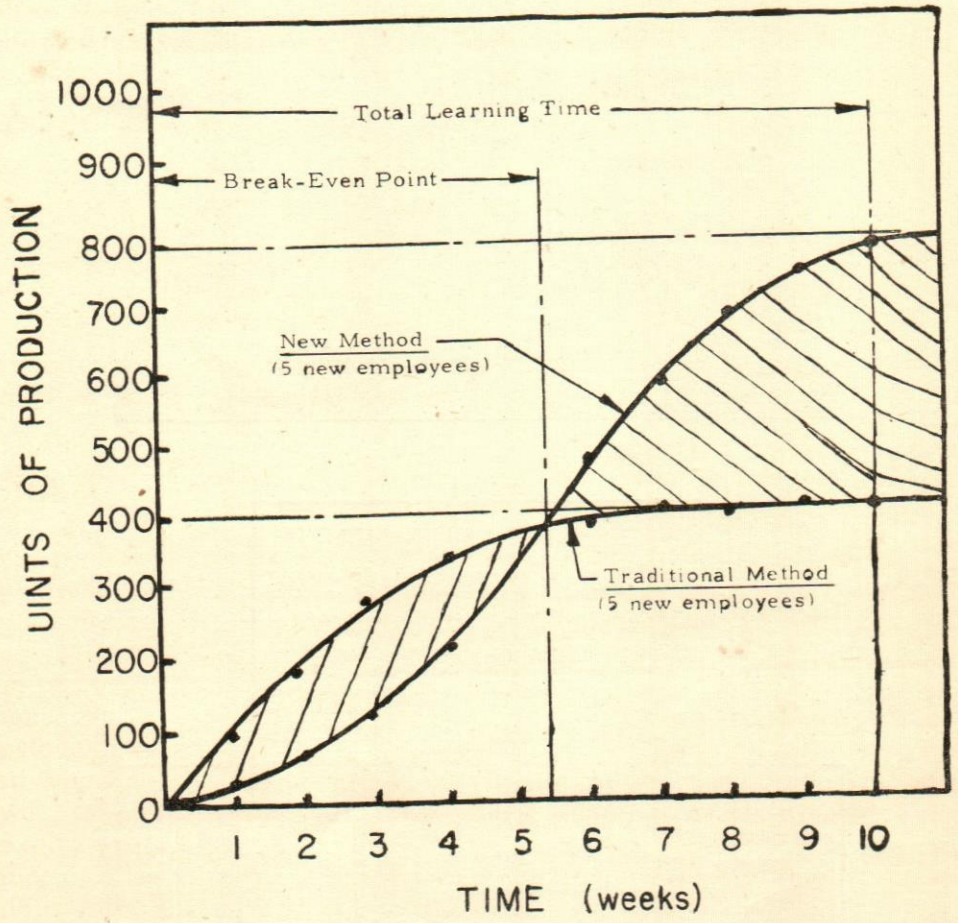
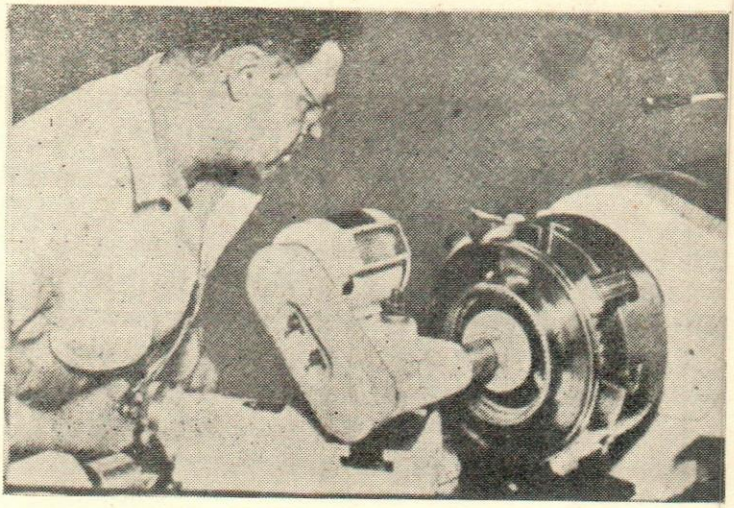


Figure 1 : Production *vs* Time for Two Groups of Five New Employees Using Traditional and New Methods of Orientation to Their Job Environment.

Conclusions

This brief study indicates that employees, if properly motivated through communicating a sense of belonging and a willingness to share responsibilities with management, can increase their productivity substantially. Further, this study has substantiated much of the literature found in motivating production personnel, and that just rewarding employees



THE JOB
ACHIEVEMENT, RESPONSIBILITY, RECOGNITION delegation, access to information, freedom to act, atmosphere of approval, merit increases, discretionary awards, profit sharing, company growth, promotions, transfers and rotations, education memberships, involvement, goal-setting, planning, problem solving, work simplification, performance-appraisal, utilized aptitudes, work itself, inventions, publications.
MOTIVATION NEEDS

PHYSICAL	SOCIAL	ECONOMIC
work layout, job demands, work rules, equipment, location, grounds, parking facilities, aesthetics, lunch facilities, rest rooms, temperature, ventilation, lighting, noise.	work groups, coffee groups, lunchgroups, social groups, office parties, ride pools, outings, sports, professional groups, interest groups.	wages & salaries, automatic increases, profit sharing, social security, workmen's compensation, unemployment compensation, retirement, paid leave, insurance, tuition, discounts.
SECURITY	**ORIENTATION**	**STATUS**
fairness, consistency, reassurance, friendliness, seniority rights, grievance procedure.	job instruction, work rules, group meetings, shop talk, newspapers, bulletins, handbooks, letters, bulletin boards grapevine.	job classification, title furnishings, location, privileges, relationships, company status.
MAINTENANCE NEEDS		

Figure 2 : Illustration of the Motivation and Maintenance Needs of Employees

financially is not necessarily going to increase productivity. The total work environment must be considered in order to assure higher productivity from its workforce. □

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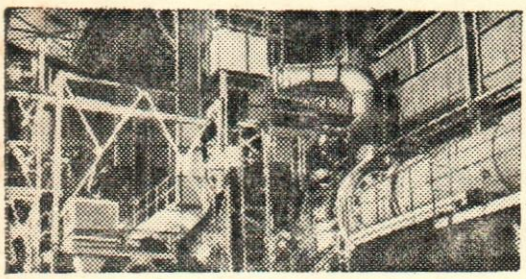
Another contribution to the nation from Tata Steel... sponge-iron technology.



For years, the steel industry all over the world has been looking for a manufacturing process which could be independent of the shrinking supplies of metallurgical coal and the erratic supplies of scrap.

Sponge-iron technology looks promising, and Tata Steel is playing a pioneering role in its development in India.

As part of its research, the Company has set up a sponge-iron pilot plant, to conduct experiments on various combinations of iron ore and non-coking coal. This pilot plant was designed and erected entirely with the Company's own expertise.

Electric furnaces, particularly in the numerous mini-steel plants, can find in sponge-iron a ready supplement to scrap and a continuous source of raw material.

Tata Steel is now on the threshold of a significant contribution to innovation in steel technology. And Indian industry can look forward to a process of steel-making most suited to its needs.

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TATA STEEL

Maintenance System : Evaluation of Performance

K. C. Sahu*

An evaluation of the 'Performance' of a given Maintenance System is necessary for better management of this function. The concept of performance like that of Productivity, Efficiency, or Effectiveness, etc. is a complex one, which involves quantitative measurement and qualitative assessment of input and output parameters, standards and trends. Specification and measurement of many of these aspects are difficult—more particularly, for a service sector like maintenance, where *output* and *standard expectation* tend to be subjective and are difficult to correlate with any directly measurable entity. However, complexities notwithstanding, assessment and evaluation of performance/productivity/efficiency, etc. are vital for better control over direct and indirect *costs* associated with maintenance.

Utility

More specifically, periodic evaluation and comparison will help to :

(i) assess areas suited for preventive maintenance and installation;

(ii) enable repair/overhaul/replacement decision;

(iii) control measures daily, weekly, monthly or annual and follow-up action at each level of management;

(iv) assess personnel requirements;

(v) design suitable incentive plan;

(vi) assess requirement of stores, spares, and equipments and their effective utilisation;

(vii) manpower planning, training and placement;

(viii) budgeting and planning of maintenance activities;

(ix) cost control ; and

(x) establish objective decision rule in as many situations as possible.

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Concepts of Performance and Productivity

To begin with, conceptual and functional definitions of productivity/efficiency and effectiveness are dealt with to clarify the context of Performance Evaluation.

'Productivity' is the efficiency with which economic resources are employed to produce goods and services. In the standard 'output by input' format, its measurement becomes a difficult task in the context of maintenance, as indeed for any service function, for, output measurement offers both conceptual and practical problems.

'Efficiency' can be viewed primarily as a measure of utilisation of input resources—men and material at the disposal of maintenance for achieving a stated level of maintenance achievement (output) norms. 'Effectiveness' can be regarded as a measure of, primarily, extent of contribution of maintenance to broader, overall (production) objectives of the company. It is essentially output-oriented—comparing actual achievement (output) against that planned.

'Performance' may be defined as assessing, how well a particular course of action achieves a particular objective [1]. More akin to productivity, involving both input and output sides, performance evaluation seeks to integrate the concepts of effectiveness/efficiency through a series of indices, without the rigorous requirements of conventional productivity measurement in production context where measurement of output, though somewhat problematic, is still fairly straight forward.

Properties of Performance Measure(s)

As a planning and control tool, measure(s) of performance suggested should have desirable properties like case of computation and interpretation, a fair reflection of management subjective/objective notion about maintenance objective *vis-a-vis* broader objectives of co-operation, a clear indication of weak areas and reasons thereof needing mangement action. Obviously, appropriate measure of performance should be developed for various managerial levels—integrated with a well-thought-out Management Information System.

Methods For Performance Evaluation

A critical review of various indices, proposed as complete or partial measures of maintenance performance is presented below :

1. Corder's Index : [1, 2, 3,]

To represent relative merit, on a year-to-year basis of maintenance function within an organisation, Corder suggests one Comprehensive Index as follows :

$$E = \frac{K}{x^C + y^L + z^W}$$

where

C = total maintenance cost expressed as a percentage of the replacement value of the plant and equipment.

L = lost time due to maintenance causes expressed as a percentage of the scheduled production hours.

W = waste of materials due to maintenance causes expressed as a percentage of the total output at the appropriate stage of the process.

x = total cost of maintenance in base year.

y = total cost of lost time due to maintenance causes in the base year.

z = total cost of waste produced due to maintenance causes in the base year.

K = a constant such that the efficiency index equals 100 in the base year.

Being a ratio only, inherent difficulty in interpreting the true effect in terms of actual performance is there. Further, though this Index may indicate an overall comparative satisfactory/unsatisfactory status, it will not indicate *what action is* necessary and *where*.

2. Priel's Indices : [1, 4]

Priel suggested a large number of indices (Annexure I). In these, as some account is taken of most of the relevant consequence variables,

causes and areas of poorer performance will be readily identifiable. However, this elaborate method will be a costly and laborious process for information collection and computation. Numerous interdependent indices do not give, readily, an idea of overall performance for the highest level. Even his 3-Summary Indices, do not eliminate this difficulty. Again, follow-up action needed is not obvious from these indices.

3. Luck's Method : [1, 5, 6, 7, 8]

A combination of (1) and (2) is attempted by Luck. He suggests 16 indices in 4 categories involving various consequence variables and combines them graphically to provide the high level decision makers with a single measure of maintenance performance. The four categories of variables affecting the overall maintenance performance are related to broad areas like (a) planning, (b) workload (c) cost and (d) productivity. For four indices in each category (Annexure II), values are determined by actual survey and goals are established for each one. Graphs are then plotted for each category—one index on each side. Actuals and 'goals' are plotted and connected and an assessment, based on combination, regarding Excellent, Good, Average, Below Average or Poor is made. Finally, results are transferred to one master graph.

4. Newbrough's Approach : [7]

Newbrough has suggested methods for labour performance and control. For labour performance, he has prescribed analysis of backlog, use of measured day work for control, incentive plans, and general methods of reporting, measuring and improving labour performance.

For control, he has suggested several indicators, some of which are listed below, to be used as trend indicators for comparison with past or with a reference point and also absolute values.

(i) Broad Indicators

Ratio of Maintenance Cost of Sales (5%)

Ratio of Maintenance Cost to Value of Facility (2.6 to 12.8%)

(ii) Workload Indicators

Current backlog

Total backlog

Preventive Maintenance hours as % of total manhours (20—40%)

(Iii) Planning Indicators

Percent of jobs completed on schedule

Percent Maintenance hours planned

Percent emergency work

Percent downtime

(iv) Productivity Indicators

Productivity of Maintenance Manpower

Maintenance Labour Cost/Material Cost

Maintenance Cost/Unit Production

Maintenance Men/Production Men

(v) Cost Indicators

Percent direct and general maintenance cost to total maintenance cost

Percent indirect maintenance cost to total maintenance cost

Percent maintenance payroll

Actual *vs* Budgeted maintenance cost.

Indices can be plotted in a calendar time scale to establish trends. Multi-index profiles may be also established as norms for comparison with actuals.

Besides Newbrough, several other authors, like Lowe [9] Kapoor [10] and Stewart [11] have also suggested several indicators/indices.

5. Work Standards as Performance Measures : [7, 12, 13]

A number of standard data systems have been suggested for an accurate estimation of 'time' on which costing, scheduling, and control can be done.

Though non-repetitive in totality, elementwise, more-frequently occuring elements can be standardised, either by actual time study or by use of standard data.

6. Work Sampling : [13, 14, 15]

Work sampling will indicate utilisation of various resources. Therefore, logical classification of productive and non-productive time must be made. The results can be utilised for :

(i) developing standard data,

(ii) plotting labour utilisation information,

(iii) identifying loopholes calling for management attention,

(iv) developing certain indices, and

(v) distinguishing few important functions from many trivials based on well-known Pareto principles for management by exception.

7. Ranking Index for Maintenance Expenditure : [7]

Based on numerical values computed for each piece of equipment/unit in organisation and each maintenance job/project, a quantified ranking index for maintenance expenditure is proposed to

(i) establish relative importance of maintenance jobs on day-to-day basis for priority in scheduling, and

(ii) assist management in proper allocation of funds/other resources.

RIME calculates and then combines two components as stated earlier (i) an equipment code and (ii) job factor point. For equipment code three factors—percent utilisation (capacity), percent profitability (utilisation) and process factor (degree of integration with other systems)—are considered, evaluated and multiplied with each other.

Job Code seeks to determine relative importance of specific maintenance jobs and includes tangible/intangible factors like deferred maintenance cost, lost production cost, quality cost, excess labour cost, and safety rating. These are added up together for finding Job Code.

$$\text{RIME Index} = \text{Equipment Code} \times \text{Job Code}$$

Lower RIME Index decides better alternative. A simplified version of RIME is often used. The RIME index provides objective basis for establishing priority between plants/departments/jobs. Normally, a great deal of

subjectivism or illogicality may exist in this scheduling area.

8. Maintenance Audit : [16]

Maintenance audit based on properly-designed unambiguous questionnaire about planning, scheduling, workforce utilisation, job assignment, working procedure, skill, inspection, spare part, tools and equipment, cost reports and return, etc., is a fairly effective, though subjective, method for assessing maintenance performance.

9. Instant Maintenance Yardstick : [17]

Priel has suggested a multi-stage indicator by which a busy maintenance manager can quickly look for making spot-checks to assess overall maintenance performance by evaluating—subjectively or through necessary information—seven important aspects relating to maintenance plant condition, work order completion, manpower effectiveness, cost of hourly maintenance, ratio of maintenance to production hours, quality of maintenance and general maintenance expenditure in budget.

10. Comparison Between Alternative Courses of Action Through Decision Models :

The comparison is related to performance, but rather on specific decision situation or parts thereof, such as,

(i) overtime *Vs* additional shift,

(ii) make or buy spares,

(iii) additional equipments,

(iv) gang and equipment utilisation,

(v) inventory control.

To test effectiveness of the present methods and procedures, and suggest more effective alternative calculations cost, financial data, engineering economy principles and more sophisticated models of inventory theory, queuing and simulation can be used.

11. Comparison :

Internally, comparison of performance between various units, levels/ divisions of organisation, in any unit at various times or externally with similar industries can be made to assess the performance. Caution is,

of course, needed, particularly, for comparison with other industry, as similarities may only be superficial. Still, judicious managements should make use of these comparisons, as indications of absolute or relative gaps in performance scale with a view to their serving as guidelines for setting future maintenance objectives/budgeting, etc. Questionnaires by professional bodies/individuals may lead to such comparison. Some such comparative studies are published [18, 19, 20] and may be referred to.

12. General Approaches for Better Insight into Performance Measurement :

Certain subjective methods of some aspects of performance measurement are maintenance cost [21], performance analysis by Lewis [5], Mack [22], Gunton [23], Tomlingson [24], Priel [25], Kittner [26], Dickson [27], and Fermont [28], Donald [29], Robinson [30], Chambers [31], Speed [9], Retrof [32].

This brief critical survey of the available concepts, ideas, approaches and methods of evaluation of maintenance performance, should naturally be supplemented by reference before any specific organisation can judiciously choose one or combination of approaches and more importantly, analyse, Interpret and use the information generated in the evaluation exercise.

Performance Evaluation : Experience in Indian Industry [33]

Our experience in evaluation of maintenance performance is confined to (i) two shops of a light engineering organisation (ii) a job shop, and (iii) a highly integrated, high-capital, process industry. Computations of various performance and control indices graphs and charts were drawn and analysed, based on which maintenance policy and wage incentive plans were suggested. Comparison within and between industries also brought out certain suggestions for improvement.

General information on equipments and data on cost, workload, breakdown frequency, etc., were collected. All day time study and work sampling were also done. Comparison was made between values of various indices and published or recommended norms as reported in

literature were made, indicating weaker areas and correcting steps. As specific values found are irrelevant for general use, they are not being quoted here in detail except for a few important ones, which are given below and in Annexure II.

	Actual	*Recommended*
Maintenance Cost/Value of Facility (%)	8	2
Planned Maintenance hours (%)	10	30-40
Preventive Maintenance (%)	2.5-10.5	30
Overtime hours (%)	21.2-34.1	1-2
Downtime (%)	4-8	2
Maintenance Men to Production Man ratio	7.4	15
Productive Activity (%) (work sampling)	30	
Labour Utilisation (%)	48.4	

Conclusion

Quantity and quality of relevant data are usually neither kept nor made available for such analysis.

Generally speaking, continuous type of industries are better placed on this score. Similarly, more-widely-conducted surveys and publication of results and norms will make comparison method more effective as a guide for maintenance planning and control. Inadequate management and insufficient resources seem to be fairly chronic in most of the industries. Overtime and management by crisis leading to fire-fighting are widespread. A rational approach to objective evaluation of maintenance performance, with regularity, based on facts and analysis will provide a basis for a more-efficient and a more-effective management of maintenance function. □

Annexure-I

Priel's Indices of Maintenance Effectiveness

Group I : Maintenance Effort (Input)

Service Assessment

Department Operation

Manpower	Manpower efficiency	=	Total man-hours allowed on jobs	/ Total man-hours worked on same jobs
	Incentive coverage	=	Total man-hours on bonus	/ Total direct man-hours available for jobs
	Craft worker utilisation	=	Total direct craft hours applied	/ Total hours clocked, all crafts
Work Order	Overdue tasks	=	No. of jobs one week overdue	/ No. of jobs completed in same period
	Work-order turnover	=	No. of jobs completed in period	/ No. of jobs on hand at present
Economy	Cost of man-hour	=	Total cost of (direct+indirect) maintenance	/ Total direct maintenance hours applied
	Breakdown repairs cost component	=	Total cost of breakdown repairs	/ Total cost of direct maintenance
Service Operation	Degree of scheduling	=	Total direct hours on sheduled service	/ Total direct hours available
	Breakdown repair hours	=	No. of hours spent on breakdown repairs	/ Total No. of direct maintenance hours
Maintenance Intensity	Maintenance hrs. applied	=	Total direct maintenance hours applied	/ Total direct production hours same period
	Maintenance ratio for investment	=	Totol maintenance cost for period	/ Total plant investment to date
Service Cost	Maintenance cost component	=	Total maintenance cost for period	/ Total production cost for same period
	Scheduled Service cost	=	Total cost of scheduled service	/ Total production cost for same period

Group II : Maintenance Effort (Output)

Plant condition

- Breakdown severity = Total cost of breakdown repair / Total no. of Breakdowns
- Breakdown frequency = No. of maintenance breakdowns / Total no. of breakdowns
- Visual and descriptive = Conditions from production supervisory personnel

Plant performance

- Machine utilisation = Total running time in hours / Total shift hours worked
- Length of running periods = Total production output in units or hours / No. of repairs during same period

Group III : Overal Effectiveness

- Progress in cost = 93.25% = Amount of controlled maintenance = 11.48% / Maintenance cost component = 12.28% = Total direct hours on scheduled jobs = 4128 / Total direct hours available = 36,094 = Total maintenance cost for period = 5,55,119 / Total production costs = 45,36,559
- Degree of Maintenance intensity index = .364% = Amount of maintenance required = 0.106 / Extent of mechanisation = 29.2 = Total direct Maintenance hours applied = 32042 / Total direct production hours = 301824 = Total connected H. P. on production = 467 / No. of direct Maintenance worker = 16
- Overall Economy of service index = $.715 \times 10^{-3}$ = Degree of machine utilisation = .848 / Cost of Maintaining Mechanisation = 1185 = Total machine time in hours = 256408 / Total No. of hours worked = 301824 = Total cost of maintenance = 555119 / Total horse power served = 467

Annexure II

Luck's Method

Including Basic Data Summary Sheet for the Case

	Factors	*Present Survey*	*Future Goal*
PLANNING	Labour effectiveness	65.0%	80.0%
	Percentage of total man-hours of maintenance on work planned and forecast weekly	50.0%	85.0%
	Percentage of total man-hours for emergency work per month	15.0%	4.0%
	Percentage of total man-hours for overtime worked per month	8.0%	2.0%
WORKLOAD	Crew weeks of current backlog	5.0 Weeks	3.0 Weeks
	Crew weeks of total backlog	8.5	5.0
	Percentage of total man-hours per month for preventive maintenance	10.0%	25.0%
	Percentage of total man-hours per month for daily maintenance work	90.0%	75.0%
COST	Maintenance cost as a percentage of plant investment	10.5%	6.0%
	Percent increase or decrease in maintenance cost per unit of product produced over a base period	+15.0%	−10.0%
	Percentage of total maintenance rupees cost for direct and general maintenance	65.0%	85.0%
	Percentage of total maintenance rupees cost for indirect maintenance	35.0%	15.0%
PRODUCTIVITY	Maintenance activity as expressed by percentage of manpower productivity engaged	55.0%	75.0%
	Percentage of forecasting effectiveness	40.0%	75.0%
	Percentage of operating time lost in mechanical downtime for maintenance reasons	12.0%	3.0%
	Percent increase or decrease in number of units of product produced per maintenance rupees over a base period	+17.0%	+12.0%

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Nature of the Planning Process

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Business planning is carried on to help assure the survival and growth of the company or corporation. Planning is one of the functions of the manager and, as such, involves the selection, from among alternatives, of corporate objectives, policies, procedures, and programmes. It is sometimes said that planning is the primary managerial function which logically precedes all other functions, since without planning, a manager would not have activities to organise, would not require a staff, would have no one to direct, and would have no need to control. To simplify this last statement, since control is the function of making sure that events conform to plans, no manager can control if he has not planned[1].

The need for corporate planning is now obvious. It is one of the most complex and difficult intellectual activities in which man can engage. There is no set formula to follow. Therefore, planning will have to be tailored to the unique characteristics of the organisation and situation in which it is carried out.

Definition of Business Planning

But what is planning? Planning could be called anticipatory decision making; it is something done in advance of taking an action. It is a process of deciding what to do and who is to do it before any action is required. If one desires a certain state of affairs at some future time and it takes time to decide what to do and who to do it, one must make the necessary decisions before taking action. Planning is a process that is directed towards producing one or more future states which are desired and which are not expected to occur unless something is done. Therefore, planning is concerned both with avoiding incorrect actions and with reducing the frequency of failure to exploit opportunities. In this way planning has both a pessimistic and an optimistic viewpoint.

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1. David W. Ewing, *Long Range Planning For Management*, New York : Harper & Brothers, Publishers, 1958, p. 11.

The pessimism lies in the belief that unless something is done, a desired future state is unlikely to occur. The optimism lies in the belief that something can be done to increase the chance that the desired state would occur.

Thus, planning can be called a process that involves making and evaluating each of a set of interrelated decisions before action is required, in a situation in which it is believed that unless action is taken a desired future state is not likely to occur, and that, if appropriate action is taken, the likelihood of a favourable outcome can be increased[2].

Peter Drucker, a well-known management consultant and author, in an article in *Management Science*, defines planning only after pointing out what it is not, that is planning is not forecasting or an attempt to mastermind the future; it does not deal with future decisions but with the futurity of present decisions; it is not an attempt to elminate or minimise risks, but, rather, taking the right risks and improving the capacity to take greater risk. Drucker then defines planning as "the continuous process of making present entrepreneurial (risk taking) decisions systematically and with the best possible knowledge of their futurity, organising systematically the efforts needed to carry out these decisions, and measuring the results of these decisions against the expectations through organised, systematic feed-back". Several key points are explicit in Drucker's definition—the preparation of programmes to implement decisions measuring actual performance against plans to maintain effective control and the stress placed on the process as a continuous one[3].

Kinds of Business Planning

In different ways, the experience of managers reported, shows three kinds of business plans : (1) plans for doing current business, (2) plans for continuing in business, and (3) plans for business development and growth. Plans for doing current business are related to creating

2. Russell L. Ackoff, *A Concept of Corporate Planning*, John Wiley & Sons, Inc., 1970, p. 2

3. Kjill Arne Ringbakk and Robert W. Dawson, *Organized Planning in 40 Major U. S. Corporations*, Stanford Research Institute, 1968, p. 4.

today's business and to scheduling today's work in accordance with time and quality standards. These are the operating plans of the manager, the supervisor and the worker. Since they concern customer service and operating efficiency in an immediate way, effective planning and scheduling of today's business are essential to future survival and growth[4].

Plans for continuing in business are those that deal with the changing character of the customer's business, with the changing technology of one's own business, and with the changing habits and expectations of workers and society at large. These plans do not deal specifically with only one order or one customer. Rather, they are plans reasoned from the manager's assumptions on long-term trends and the changes in those trends. These are plans to build the changing values of the customer into the products and services of the business.

In addition to, or instead of, plans made to perpetuate a business in the markets it already serves, the chief executive may see opportunities his business could logically exploit in other areas. Plans for business development and growth sometimes involve preparation to open markets different from those traditionally served by the business, with products different from those the business itself makes. Or, the plans may be to serve essentially the same customers with different or more expanded products and services.

For many companies, business planning is the act of making decisions in one or more of these areas. By thinking of plans to meet needs in each of these three areas, a manager can identify the areas in his own company in which planning ought to be accelerated.

Business Planning Process

The nature and techniques of planning may be clarified by outlining the steps involved in major planning. Although these steps are presented here as dealing with a major programme, they are still steps that in their essential nature must be followed in any kind of thorough and

4. Stewart Thompson, *How Companies Plan*, American Management Association, Inc., 1962, p. 15.

logical planning. In this case the planning process will be broken down into the following six steps:

1. Establishment of objectives;
2. Establishment of planning process;
3. Search and examination of alternative courses of action;
4. Evaluation of alternative courses of action;
5. Selection of a course or courses of action; and
6. Implementation and revision[5].

Establishment of Objectives

The first step in the planning is the establishment of planning objectives. This must be first at the level of the entire corporation, but it is also necessary to have an objective or objectives for each derivative or subordinate plan. Planning must be for or toward some goal, to be meaningful, because the objective gives the key as to what basically to do, where to place the primary emphasis, and what to accomplish by the policies, procedures, budgets and programmes of the corporation.

Regardless of the nature of the objectives, they must be understood if plans of any meaning are to be pursued in the corporation. Therefore, the objective of the entire corporation should control the direction of major plans affecting the corporation as a whole. These plans define the objectives of the major departments. Major department objectives and plans give a key to the objectives of the sub-departments, and so down the line through the organisation structure. Therefore, the lesser subdivisions will do their planning more effectively if they understand the overall objectives of the enterprise.

Establishment of Planning Premises

The second step in the planing process is the establishment of an agreement upon planning premises. These are forecast data of a factual nature and basic policies expected to be applicable for the future. These premises are basically key factors which will have a major influence

5. Ewing, *Long Range Planning*, p. 34.

on the plan that is being established.

Some premises are forecast policies that have not yet been made. If, for example, a company does not have a pension plan and if no policy with respect to having one has been made, those who would develop planning premises must forecast whether such a policy decision will be made and what it will contain. Other premises naturally grow out of policy decisions or plans already made. For example, if a company has made large investments in special-purpose fixed plant and machinery, the very fact that this has been done becomes a planning premise of some importance for the future.

Planning premises may be divided into three groups. There are those planning premises that are non-controllable, in the sense that the individual firm doing the planning cannot do anything about them. These include such premises as population growth, future price levels, government regulation, tax rates and policies, and business cycles. Then there are those planning premises that may be regarded as semicontrollable, in that the company cannot control them but can influence them to a greater or lesser degree. These premises may include assumptions as to the share of the market, labour turnover, labour efficiency, and company price policy. The third group may be characterised as controllable by the company. These include policy matters and programmes that the company management can decide largely for itself. They may include such policies as expansion into new markets, the adoption of a research and development programme and the location of the company offices. Section discussed below covers the development of how one company faced a water pollution problem. In the light of this, some factors that will affect management's decisions in situations involving water pollution would be : types and causes of water pollution, problems encountered in measuring the extent of the pollution, cost of equipment and clean-up operations, private and public pressure groups (including government regulation, and company considerations). All of these factors must be thoroughly looked at before management can develop any plans for the future.

Development of Alternative Courses of Action

The third step in the planning process is to search for and examine

alternative courses of action. Before weighing the alternative and reaching a decision, it is wise to search for alternatives that may not be immediately apparent. In some instances an alternative not immediately seen proves to be the most profitable way of undertaking a plan.

As a manager continues his study of a decision situation, he synthesises key situation elements and develops feasible alternatives. The following is how one company developed alternative courses of action in developing a plan to deal with their pollution problem :

The Reserve Mining Company of Silver Bay, Minnesota (about 60 miles north of Duluth on Lake Superior's northern shore, was a joint subsidiary of Armco Steel and Republic Steel Companies and their principal supplier of iron ore[6]. Reserve Mining mines a low-grade ore called taconite and uses more than 350,000 gallons of Lake Superior water every minute in its refining operation. The company negotiated with the Army Corps of Engineers for a permit to dump the unusable waste "tailings" from its taconite into the lake. Since the Company went into full-time operation in 1955, it has deposited more than 190 million tons of waste into Lake Superior.

Reserve Mining claimed that the waste material discarded was "harmless sand" that sinks rapidly in the deepest part of Lake Superior and remains inert on the bottom. However, an investigation by the Department of Interior's staff revealed existence of a serious pollution problem. Everyday the waste from Reserve's mine contained a ton of nickel, more than 2 tons of copper, a ton of zinc, 3 tons each of lead and chromium, 25 tons of phosphorous and 310 tons of manganese. Over 5,000 tons of the daily deposit had been ground so fine as to remain in suspension for an indefinite period of time. The report's recommendation was that the mining company be given a maximum of three years to find another location for its taconite wastes and to discontinue dumping into Lake Superior entirely.

The Reserve management, in developing alternative courses of action to evaluate, had to weigh their position in the industry and how any solution would affect it. In doing this they decided that they would not

6. James M. Fallows, *The Water Lords*, New York : Grossman Publishers, 1971, pp. 75-77.

sway from their present objective as principal supplier of iron ore. One of the alternative courses of action considered was to fight the recommendation of the Department of the Interior by hiring a battery of scientists to prove that there is inter-state pollution from other sources, in Michigan, Wisconsin and Minnesota. The findings of these scientists might very well prove that the waste material from the company's operations was not a major cause of pollution of the lake.

As a second alternative, management could take a conciliatory position and agree that it had contributed to the pollution of the waters of Lake Superior. However, it would need additional time and help from the government to eliminate the dangerous pollutants in its waste material. In addition, government aid in finding new areas to dump these wastes would also be needed.

As a final alternative, the Reserve management could take the position that there were 61 other industries and 93 municipilities discharging wastes into the lake. Since most of these industries and municipailities had never treated their wastes in any manner, reserve could agree that it should not be compelled to act to clean up its wastes until all the other potential polluters were made to participate in the programme.

Evaluation of Alternative Courses of Action

Having sought out the available alternatives and having made an examination of the strong and weak points of each alternative, the planner must evaluate each of the alternatives. The evaluation involves the weighing of the various factors involved. At times, the presence of overriding factors will dictate the choice among alternatives. One alternative may appear to be the most profitable course of action but may require a large cash outlay but a slow payback. Another course may be less profitable but involves less risk. Still another course of action may better suit the company's long-range objectives.

Like other management situations, developing plans for situations involving water pollution problems are often active not static, with new factors being continuously introduced. In the Reserve Mining Company situation described in the preceding section, management reviewed the

alternative courses of action open to them. They decided that the best course of action would be to argue for a comprehensive clean-up programme involving all industries and municipalities discharging waste into Lake Superior. Since there were 61 other industries and 93 municipalities discharging waste into the lake, they felt it would be best for the Reserve Mining Company to take a position that all companies in the area had a part in the pollution of the waters and, therefore, had equal responsibility in providing treatment facilities for eliminating water pollution.

But remember, no matter how carefully a manager has evaluated a particular situation, his decision may be wrong, for some factor may have been overlooked or new circumstances may develop.

Selection of a Course or Courses of Action

The fifth planning step is that of selecting the courses of action to be undertaken. This is the point at which the plan is adopted. This step is very close to the preceding step. In the example given above the course of action was decided upon during the evaluation or shortly thereafter.

Often an analysis and evaluation of available alternatives will show that two or more courses of action are advisable and the manager concerned may decide to do several things rather than the one best thing.

Formulation of Necessary Derivative Plans

Eventhough one has gone through all of the above steps, in many cases the planning process is not complete. In this case, once a plan is adopted, there are almost invariably necessary derivative plans to be constructed to support and supplement the basic plan. In addition, it may be necessary to develop new policies and procedures for carrying out the plan. Also, plans require a breakdown into subsidiary plans which will be carried out by different departments of the company. These plans will work together to formulate the one basic plan decided upon.

Problems in Planning

What are the major problems encountered in formal planning ? The most frequently cited was getting operating managers to accept planning as part of their job and to do the planning for their areas of responsibility. This was based on a survey of 36 companies. About four in ten planners pointed to the problem of getting the support of top management for corporate planning. Acceptance of planning, then by operating management and corporate mangement, is the most frequently cited major problem in the planning efforts at these companies.

The following is a list of the most crucial problems faced in corporate planning :

	Frequency
Getting operating management's acceptance of and participation in planning	19
Getting corporate management's support for planning	14
Inadequate thinking in terms of the future and inferior understanding of what is most important to long term success	13
Lack of realism and conciseness in plans due to lack of analytical thinking	13
Need for improved forecasting and for higher quality informational inputs	13
Need for improved planning in functional areas	4
Need to use the plans for monitoring and control	3
Inability to predict the likely actions of government agencies and other political bodies	3

Moreover, some of the other major problems that planning executives cite appear to be related to acceptance of formal planning by management. Two problems mentioned quite frequently were inadequate thinking about the future and poor understanding of the factors most important to the

company's long term success, and lack of realism and conciseness in plans due to lack of analytical thinking.

It would appear that management's unwillingness to accept formal planning has affected the way planning tasks are performed, the amount of effort that is going into planning for the future relative to enhancing short run performance, and the quality of the planning job.

Features of a Good Plan

A plan of action is very useful. But before taking action it is necessary to know what is possible and what is wanted. It is known that an absence of planning leads to hesitation, false steps, untimely changes of direction, etc. In many cases experience is the only thing that finally determines the true value of a plan. But, there are certain broad characteristics on which general agreement may be reached beforehand without waiting for an answer by experience.

Unity of plan is one way. Only one plan can be put into operation at a time. Two different plans would mean duality, confusion and disorder. But a plan may be divided into several parts. But in this case all these parts are linked together so as to make up onlyone. Every modification brought on any one of them is given expression in the whole plan. The action of the plan must be continuous.

Another good point about a plan is to have as much accuracy as possible, taking into consideration the unknown factors that are present. Usually it is possible to mark out the line of proximate action fairly accurately, but before the time for their execution arrives, sufficient enlightenment will have to be developed to settle the line of action more precisely. When the unknown factor occupies a relatively very large place there can be no preciseness in the plan, and then the concern takes the name of venture. While different factors arise, the plan should be flexible enough to bend before such adjustments.

How Far into the Future ?

Certain characteristics of every business must be identified in order to

determine what needs to be planned and for what period of time. Deciding on a range of time for planning is associated with the problems of evaluating the success of a manager. If one evaluates a man's work today the result may be different than the result of an evaluation in 5, 10 or 25 years. In formulating objectives, the manager must visualise the results as he expects them to be in the future. The range of time to be considered is a decision of large consequence in formulating a plan. Planning has to do with identifying what Peter Drucker calls the futurity of today's decisions. There are some guides to be followed in deciding the length of futurity appropriate for the plans of a particular business or special unit within a business[7].

There are certain characteristics of the operations of each firm that lead to the selection of a particular span of time for planning. Factors which lead to a selection of the proper planning time span are the following :

1. *Lead time*—This is the length of time it takes from the realisation that major new products are needed to the completion of their design, production, and distribution, plus a major period of utilisation before the product is declared obsolete.

2. *Length of time required to recover the capital funds invested in plant and equipment and in training skilled personnel*—A plan should provide for recovery of the capital funds invested in the actual physical construction of the plant and equipment and in hiring and training managers and skilled personnel. For example, a firm with a heavy investment in manufacturing and other facilities would have to base some of its plans on a period of time during which the machines would remain useful. Often this time span would be well in excess of the time required to manufacture one line of products.

3. *Expected future availability of customers*—For manufacturers of machinery and equipment used by other manufacturers, this is the time period up to the expected obsolescence of the customers' products.

4. *Expected future availability of raw materials and components*—If it takes 99 years to grow a forest to replace the trees a company uses in its manufacture of wood products, someone has to think about planting

7. Thompson, *How Companies Plan*, p. 23.

seedlings now. In this area, the planning span would be 99 years. Research may possibly shorten such long planning spans by providing entirely new raw materials[8].

As previously stated, one useful concept in determining the planning span is lead time. Lead time should be defined in relation to the kind of action one is willing to take. In situations where the process of production or transportation is familiar, lead time is readily determined. For example, if a ship takes five days to cross the Altantic and five days are needed to load and unload, the lead time is ten days. Lead time, therefore, may be best defined as the period between decision and arrival at the final results. If routine methods are used, the period or range of time would be considered normal lead time.

With respect to planning, the appropriate ranges of time may also be described in terms of lead time. If, for instance, the building of facilities is being considered, you could express the lead time required to decide what to build and where to build, plus the time needed to complete the construction.

Conclusion

Planning has been viewed as the process of determining a desirable future condition, and deciding how to proceed from an existing state to the desired state. In corporate planning, the process of setting goals and mapping paths is performed within the context of an economic subsystem, the firm, which is organised to convert certain inputs into outputs. This subsystem is integral to a number of subsystems.

All corporations have a basic objective, production of goods or services. But there are countless ways of expressing this objective. In some cases, objectives are subjective and nonquantifiable ; in others, they appear in terms of specific goals. Some planning can be, and indeed is undertaken on a nonquantified basis. But in many cases, objectives can be put in terms of measurable, or numeric goals[9]. □

8. Ibid., p. 25.

9. M. F. Elliott-Jones, *Economic Forecasting and Corporate Planning*, The Conference Board, Inc., Report No. 585, 1973, p. 6.

Export Marketing in the Eighties : Challenges and Opportunities

R. L. Gulati*

It may not be out of place to start from the proposition why we should export. Through exports of goods and services, a country earns foreign exchange or a right to purchase all goods, services and technologies from other countries. Since in a dynamic world, economic progress is continuous and new ideas, processes and technologies are being evolved in other countries, it is imperative to keep in touch with these and import them to improve the production and standard of living of the people, which, in final analysis, is the essence of economic development. In order to achieve this, a progressive increase in exports is necessary so that a country is able to pay for its import of materials, technologies and processes not available within its national boundaries.

Significant Export Performance

An analysis of the trends of our export trade during the last decade reveals that there has been a continuous increase in export earnings of the country over the years. The year 1976-77 witnessed remarkable shift in India's balance of trade from the previous year's heavy deficit of Rs. 12,430 million to a surplus of Rs. 720 million (provisional). Ever since India's Independence, balance of trade remained adverse with the exception of the year 1972-73 and thereafter in 1976-77 when exports exceeded the level of imports. Exports (including re-exports) during 1976-77 reached a total of Rs. 49,810 million showing an increase of 23.8 percent whereas imports at a level of Rs 4,908 crores were lower by 6.8 percent as compared to the previous year.

The performance of exports during the year was particularly significant in a number of manufactured/semi-manufactured products like iron and steel, engineering goods, cotton textiles, gems and jewellery and leather and leather manufactures. Even in regard to primary products, the overseas demand was fairly buoyant in certain items, viz., tea, coffee, oilcakes and fish, either for reasons of shortages or revival of world demand.

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As regards the directional pattern, the USA, Japan, the USSR, the UK and Iran constituted the first five major markets of Indian exports during 1975-76. During the first 10 months of 1976-77 as compared to the corresponding period of the previous year, India's exports to the USA increased by 15.6 per cent, to Japan by 32.3 per cent, to the USSR by 8.1 percent, to the UK by 31.1 per cent.

Over the last few years, newer items of manufacture and finished products have assumed greater significance in the development of India's export trade. As an illustration, the combined share of engineering goods, iron and steel, chemicals and allied products, clothing, finished leather and leather footwear in India's total exports was 13.4 percent in 1968-69 but by 1975-76 this share increased to 20.9 percent. During the first ten months of 1976-77, it moved up further to 28.2 percent. During this period the exports of engineering goods alone registered almost eight-fold rise from Rs. 670 million in 1968-69 to an estimated value of Rs. 5,500 million in 1976-77. Besides exporting a wide range of sophisticated engineering goods, India has been able to make significant progress in the fields of project exports, civil engineering construction contracts abroad and providing consultancy services in several developing countries.

As a matter of policy, increasing stress is being laid on the exports of more value-added items such as finished leather and manufactures of leather, instant tea, packaged tea, and tea bags, instant coffee, jute, decorative fabrics, fine and superfine cloth and garments.

Proportionately, the growth of exports in the last few years was confined more to free currency area and trade with rupee-payment countries ceased to grow as fast as hitherto. Over the level of 1974-75, exports to North America during 1975-76 increased by 31.3 percent, to ESCAP by 29.3 percent, to Asia and Oceania by 12.4 percent, to Africa by 13.8 percent, to EEC by 17.2 percent, whereas the exports to East Europe were moderately lower by 1.2 percent. During the first ten months of 1976-77, exports showed pronounced rise particularly in the case of EEC and Asia (mostly West Asia) with increase of 65.2 percent and 81.4 percent respectively, the increase in other regions being : North America 16.5 percent, ESCAP 10.2 percent, Africa 18.1 percent and East Europe 13.9 per cent. India's trade with West Europe has generally been adverse, but it would be interesting to note that during

the first ten months of 1976-77 the balance of trade had tilted in India's favour. At present, the USA is our number one trading partner. There has been a great deal of diversification in trade and future holds a great scope for exports to Gulf countries, South East Asia, Far East and Australasia, Africa, Latin America and East European countries in view of the intensive development programmes being launched by them.

For promoting exports, efforts have not only been made in the domestic field but steps have also been taken at the international level. Apart from extending and developing economic cooperation with developing countries, India has supported both at regional and international level, the formation of commodity associations and arrangements particularly in respect of iron ore, pepper, jute, etc. Efforts continue to be made in different international forums for obtaining better access in the markets of developed countries through extension, expansion and enlargement of G. S. P. and similar trading arrangements. Needless to stress that the export sector offers a great potential for future growth.

A significant change in the sphere of exports is the growth in the relative importance of the items with a high degree of technical inputs and services. There has been a noticeable shift from the traditional exports of commodities and simple manufactures to those of engineering goods including consumer durables as well as capital goods and contracting and consultancy services. The continuous rise in exports from year to year, diversification in terms of markets and product coverage, and the expanding share of value-added items and services are the result of meticulous planning, policy responses to changing internal and international market developments and, above all, of dynamic leadership at the top.

Export marketing is a complicated operation, as it involves doing business with foreign firms and organisations in an atmosphere of competition both from local manufacturers and from manufacturers of other countries. Trading conditions as well as government policy affect the marketing strategy. Basically, information on which goods will be saleable in a particular market and under what conditions, will have to be acquired before a marketing strategy can be formulated for the future. Incidentally, a national trade information centre is going to be set up soon.

Both Challenges and Opportunities

Marketing in its diverse aspects has received constant attention at the hands of many exporting countries. Now, when India is poised for the sale of manufactured products (both consumer goods and capital goods) the problem of overseas sales becomes highly important and calls for urgent attention. Pertaining to various aspects of overseas sales in the 80's we will have to face many challenges. Opportunities, of course, would be galore at the same time as nations all over the world would have made rapid advances. The problem, no doubt, would differ widely from product to product and market to market Hence no one solution can be suggested to fit all situations. An important requisite, however, is that the Indian manufacturer on one side and the government of India on the other become conscious that export marketing is a key factor in developing exports and that it involves considerable initial expenditure both in terms of rupees and foreign exchange.

Emphasis on Marketing

With regard to "Export Marketing in the 80's", increasing competitiveness in the international sphere, emphasis on marketing rather than purely exporting, market information, foreign exchange regulations and availability, a large trained workforce in export marketing, pre and post-shipment export credit, international legal regulations, tariff and other hurdles seem to be some of the factors that will have to be reckoned with. It would not be a question of exporting only finished and semi-finished goods and components and ancillaries but also providing consultancy services, handling turn-key projects and entering into joint ventures in the third countries. Happily the record for India in handling turn-key projects and setting up joint ventures not only in the co-developing countries but also in the developed countries is a commendable one.

In the 80's, it will not only be the developed markets that will have to be considered but also the expanding markets of developing countries, their needs and requirements as they will be completely different by that time. We will have to cater to the changing needs and developments taking place in the production of various products. Because product decisions play an important role in the export marketing strategy and because they usually involve large, long-term financial commitments and often serve as

points of orientation for designing other elements of the export marketing plan, they will have to be considered with great care. Product policy decisions for export markets will have to deal with such major questions as product or product line to be marketed in a foreign country, relationship among products in a product line and relation to foreign competitive products, addition of new products and the review of the existing products, evaluation of product sales and profit performance, and analysis of product life-cycles All product decisions of particular importance for India's exports are the cultural differences in foreign markets which determine the foreign customers' reaction towards the products. The major aspects which will have to be considered in planning the product mix for foreign markets include the colour design of the product, and designing the products in a manner that it suits the taste of the foreign buyer. In nutshell, foreign consumer characteristics and product characteristics will have to be matched. The product would have to reflect the foreign market requirements for value, quality and utility. Packaging for the product will have to be such that it adequately protects the product as well as becomes appealing to the consumer. Packaging design can advertise, be informative and should identify the product.

For exports in advanced countries, specifications and requirements will be more exacting in the 80's. We will, therefore, have to orient ourselves to greater sophistication and precision. The product planned and developed, for instance for the US or the USSR markets, would particularly require adjustments to meet the requirements of the consumer in that specific foreign market. It is rare that an Indian manufacturer produces a product or a line of products exclusively for export. Where it is done, it is only there that the volume of sales would permit volume production. Indian products, therefore, will have not only to be modified to meet market demands abroad but product labelling also will have to accord with local laws.

Need for Constant Innovation

For enhancing exports, the manufacturers will have to keep in mind the constant need for innovating new products, improving and adding new features to existing products and eliminating obsolescent products. Further, it is not the question of once-for-all sale of the product. Provid-

ing after-sales service in the country of export would be very essential.

Another factor which is most important is "Inter-communication" amongst the developing countries so that they are kept informed of the developments taking place in one another's country. Needless to say that providing of financial and technical assistance for meeting competitiveness in the developed countries will have to be the order of the day amongst the developing countries. It is not only the export strategy but the commercial credit, fiscal, the industrial and agricultural policies which will have to be juxtaposed in such a manner amongst the developing countries that they are able to face not only the international liquidity question but also the competitive aspect of the developed economies in all spheres of economic development.

Since shipping is important from the point of view of the country's balance of payments, a reduction in freight rates would be very useful to developing countries. In the immediate future there will be an absolute need to raise substantially the shipping tonnage for removing shipper's difficulties relating to shipping space, regularity and frequency of service, and port coverage, etc. The ratification of the UN Code of Conduct for Liner Conferences is called for because it has a vital bearing, among other things, on the level of freight rates charged by Conference Lines.

All said and done, policies must be devised to develop the production of the items in which the country has long-term comparative advantage and which will enjoy strong demand abroad for a long time, to build up production on a sufficiently large scale, to restrain domestic consumption if there is not enough to go round and to improve efficiency of production to match the competitors, and lastly to create an image and impact on the international market.

To conclude, the export marketing strategy in the 80's will call for all the ingenuity and efficiency that a government can muster, all the competitive efficiency and devotion that industry and trade can harness, all the cordiality that labour-management relations can reach and all the self-denial that the common citizen can stand and also all the coordination and cooperation which the central, state and local governments can attain. □

Critical Factors Affecting Capacity Utilisation in Iron & Steel Industry in India During 1955-66

K. R. Shaligram*

The economic development of a country is often measured in terms of the per capita consumption of steel in that country. As steel is a crucial input to most industries, the performance of the Indian industry as a whole is very much dependent on the performance of the Iron and Steel Industry. The paper examines one measure of performance, namely, capacity utilisation and highlights the factors affecting capacity utilisation in the Iron and Steel Industry during the period 1955-66.

Constitution of Iron and Steel Industry

The iron and steel industry is constituted of the integrated steel plants and the mini-steel plants. The technology of steel making in the integrated steel plants, however, differs considerably from the technology in the mini-steel plants. The capital intensity and scale of operations in the two cases are also quite different. The period of 1970's was characterised by two unusual phenomena. The first, in chronological order, was the widespread sickness in the mini-steel industry. The mushroom growth in the number of mini-steel plants in the late 1960's and early 1970's led to a scarcity of inputs which rendered many of these units idle or largely idle in the early 1970's. The second phenomenon was the commissioning of the giant modern integrated steel plant at Bokaro. The period 1955-1966 was chosen deliberately, because during this time the constituent iron and steel plants of the industry were, mainly, the integrated iron and steel plants. It may also be noted that the integrated iron and steel plants contribute the major share of the total steel output even now. The devaluation of the Indian rupee in 1966 was an important economic phenomenon because this was expected to boost India's exports relative to imports.

Table 1 shows that, following devaluation, there were net exports of finished steel. This is one more reason for restricting the period of study upto 1966.

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Table 1

(In '000 Tonnes)

Year	1954—55	1955—56	1956—57	1957—58	1958—59	1959—60	1960—61	1961—62	1962—63	1963—64	1964—65	1965—66	1966—67	1967—68	1968—69	1969—70
Net Imports Finished Steel	299	719	1348	1254	855	825	1236	998	862	856	853	594	154	—73	—297	—320

Source : Liedhom, C., *The Indian Iron and Steel Industry : An Analysis of Comparative Advantage*, Division of Research, Graduate School of Business Administration, Michigan State University, East Lansing, 1972, p. 10.

The above table is computed from data available from this source.

Salient Features of Production Process in the Integrated Steel Plants

The process of steel making in the integrated steel plants consists of two stages. In the first stages, pig iron is produced in the traditional blast furnance process. In the second stage, the pig iron in the molten condition is directly converted into steel in a steel-making furnace. Conversion of molten pig iron into steel results in conservation of thermal energy which is the principal rationale for the integrated steel plants. As steel making moves to the second stage, the capacity utilisation in the first stage, namely, the blast furnace process, affects the capacity utilisation in the steel making process also. Iron and steel plants, due to the capital intensity, and the need for thermal efficiency are operated continuously unless the furnaces have to be given a new refractory lining or for some other major reasons. Even during periods of strikes the furnaces are maintained at high temperature conditions by firing fuel, although there is no output.

Capacity Utilisation and Probable Causal Factors

Capacity utilisation is an operational efficiency index. It is defined as a ratio of output to capacity. The measurement of capacity poses a

problem regardless of whether the economists' definition or the engineers' definition is adopted. The concept of rated capacity is in vogue which is an engineering definition[1]. As published data refer to the engineering definition, this rated capacity will be the basis of this study.

The measurement of output is also complicated in the integrated steel plants for the following reasons : The output of the blast furnace is pig iron, slag and gas. The rated capacity of the blast furnace is, however, defined with respect to output of pig iron only. The blast furnace requires iron ore, coke, limestone, fluorspar (in small quantities), air, water, etc. as inputs. These inputs being mainly of mineral origin naturally vary in chemical composition. Thus, variations in the composition of the iron ore will render the total charge variable in "quality"[2]. Similarly, the quality of coking coal has been known to affect the quantum of output of pig iron in the blast furnace process. To be precise, coke with a high ash content[3] requires more of limestone as flux. When the proportion of fluxes in the total charge increases, the proportion of iron-bearing iron ore naturally decreases and the output of pig

1. "Rated Capacity is an ambiguous concept that varies from mill to mill" W. A, Johnson, *The Steel Industry of India*, Harvard University Press, Cambridge, Mass. 1966, p. 146.

2. In explaining the setback in production at Tata Iron & Steel Company (TISCO) in 1958-59, deterioration in quality of ore and coal were mentioned. The company had to draw its ore requirements to an increased extent from the Noamundi mine. The ore from this mine having larger alumina content rendered the blast furnace slag viscous and interfered with satisfactory blast furnace practices. Directors' Report, *TISCO Annual Report* (1958-59).

3. The Chairman of Tata Iron & Steel Company (TISCO) stated that the main obstacle which equally affects the operation of the other major steel plants in the country both in the private and state sectors continued to be the high ash content in coal. For every 1% increase in the ash content of *coal* the production of pig iron at the blast furnace declines by 5% or more, while consumption of *coke* and *limestone* increases by 5%. Operations are thus doubly penalised. Furthermore, as TISCO had not provided for spare coking capacity (due to financial constraints) the higher *coke consumption per ton pig iron* meant that the company would run short of coke and would have to supplement it by outside purchase which is not always possible. Chairman's statement, *TISCO Annual Report*, 1960-61.

   The average ash content of coal received by the Indian Iron & Steel Company (IISCO) was as follows : 18.22% (1963), 18.76% (1964), 19.55% (1965), 19.72% (1966), 18.86% (1967). The magnitude of the problem of increasing ash content of coal would be realised when it is remembered that an empirical formula applicable to IISCO equates a rise of 1% in the ash content of coke with a reduction in output of 4.5%. The latter percentage represents 45,000 tonnes of ingot steel per annum." Director's report, *IISCO Annual Report*, 1965-66.

iron also declines with attendant increase in slag formed. The Indian limestone contains excessive amounts of "insolubles" tending often to change the steel making into slag making[4]. These effects are due to the heterogeneous nature of the inputs.

The quantity of pig iron output also varies, depending upon the grade of pig iron that is required to be produced; and this is a deliberate operating practice because a blast furnace admits the production of a wide range of pig iron of differing quality.

Ideally, capacity should be defined for each blast furnace for specified quality of inputs and output. In practice, because rated capacity is defined for an average quality of input, variations in chemical compositions of inputs are reflected as variations in capacity utilisation. This crucial technological feature is the basis for the principal hypothesis proposed in this paper.

Another major factor responsible for the extent of capacity utilisation appears to be transportation. According to the Chairman of the Tata Iron & Steel Company (TISCO), improvement in quality of iron ore despatched from the mines, and ensuring regular supplies of properly blended and sized ores to the plant to suit the exact requirements of the blast furnaces are both important. The company had been able to do so in the past, without elaborate storage and blending facilities because of the good quality of the hand mined ore, the reasonably low percentage ash in coal and the regular transportation provided by the railways. These conditions had changed. The strain imposed on the railways due to massive increase in the transport of ores and coal for the expanded steel industry, the steel companies could no longer be sure of the consistently regular arrival of raw material trains which are absolutely essential to good operations when raw materials are fed straight into the plants from incoming wagons without prior stacking[5]. Six years later, Johnson observed :

> "India's steel mills have, for the most part, been given priority over other customers by the railways. Rather, primary blame for the

4. Chaudhuri, M. R., *The Iron and Steel Industry of India : An Economic Geographic Appraisal*, (second edition), Calcutta : Oxford Book Company, 1975, p. 213.

5. Chairmans' statement, *TISCO Annual Report*, 1959-60.

mills' transportation difficulties was attributed to the "bunching" of wagons, receipt of the wrong types of wagons, and mixing of different types of wagons in the same train and of different types of coal in the same wagon. These practices were probably encouraged by India's wagon shortage.

India's steel mills have been designed to handle a specific number of wagons at any one time. Unfortunately, the movement of wagons to and from the mills have been erratic, especially during the early 1960's. Several trainloads of a particular raw material may arrive within a short time of one another and then may not be followed by other trainloads for a long period of time. The bunching of wagons has resulted in the levy of demurrage, a charge placed on the mills by the railways for unusual detention of wagons. Bunching has also made it difficult for Indian mills to consume desired blends of coal. Frequently, excessive amounts of one type of coal have been shipped to a mill, and, because of limited storage space it has, necessitated coking in proportions different from those desired. The result is the production of coke not always ideally suited to the blast furnaces of India's mills. Bunching has also resulted in occasional crisis or near crisis accompanying the diminition of the plants' stocks of raw materials. In a few extreme instances stocks of certain raw materials have fallen to as low as one day's supply[6]."

Other plausible factors causing variations in capacity utilisation are the output of iron ore, coal, limestone and power which are important inputs to the iron and steel industry. Labour relations and absenteeism are also likely to affect capacity utilisation. Demand for steel is another likely causal factor.

The Chairman of TISCO aptly summed up the situation as regards capacity utilisation in the iron and steel industry when he observed :

"The continuous operation of a steel plant at its maximum capacity depends on such a perfect balance and coordination between diverse elements of production, transport, labour and management, covering the operation of so many separate departments and units of plants,

6. W. A. Johnson, *op. cit.*, p. 168.

that it is rarely achieved on a year-round basis .. ..[7]."

The foregoing qualitative opinions and observations regarding the functioning of the Indian Iron and Steel Industry are indicative of the utility of a quantitative examination of the following hypotheses.

The capacity utilisation in the Indian Iron and Steel Industry during 1955-1966 has been affected by :

1. Technological constraints imposed by varying quality of raw materials (principal hypothesis),

2. Inadequate quantum of output of iron ore, coal, limestone and insufficient power generation which are inputs for the iron and steel industry,

3. Poor industrial relations as reflected in absenteeism,

4. Inadequate transport of raw material inputs to the steel plants,

5. Fluctuations in the demand for steel.

Methodology, Data and Data Sources

It is proposed to make a study of capacity utilisation in the aggregate iron and steel Industry. The multivariate regression analysis methodology will be adopted to study the various factors causing capacity utilisation in the aggregate. The aggregate causal variables on which data were assembled are the following :

1. Iron ore consumption per tonne of pig iron produced (abbreviated as ORE/PI),

2. Coal consumption per tonne of pig iron produced (abbreviated as COAL/PI),

3. Iron ore mined (production), (IOM),

4. Coal mined (production), (CM),

5. Limestone mined (production), LM,

6. Power generated, (PG),

7. Chairman's statement, *TISCO Annual Report*, 1959-60.

7. Absenteeism in iron and Steel Industry, (ABS),
8. Railway wagon loading (Manganese Ore/Iron Ore), (abbreviated as WAGONS ORE),
9. Railway wagon loading (coal/coke), (abbreviated as WAGONS COAL),
10. Index of industrial production, (IP).

These variables numbered 1 to 10 will hereafter be referred to as causal variables. Causal variables 1 and 2 are indicative of the quality of iron ore and coal. The lower the iron ore consumed per tonne of pig iron and the lower the coal consumed per tonne of pig iron the better the quality of these raw materials. The quantum of coal consumed per ton of pig iron can also be reduced by substituting liquid fuels for coke in the blast furnace. Thus, this same variable also represents technical progress as regards blast furnace practice. The steel industry in Japan has achieved excellent results in the technology of blast furnace operation by partly substituting coke with liquid fuels. Reducing the quantum of iron ore consumed per tonne of pig iron can be indicative of the extent of substitution of sinter[8] for iron ores. This is again a fairly recent innovation in blast furnace practice in India. Both causal variables 1 and 2 are expected to be negatively related to capacity utilisation, that is, the lower the value of these variables the higher the capacity utilisation.

Causal variables 3, 4, 5, 6 and 7 are indicative of the primary supply of inputs. Except absenteeism which is expected to have a negative relation, all the others are expected to have a positive relationship with capacity utilisation.

Railway wagon loading is indicative of the secondary supply of inputs. By 'secondary' what is implied is that it is not just sufficient to mine iron ore, coal etc., but it is also necessary to transport the same to the steelworks in time. The greater the number of railway wagons loaded with raw materials and delivered to the steelworks, the greater the capacity utilisation possible.

The index of industrial production is expected to be indicative of the demand for iron and steel. The data on these variables and data sources are included in Tables 2 and 3.

8. Sinter: Sintering is a process of agglomerating a mixture of iron ore fines and flux (usually limestone fines) under high temperature conditions. In simple terms, sinter may be defined as a processed mixture of iron ore and flux.

Table 3

Year	CU_{PI} a	CU_{FS} b	ORE/PI c	COAL/ PI d	IOM '000 M.T.	CM '000 M.T.	LM '000 M.T.	PG Lakh KWH	ABS %	WAGONS p ORE '000 Ns.	WAGONS q COAL '000 Ns.	IP r
1955	.854	.728	1.683	1.38	361e	3242g	624i	7057k	11.4m	23.7	97	73
1956	.882	.773	1.673	1.22	360	3346	669	8009	11.6	27.9	104	79.2
1957	.861	.778	1.713	1.27	392	3691	798	9029	12.7	30.7	110	82
1958	.758	.751	1.697	1.2	485	3847	878	10201	14	30.1	113	83.4
1959	1.104	1.003	1.447	.96	667e	3993g	903i	12130k	12.2	42.5	120	90.7
1960	1.483	1.253	1.076	.71	890f	4385h	1061j	13694l	12	50	132	100
1961	.884	.795	.962	2.6	1023	4675	1216	15926	12.5	55.1	153	109.2
1962	1.027	1.055	1.619	1.09	1114	5129	1409	17894	12 3m	64.7	161	119.7
1963	1.17	1.189	1.78	1	1244	5577	1437	20659	11.5n	68.4	174	12.97
1964	1.168	1.213	1.73	.73	1242	5333	1410	23773	11.7	71.1	167	140.9
1965	1.232	1.262	1.594	.81	1408	5788	1656	26148	11.3	79.3	192	153.9
1966	1.248	1.232	1.674	.73	1664f	5878h	1624j	28457l	12.8n	79.1	193	152.4

Source ; (i) Government of India, *Monthly Statistics of the Production of Selected Industries in India*, Vol. XV No. 1, Jan. 1963.

(ii) ,, ,, Vol. XX No. 7 Jul. /Aug. 1968

(iii) Government of India, *Monthly Abstract of Statistics*, Vol. No. 17, Jan. 1964.

(iv) ,, ,, Vol. 23. No. 1, Jan. 1970.

(v) National Productivity Council Research Report, Productivity Trends in Iron and Steel Industry in India, Hind Union Press, New Delhi, 1974, pp. 38-39.

Abbreviations used in the text

(a, b) computed from Table 2
(c, d) from source (v), pp. 38-39
(e) from source (i), p. 1
—figures converted from British tons to metric tonnes
(f) from source (ii), p. 1
(g) —figures converted from British tons to metric tons
(h) from source (ii), p. 1
(i) from source (iii), p. 5
(j) from source (ii), p. 6
(k) from source (i), p. 63
(l) from source (ii) p. 108
(m) from source (iii), p. 3
(n) from source tv), p. 3
(p, q) reproduced from Table 2

(r) fromTable 2 : The Index of Industrial Production series has been expressed entirely with the base year 1960.
(Data in columns ef, gh, ij, kl are monthly average figures)

Findings

The variable 'capacity utilisation in the pig iron making process' and the variable 'capacity utilisation in the steel making process' were separately regressed on various combinations of the causal variables listed earlier. For each combination of causal variables the linear, semi-logarithmic and double logarithmic functional forms were tried.

Iron ore mined, coal mined, limestone mined, power generated, railway wagon loading(coal coke), and index of industrial production did not prove to be statistically significant causal variables. The best functional form to explain 'capacity utilisation in pig iron making process,' (CU_{PI}) is as follows :

$$(\log CU_{PI}) = \underset{(2.4)}{\hat{1.61169}} - \underset{(-5.3)}{\hat{0.456664}} (\log ORE/PI)$$

$$- \underset{(-7)}{\hat{0.403258}} (\log COAL/PI) + \underset{(3.6)}{\hat{0.14632}} (\log WAGONS\ ORE)$$

$$- \underset{(-3.1)}{\hat{0.769857}} (\log ABS)$$

(figures in parentheses are t ratios)

$n = 12$

$R^2 = 0.961218$

F (with degrees of freedom 4,7) = 43.3746

Durbin watson statistic = 2.69636

The best functional form to explain "capacity utilisation in the steel-making process," (CU_{FS}), is as follows :

$$(\log CU_{FS}) = \underset{(0.05)}{\hat{0.0227916}} - \underset{(-3.2)}{\hat{0.186604}} (\log ORE/PI)$$

$$- \underset{(-10.1)}{\hat{0.351966}} (\log COAL/PI) + \underset{(11.3)}{\hat{0.306429}} (\log WAGONS\ ORE)$$

in this paper are static representations of dynamic systems. Depending upon the prevailing conditions the determinants of capacity utilisation are, therefore, liable to be different from those effective during 1955-66.

If we assume that the conditions prevailing in 1955-66, continue in the ensuing period also, what are the implications ? To manage the task of improving capacity utilisation in the iron and steel industry, the following steps seem appropriate. Efforts must be made to reduce absenteeism in the iron and steel industry.

Measures to reduce the ore to pig iron ratio and coal to pig iron ratio would also be necessary. These ratios can be reduced by washing of ore and coal to improve their quality. Progress in this direction has been made already but the washeries have not yet proved to be commercially very successful. Thus, further progress in the technology

$$\hat{\Lambda} = -0.451375 \text{ (log ABS)} \qquad n = 12$$
$$(-2.7) \qquad r^2 = 0.986296$$

(figures in parentheses are t--ratios)

F(with degress of freedom 4,7)=125.95

Durbin Watson Statistic=2.17961

of washing would require extensive research. The use of iron ore sinter to substitute iron ore is, on the other hand, a feasible proposition for reducing the ore to pig iron ratio and, consequently, reducing the coal to pig iron ratio as well. It may be noted that the blast furnaces at Bokaro are designed to consume a larger proportion of sinter in the total charge.

The foregoing measures are, to a large extent, within the jurisdiction of the managements of the steel plants. The following requirement illustrates the fact that factors external to the steel industry nonetheless can have profound influence on the working of the steel industry. Specifically, transportation is one such factor. There is an urgent need to increase the number of iron ore wagons loaded. A 1% increase in the number of iron ore wagons loaded would result in a 0.14% increase in capacity utilisation at the blast furnace stage and a 0.31% increase in capacity utilisation at the finished steel stage. These regression estimates help in arriving at this conclusion. However, unless a detailed study at the plant level is conducted, it might be erroneous to recommend that the Indian Railways should acquire more iron ore wagons. The problem might perhaps be due to poor scheduling of wagons and trains. There has been some concern in the Railways for the poor turnaround of wagons. The much-talked-about unit-train concept (that is, a complete train with all wagons containing the same raw material, obviating the need for detachment and attachment of wagons) appears to merit examination[9].

This paper was conceived from a belief that a combination of technical and economic factors are jointly responsible for the capacity utilisation in the iron and steel industry. This has been borne out to some extent by the findings. Some hypotheses which have not been examined in this paper are the following :

1. The net import of steel into the country for a fairly long period of time gave a fillip to the Indian Iron and Steel Industry to raise capacity utilisation.

2. The government price policy on steel restricted the extent of capacity utilised.

9. Chaudhuri, M. R., *op. cit.* p. 218.

Examination of these hypotheses would throw further light on the capacity utilisation in the Iron and Steel Industry in India. □

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Productivity, Gains and Accounting for Growth in Indian Railways (1951-74)

S. Kishan Rao*

Today the Indian Railways are Asia's biggest and World's fourth largest railways. Since it is the nation's biggest enterprise having direct and indirect bearing on the development of the economy, it is desirable to analyse and review its performance during the four Five-Year plans. The paper sets out to present trends in partial and total factor productivity, productivity gains as well as accounting for growth in the Indian Railways during 1951-74.

The study is broadly divided into three sections. The first section deals with some of the theoretical issues connected with the concepts of productivity and the methods to measure productivity ratios. In the second section, we discuss the adjustment of data and the limitations. Productivity trends and the relative gains are analysed overtime. The last section is concerned with what is now popularly known as accounting for growth. It deals with the contribution of inputs and output per unit of input or the so-called "Residual" to the growth of Indian Railways.

Concepts, Definitions and Measurement

Partial and Total Productivity : Productivity is often measured as output per unit of input. We may have as many indexes of productivity as there are factors of production. While each index has its own use, the most important and often used are the partial productivity indices of labour and capital and total factor productivity index. Labour and capital productivity indices measure average products of labour and capital. Total factor productivity which is also termed as "residual" or "measure

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The present study is prompted by the inducement given by the useful literature on quantitative research specially the works of Kendrick (1961), Sinha & Sawhney (1974) and Denison (1962, 1974). Though I have liberally made use of their methodology, I alone am responsible for errors and omissions. I am thankful to Prof. V. N. Kothari of M.S. University of Baroda and Dr. A. Nagaraj of Osmania University, for helpful suggestions on an earlier draft.

of our ignorance" or index of technical progress is output per unit of combined labour and capital input. To quote Kendrick (1961), this measure is obtained by comparing "actual real output of II with what the output of the factors would have been in II had the productive efficiency of I (real input) prevailed".

The reciprocals of partial productivity ratios are useful to measure saving in the inputs over time. But these ratios do not measure overall changes in the productive efficiency since they are affected by changes in the composition of input, i.e., factor substitution. Output per unit of labour (labour productivity) may rise due to substitution of capital for labour as well as increased efficiency of production in general. Hence to measure net saving in factor use and thus the increase in overall productive efficiency, output should be related to all the inputs. In the total productivity indices, the effects of factor substitutions are cancelled out. In what follows, both partial productivity and total productivity indices have been constructed in the following way :

Partial Productivity indices :

$$P_L = \frac{V}{L} \qquad P_K = \frac{V}{K}$$

Total productivity Index :

$$P = \frac{V}{(L_X + K_Y)}$$

where P represents productivity ratio, V the output, L and K the inputs of labour and capital, x and y some appropriate weights.

Total productivity may be measured either (a) by dividing Gross Value Added (GVA at current product prices) by real labour and capital input at base period rates of compensation or (b) by dividing the index of GVA (at constant product prices) by the combined indices of labour and capital weighted by base period *respective* shares in GVA. It is interesting to note that both the measures yielded the same rate of growth of GVA and output per unit of input.

Output : The movement of productivity ratios depends on how output and inputs are defined and on the weigting system adopted. In the present analysis the concept of output has been taken as value added, since it refers to the true production assignable to the industry. Generally

GVA is measured by deducting the value of inter-industry purchases from the value of gross output both taken at their respective prices in the base period. This method is called double deflation. But this method does not yield the value always available for distribution between labour and capital within the industry. It is likely that the prices of inter-industry purchases have risen faster than output prices, so that real value (at constant product prices) accruing to the suppliers of raw materials would have decreased more than the index of material consumption (in real terms) and to that extent amount divisible between labour and capital in the industry would be more than GVA in real terms (cf. Sinha and Sawhney, 1970). Since the objective is to measure distributable output between labour and capital within the enterprise, this is measured by adding wages and surplus (at current prices) and deflating the amount thus available by product prices index.

Inputs : Since the inter-industry purchases have been eliminated by considering the incomes generated within the enterprise, the two main inputs will be labour and capital. Inputs may relate to the amounts available for or utilised in the process of production. To measure technical input-output relations, the latter concept is relevant. However, it should be noted that input is the time-flow of services of human and non-human factors available for use in the productive process. Unlike labour, capital stock is immediately available for use at all times. Hence, the rate of utilisation is not adjusted, counting this as an aspect of the efficiency with which capital is used (Kendrik, 1961).

Regarding labour, the stock available is the number of persons employed in the enterprise during a year. Flow of labour services can be computed in man-hours by multiplying the number of staff with average working hours. In the present study since working hours and mandays lost remained more or less constant, the number of persons is used as a measure of labour input.

Capital : For capital input, the data on gross fixed assets is used. No attempt to compute net capital series has been made. Notwithstanding the fact, though working capital plays an important role in any enterprise, it has been excluded from the present study. The relation of working capital is less influenced by technological factors than the relation of fixed capital to output. Besides, the amount of working capital depends not on the techniques of production used but on various

other factors such as integration.

Data and Variables

The main sources of data for the present study are Supplement to the Report by the Railway Board on Indian Railways-Statistical Statements and Block Accounts, Appropriation Accounts of Railways in India Part II Annexure 'G' These publications hereafter will be termed as Supplement and Block Accounts respectively.

The Indian Railways own and operate three independent manufacturing units, viz., Chittaranjan Locomotive Works, Integral Coach Factory and Diesel Locomotive works. Since these units produce capital items, we have omitted them and restricted the study to passenger and freight services alone.

From the Railway statistics, it is not easily possible to isolate the inter-industry purchases. Hence, the value of GVA is computed by adding wages and profits (surplus). These two terms are used to represent the respective shares of labour and capital employed in the enterprise. Wages include all monetary and non-monetary benefits accrued or deemed to have been accrued to the employees. They include salary, dearness allowance, other special allowances, overtime payment, subsidised food, medical and welfare benefits, contributions to provident fund, pensionary and gratuity benefits. Profits are the residue which remain after meeting the working expenditure. They include dividend paid to the Government of India, depreciation allocated and amounts ploughed back to various revenue funds. To obtain distributable output at constant rupees, wages and surplus are added (at current prices) which is equal to GVA (at current prices). The amount so obtained is then deflated by a composite index of fare and freight charges.[1] Table 1 presents wages, surplus and the product prices as well as GVA at current and constant rupees.

It is evident from the table that during the 23-year period, the product prices increased by about 73%. Upto the Second Five-Year Plan, the rise in price is moderate, but thereafter, there is a perceptible rise in prices.

1. For details on methodology, see the author's doctoral dissertation (1975)

Table 1 : Wages, Surplus, Product Prices and GVA at Current and Constant Rupees.

Year	*Wages*	*Surplus*	*GVA at Current prices*	*Index of product prices (1951-52 =100)*	*GVA at constant rupees of 1951-52 (Rs. crores)*	*Index of col. 5 (1951-52= 100)*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
1951–52	121.1	91.5	212.6	100.0	212.6	100.0
–53	125.6	77.0	202.6	104.2	194.4	91.4
–54	135.4	66.6	202.1	104.1	194.1	91.3
–55	140.0	74 1	214.1	102.9	208.1	97.9
–56	148.1	95.3	243.4	104.3	233.4	109 8
–57	155.6	103.1	258.6	106.2	243.5	114.5
–58	172.2	102.7	274.9	106.7	257.6	121.2
–59	183.4	104.2	287.6	107.0	268.8	126.4
–60	187.4	119.4	306.8	109.2	281.0	132.2
–61	203.2	132.7	336.0	112.0	300.0	141.1
–62	212.1	164.6	276.7	117.0	322.0	151.5
–63	231.2	190.3	421.4	123.2	342.1	160.9
–64	246.2	225.0	471.2	129.7	363.3	170.9
–65	284.5	201.1	485 6	132.5	366.5	172.4
–66	318.2	219.9	538.1	137.8	390.5	183.7
–67	346.2	214.0	560 2	140.0	400.1	188.2
–68	371.0	205.1	576.1	144.8	397.9	187.2
–69	395.4	237.7	633.1	151.8	416.8	196.1
–70	419.9	241.5	661.4	153.3	431.4	202.9
–71	461.7	244.7	706.4	159.2	443.7	208.7
–72	491.0	274.0	765.0	163 8	467.0	219.7
–73	519.9	274.4	794.3	166.8	476.2	224.0
–74	569.8	170.4	740.2	172.7	428.6	201.6
Trend rate of growth (1951-74)						4.3

Source : Supplements

GVA at constant prices witnessed an increase of 102% or it had grown at an annual rate of 4.3%.[2]

Labour and Capital Inputs (in real terms) : The Railways classify the staff into two broad categories—open line and construction. The latter accounts for about 1% of the total staff. The expenses on their wage bill are more in the nature of capital costs. Aside, the construction activities though essential are not immediately related to the production of transport services. Hence, they have excluded them from the present study. Further, the Railways divide their staff into four categories: class I, class II, class III and Class IV. Upto 1973-74, data relating to the former two classes are clubbed together. For a meaningful analysis, labour input should not be a mere summation of all categories of employees. The work performed by a skilled person like a technocrat is substantially different from that of a manual worker. Hence, different categories of staff should be given proper weightage.

The concept of necessary quantum of labour is generally discussed in the context of marginal productivity of labour. It is questionable whether the productivity of each category of labour is related to the respective wages. Since the output cannot be divided and assigned to each category of labour, individual productivity of each category of labour is impossible to evaluate in empirical research. Labour units as inputs can be calculated by giving weights to different types of labour, taking their base year wages as weights. By weighting the available service-time of the factors by their base period wage rate, we obtain a measure of what the resources would have produced had technological and other conditions of efficiency remained same as in the base period.

In calculating the capital stock three major typ s of gross fixed capital were taken into account – structural engineering works, equipment and rolling stock—which account for about 85% of total capital. Gross fixed capital at constant prices is calculated by using perpetual inventory method. The base year (1951-52) gross fixed capital has been adjusted for price changes since Railways were in operation since 1853. Having corrected the base year capital stock, the annual incremental capital has

2. Growth rates are computed by using the exponential function, $Y=ab^X$ where Y is observed data, x number of years and 'a' projected value of Y in zero year and 'b' coefficient of growth (b—1=rate of growth).

been deflated by machinery transport equipment price index to compute capital at constant Rupees. The next step in calculating capital input is to weight the capital (at constant rupees) by the base period rate of return. For measuring the consumption of capital services in the year, it is assumed that there is a constant relation between stock of fixed capital and the flow of its services which is measured by the base period rate of return. When capital stock in constant rupees is wheighted by the base period rate of return, it yields a value which measures what it would have produced had each unit operated at the base period level of efficiency (Sinha and Sawhney, 1970).

Partial productivity along with total factor productivity indices are presented in Table 2. Labour productivity increased at an annual rate of 2%. The increase in labour productivity is not steady specially upto the First Five Year Plan. Contrary to the trend in labour productivity, capital productivity registered a decline to the extent of 0.2% per annum. The overall productive efficiency is revealed by total productivity indices. It has registered a growth rate of 0.2% per annum. The increase is perceptible from the end of the II Five Year Plan to the 4th year of the Fourth plan. Due to decreased physical production, the total productivity index fell to 103 in the last year of our analysis.

Productivity, Gains and their Sharing : Now the attempt would be to analyse productivity, gain and its distribution. Changes in the factor and product prices and changes in the factor inputs which illustrate the mechanism of the sharing of productivity gains are presented in table 3. It is evident from the table that labour prices shot up by 189% and capital prices by 28% (actually there was a big drop in capital prices in 1973-1974; up to 1960-1961 they are at a lower level compared to base period and their movement is erratic), while product prices rose by 73% during the period of analysis. Labour prices steeply increased than capital prices. Upto 1959-1960, relatively the total factor price index is lower than the product price index. Thereafter, the picture is opposite, i.e., from 1960-61 the combined incomes of labour and capital at constant product prices have risen faster than what they would be at constant rates of rewards. The capital price index lagged behind product price index barring a brief period (1961-62 to 1963-64) reflecting negative productivity gain to capital. On the other hand, labour prices registered a faster rise than product prices, implying substantial accrual of productivity gain.

Table 2 : Indices of Partial and Total Productivities (1951-52 = 100)

Years	*Labour Productivity* (1)	*Capital Productivity* (2)	*Total Productivity* (3)
1951 52	100.0	100.0	100.0
—53	91.3	90.5	90.0
—54	87.9	88.6	88.2
—55	91.7	91.8	91.8
—56	98.4	98.8	98.6
—57	98.6	97.5	98.2
—58	98.8	96.6	97.8
—59	99.3	95.0	97.4
—60	103.4	94.6	99.4
—61	110.0	95.9	103.5
—62	115 8	97.6	107.2
—63	119.8	97.3	108.9
—64	121.1	96.9	109.4
—65	118 2	91.0	104.7
—66	122.7	92.1	107.4
—67	123.6	91.4	107.3
—68	122.8	88.5	105.3
—69	128.8	90 6	109.1
—70	132.2	91.9	112.2
—71	134.0	92.7	112.5
—72	138.8	95.6	116.2
—73	139.6	95.6	116.2
—74	123.6	83.9	102.7
Trend rates of growth 1951-74	2.0	(—) 0.2	0.9

Sources : Supplements and Block Accounts

Table 3 : GVA, Inputs, Product and Factor Prices

	Labour			Capital			GVA				
	Income at current prices	Input at 1951 rate of wage	Implicit price index	Income at current prices	Input at 1951 rate of return	Implict price Index	at current prices	at constant 1951 product prices	Total factor Input at 1951 constant input prices	Implict price index of product prices	Total factor price index
	(Rs. Crores)		3=1÷2	(Rs. Crores)		6=4÷5	(Rs. Crores)		9=2+5 (Rs. Crores)	10=7÷8	11=7÷9
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1951—52	121.1	121.1	100.0	91.5	91.5	100.0	212.6	212.6	212.6	100.0	100.0
—53	125.6	121.3	103.6	73.1	92.5	83.4	202.6	194.4	213.8	104.1	94.8
—54	135.5	125.8	107.7	66.6	94.3	70.6	202.1	194.1	220.1	104.1	91.8
—55	140.0	129.2	108.4	74.1	97.5	76.0	214.1	208.1	226.7	102.9	94.4
—56	148.1	135.1	107.6	95.3	101.6	93.8	243.4	233.4	236.7	104.3	102.8
—57	155.6	140.6	110.7	103.1	107.5	96.0	258.6	243.5	248.1	106.2	104.2
—58	172.2	148.6	115.9	102.7	114.7	96.3	274.9	257.6	263.3	106.7	104.4
—59	183.4	154.2	118.9	104.2	121.8	85.6	287.6	268.1	276.0	107.0	104.2
—60	187.4	154.8	121.1	119.4	127.8	93.5	306.8	281.0	282.6	109.2	108.6
—61	203.2	155.4	130.8	132.7	134.6	98.5	336.0	300.0	290.0	112.0	115.9
—62	212.1	158.4	133.9	164.6	142.0	118.1	376.7	322.0	300.4	117.0	125.4
—63	231.2	162.7	142.1	190.3	151.4	125.8	421.4	342.1	314.1	123.2	134.2
—64	246.2	170.8	144.2	225.0	161.4	139.4	471.2	363.3	332.2	129.7	141.8
—65	284.5	176.6	161.1	201.1	173 4	116.0	485.6	366.5	350.0	132.5	138.7
—66	318.2	181.2	175.6	220.0	182.4	120.7	538.7	390.5	363.6	137.8	148.0
—67	346.2	184.4	187.7	214.0	188.4	113.6	560.2	400.1	372.8	140.0	150.3
—68	371.0	184.6	201.0	205 1	193.4	111.3	576.1	397.9	378.0	144.8	152.4
—69	395.4	184.3	214.5	237.7	197.9	120.2	633.1	416.8	382.2	151.8	165.7
—70	419.9	185.9	225.9	241.5	202.1	119.5	661.4	431.4	388.0	153.3	170.5
—71	461.7	188.6	244.8	244.7	205.9	118.8	706.4	443.7	394.5	159.2	179.1
—72	491.0	191.6	256.3	274.0	210.3	130.3	765.0	467.0	401.9	163.8	190.4
—73	519.9	194.2	267.7	274.4	215.2	127.6	794.3	476.2	409.4	166.8	194.0
—74	569.8	197.4	288.7	170.4	219.9	77.5	740.2	428.6	417.3	172.7	177.4

Sources : Supplements & Block Accounts

Next, the effect of sharing of GVA between labour and capital on capital accumulation in the enterprise is anaylsed. If the objective is to quicken the process of capital formation by ploughing back of profits, the share of capital in GVA should be higher than its share in total factor input. The relevant data are presented in table 4.

Table 4 : Factor Shares in Total Input and GVA

	% share in Total Factor Input		% share in GVA	
	Labour (1)	Capital (2)	Labour (3)	Capital (4)
1951—52	57.0	43.0	57.0	43.0
—53	56.7	43.3	62.0	38.0
54	57.2	42.8	67.1	34.6
—55	57.0	43.0	65.4	34.6
—56	57.1	42.9	60.9	39.1
—57	56.7	43.4	60.2	39.8
—58	56.4	43.6	62.6	37.4
—59	55.9	44.1	63.8	36.2
- 60	54.8	45.2	61.1	38.9
— 61	53.6	46.4	60.5	39.5
— 62	52.7	47.3	56.3	43.7
—63	51.8	48.2	54.9	45.1
—64	51.4	48.6	52.3	47.7
— 65	50.5	49.5	58.6	41.4
—66	49.8	50.2	59.1	40.9
— 67	49.5	50.5	61.8	38.2
—68	48.8	51.2	64.4	35.6
—69	48.2	51.8	62.5	37.5
—70	47.9	52.1	63.5	36.5
—71	47.8	52.2	65.4	34.6
—72	47.7	52.3	64.3	35.8
—73	47.4	52.6	65.5	34.5
—74	47.3	52.7	77.0	23.0

Source : Table 3

During the entire period of analysis, capital share in GVA is lower than its share in total factor input. The percentage share of capital in GVA had a downward tendency (43% to 23%), while its share in total factor input showed an upward trend (43% to 53%). Thus the relative share of capital in GVA compared with its share in total factor input is less than proportionate. It was only in 1963-64, the share of capital in GVA approximated to its share in inputs (49% and 48% respectively). Thereafter, its share in inputs had been much higher than its share in GVA. Thus since 1964-1965, the prevailing situation implicit in the relative shares was not conducive to capital formation out of ploughed back profits.

Having discussed the trends in productivity, relative gains and shares of labour and capital, an attempt is made to analyse sources of economic growth popularly known as "Accounting for Growth" in the Indian Railways.

The relevant indices of inputs and output are presented in table 5. The GVA has grown at an annual compound rate of 4.3%. The total contribution, to this growth rate, of the increase in the two inputs is 3.4% per annum. This is the growth that would have been achieved, had there been no change in output per unit of input. However, actually there did take place a significant increase in output per unit of input (4.3 less 3.4 = 0.9%.)

The contribution of the growth rate of output per unit of input to the average growth rate of GVA is calculated as follows :

(100 + growth rate of GVA) ÷ (100 + growth rate of total factor input) — 100 (Dholakia, 1974)

$= (100 + 4.3) \div (100 + 3.4) - 100$

$= 104.3 \div 103.4 = 100.87 - 100 = 0.87$ or 0.9% approx.

The contribution of total factor input, 3.4%, is then allocated between the two inputs of labour and capital as follows :

(1) Growth rate of labour input = 2.3%

Share of labour in GVA = 57%

Contribution of labour input to 3.4%

$= 2.3 \times 57\% = 1.311\%$

while capital accounted for about one-half. The remaining, one-fifth is contributed by technical change.

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Multinational Business

O. P. Jain*

Multinational Firms/Corporations are a controversial issue in regard to their contribution to the economic development of host countries and their relevance to future trend and pattern of economic welfare. These Corporations are depicted as key instruments for maximisation of world welfare in some quarters and agents of imperialism in others. Ernest W. Ogram (Jr.), a well-known analyst of international business, foresees "progress towards a one-market world, reflected in the continued, apparently inexorable, growth of multinational business through the multimarket, multinational corporation" [1].

Norman Macrea, Deputy Editor of the *Economist* (London), who undertook a detailed survey of the subject, does not unreservedly share such an optimism about the future of multinational business and does not totally accept big multinational corporations as the most efficient media during the years 1972-2012. He does not subscribe to the fashionable belief that by about 1992, 300 biggest multinational corporations will entirely dominate the world's business scene. He believes that it is late afternoon for some of the giants, instead [2].

The above observations lead one to appreciate the 'Tomorrow' of multinational corporations against the 'Yesterday' and 'Today' of multinational business. The 'Yesterday' of such a business provides a fascinating reading when one peeps back into the trading companies of acncient Mesopotamia, the merchant bankers of the Middle Ages. The recent phase is traced back to the East India Company and other British multinationals, founded four centuries ago. With its huge international investments, Great Britain led the world into the nineteenth century industrial revolution. America followed it and led the world into the twentieth century industrial revolution. Whereas the British had the portfolio overseas investments, the Americans became the real fathers of overseas subsidiary companies and continued their trans-Atlantic invasion without any great acceleration. Europeans went multinational by joining together in restricted international cartels. After 1950, the west European

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flood-gates opened, and the American direct investments abroad became ten-fold in value over the following 20 years. In 1966, American multinationals were 532 in number and sales by their subsidiaries increased more than 2.2 times at $ 221 billion during 1966-72 [3]. Such a growth in American multinational business is ascribed specifically to the "expectations or achievements of lower labour, lower marketing costs, the advantages of some local product differentiations. Such an upsurge in foreign investments was witnessed in case of other countries also, motivated, as they were, by what is theorised as Product Cycle by R. Vernon.

The Report of the "Eminent Persons" prepared by the UN in 1973 showed that $ 165 billion had been invested abroad by national companies of industrialist countries to create productive facilities in other countries in 1971. USA accounted for 52.1 percent and Europe for 37.6 percent of the total. Total foreign sales resulting from such investments amounted to $ 330.0 million, exceeding total and world exports by 5.8 percent [4]. Such sales of the US companies were about four times the total exports from within the USA, corresponding to more than two times in case of the U. K. companies.

The Japanese companies also expanded their foreign investments amounting to $ 4.5 billion in 1971. The number of their affiliates went up from 420 before 1972 to 929 in 1973. Fujitoa (computers), Fuji Photo (films) and Fuji Heavy Industries (cars and aeroplanes) are Japan's 'growth' multinational companies. These companies have developed investment ties to a bearing extent with companies in America, West Germany and Canada. Apart from being poised for a major thrust of the American market, Fuji Heavy Industries are investing production sites in cheaper countries. More recently, it agreed to set up a plant in Taiwan to produce Subaru Rex, a mini car relative of Leone [5].

Contribution of Multi-nationals

In fact, the rise of multinationals is a logical reaction to the objective trend of free enterprise toward internationalisation of production and capital governing the development of world economy ever since tech-

nological development has taken place. This reaction behaved differently in the west and in the East, (centrally planned economies). In the East, it reflected in the planned development of economic ties among COMECON countries, leading to socialist integration at the level of an enterprise and the State without any contradiction. The regional blocks in West Europe, Latin America and even in Africa, though not complying entirely with the objective trend towards production internationalisation, allowed more space to productive forces of national firms for their development than othererwise. Since the space was not adequate for the largest among them, the latter crossed boundaries of the block to invest directly abroad. Their links with the affiliates through remittance by the latter of dividends, royalities, technological fees, etc. gave way to their integration with international net-work of enterprises both technologically and financially in the latter half of the sixties.

Acceptance of multinationals by and their penetration into the Third World Countries are to be viewed against the political and economic background of the latter during the fifties and the sixties. Most of these countries had open economies and could not exclude the power of the Neo-colonial policies of industrialist nations. Also they suffered from balance of payment disequilibria without foreign aid. At the same time, they were anxious for self-development, and had to welcome capital and technical knowhow provided by multi-nationals. All the multi-nationals were reportedly motivated for their operations in these countries by such objectives as regional representation, production behind traiff walls, closeness to overseas customers, organisation of world-wide production as an integrated operation, and expectations or achievement of lower marketing costs and advantages of some local production differentiations. That is why Sir Arnold defined a multinational as "An American registered company manufacturing its product where labour is cheapest and channelling its profits to another country where taxing is lowest or preferably non-existent".

Contribution by multinational corporations towards economic development of the host countries is generally accepted, though challenged in certain quarters. A number of objections are raised towards their operations in the host countries. They border on disregard of these corporations towards economic aspirations and needs of these countries. An objective assessment can be made of their contribution, to

the extent permitted by available data, in terms of (i) export orientation and creation of exportable surpluses through investments, (ii) building up of foreign exchange reserves, (iii) utilisation of imported technology and (iv) impact on labour efficiency and relations.

Export Orientation

Investments by multinational corporations in the devloping countries have been substantial. As early as in 1967, the percentage of total investments in the developing countries was 28 for USA, 38 for UK, 50 for France, 13 for Switzerland, 39 for Canada, 33 for Federal Republic of Germany and 70 for Netherlands. These varied percentages are to be correctly interpreted with reference to the level of total investments made by different developed countries. However, the achievement in this regard was not mean in size, though their objectives are debated. Raul Prebisch and Hans Singer spoke of the 'enclave' effect of foreign investments in that multinational corporations never became part of the internal economic structure of the less developed countries. It is further opined that these corporations located production abroad as tariff jumping devices in home markets and generally moved literally into areas with high barriers to entry, sophisticated marketing, international production and cross handling [6]. There are, however, evidences to say that a part of foreign investments in the host countries accounted, though imperceptibly, for export orientation to and the creation of exportable surpluses in the economies of the latter. "Foreign subidiaries of US companies were responsible for 65 percent of rise in exports of manufactures between 1960-72 from Latin America, 20 percent in South Korea and over 50 percent in Taiwan,"

The Indian pharmaceutical industry is a striking instance of such an impact : Being in domination of multinational corporations, it exported drugs and chemicals worth Rs. 430 million in 1974-75 compared to Rs. 75 million in 1969-70. The foreign untis of this industry—Glaxo, Pfizer, Hoecsht, Sandoz, Hindustan Richardson, etc.—have helped India in the development of base of this industry and an upsurge of over 2500 small scale units with total industrial production of over Rs. 4000 million compared to Rs. 100 million in 1948 [7]. Also creditable are ITC's exports of garments, food products and the like at Rs. 50 million. Dunlop and ICI also crossed this mark.

Foreign Balances

Impact of multinational corporations on foreign exchange balances of the developing countries invites controversy. As one viewed, "a major disadvantage of foreign investment is the long-run balance of payments offlow on largely static capital inflow, by way of repatriation of dividend and royalties abroad". The Indian Institute of Public Opinion, New Delhi, analysed operations of foreign subsidiaries in India and estimated that total excise contribution by them could be Rs. 4000 million against about Rs. 200 million in dividends remitted. [8]. The Reserve Bank of India studies reveal that 66 pharmaceutical multinational corporations operating in the country in 1969-70 contributed, by way of excise duties,corporate tax, customs duties and sales tax, some 500 million rupees to national exchequer, a cost-benefit ratio of 1:10" [9].

The Columbian experience, on the other hand, shows that for every dollar of income accruing to all domestic factors of production, more than one dollar and a half accrued to the foreign investors who accounted for 40 percent to 50 percent of the whole foreign Columbian sector. Thus about 50 percent of the total amount represents a fiscal loss for the Columbian government and above 80 percent of it, a balance of payments loss [10].

Another aspect of the impact is provided by what is known as 'Trade Off' which is made to move in favour of multinational corporations. Citing two evidences, these corporations in India remitted abroad about $ 120 million, i. e., 6 percent of her total exports during 1970 ; and those in Mexico remitted abroad $ 200 million or 16 percent of its total exports in 1968. Such a 'Trade Off' has a relevance to the period of development in the host countries and is also subject to certain hypotheses for its validity. Until the hypotheses are carefully verified, the 'Trade Off' may not be accepted as an evidence of adverse effect of multi-national corporations on the developing countries.

Imported Technology

Harry Johnson visualises multinational corporations to contribute not only in the trans-plantation of superior technical and managerial know-

ledge but also in the development of embodied knowledge locally rather confining difference to product sclection only. Dale R. Weigal amplified his point to say that (i) technology transferred by multinational corporations is not appropriate for conditions in capital-poor, labour-abundant developing countries; and that (ii) foreign firms do not adapt their technology because they do not have to do so in their monopolistic conditions. Such a variation in the expectation from and in experiences of multinational corporations in matter of technology transfer and development are explicable in terms of interest/stake of corporations in technology adaptation and absorptive/reproductive capacity of developing countries for improved technology.

The Reserve Bank of India Survey 1964-70 reveals that availability of newer technology from the parent bodies has been greater in the case of subsidiaries or the minority companies than in the case of purely technical collaborative units, because a foreign collaborator is more eager to import some of his best methods and processes in the former than in the latter case.

Absorptive/reproductive capacity is noticed to have varied among the recipient countries according to differences in their organisational and socio-economic factors : wherever the influencing factors proved appropriate, the imported technology was not only absorbed but also duplicated with local adaptations. The Japanese improved upon the borrowed western technology further through ruthless application of the disciplines of value engineering, cost, quality and market. "If you find a way of making a better mouse trap, the whole world will still beat a path to your own door; but, at present, the first beater on your door mat will be a Japanese asking for a licencing agreement, and among the last will be the British (who will not believe much in these new-fangled mouse traps) and the communist countries (who are often not allowed to buy foreign technology and have been interestingly inefficient in their devoted and expensive efforts to pinch it)". [11]. In most developing countries with low technology—absorptive capacity, it is believed, multinational corporations have not been efficient to utilise imported technology because of management gap between them and the local entrepreneurs.

Labour Pattern

Both at the level of individual scholars and international agencies, it is argued that multi-nationals introduce a high-wage economy into the

developing countries intrinsically having a low wage economy, with a consequent disturbance to the labour market and severe convulsions of change in the industrial culture of these countries. In fact, the phenome non of multinationals is exactly comparable to that of industrial revolution affecting the non-industrial society. Beneficial aspects of the former as of the latter can be retained/absorbed and their damaging effects effectively controlled through appropriate policies. The need for an acceptable and rational code of conduct for multinational corporations is well admitted, though the form and mechanism of such a code are debated.

In India with a fairly satisfactory control on foreign investments, multi-national corporations are not viewed with as much suspicion as in some other developing countries. A survey carried out by the Indian Institute of Public Opinion, New Delhi, in the last quarter of 1974 revealed: "a little over half (51%) the respondents shared the view that on balance India benefits more by foreign investments. Only one in four thought that the country is harmed by them."

The Code of Conduct is a preliminary step intended to safeguard interests of the host countries till a proper understanding develops between the parent companies and their subsidiaries in such countries. "As knowledge about industry operation is accumulated, as secrecy is developed and domestic confidence is gained, the monoply position of the foreigner even in his peaks of strength is eroded. The result is a cumulative shift in favour away from the international corporations towards the host country" [12].

Prospects

Notwithstanding a mixed experience of and varied reaction to the operations and contribution by multinational corporations int he development context of the Third World, the developing countries are, by and large, likely to favour the strategy of using the integrating ability of these corporations on a global basis to develop their large productive potentialities through an access to the market of the developed world. As Drucker puts it, "a policy of self-sufficiency is not possible even for the best endowed country". He, therefore, prophesied, "the next 10 years are the years in which they (developing countries) will both most need the multinationals and have the greatest opportunity of benefitting from them." He, further added, "the multi-nationals have a bigger stake in the rapid economic development of the host countries as

these offer the best chance of their own growth and profitability because of the multiplier impact of their investment, products and technology".

There is, however, need to take note of the views of Norman Macrea, author of the *Economist* Supplement on the subject, who does not unreservedly accept big multinational corporations as the most efficient media during 1972- 2012 for (i) training manufacturing labour in today's poorer countries, (ii) standing up against possible expropriation by governments of such countries, (iii) spreading modern management techniques and improved technology, and (iv) exporting capital. He seems to be seized of a few pessimistic portents in this respect, namely, urbanisation and revolution, native establishment, cultural gaps, government inefficiencies and the fear of the unknown. As such, multinationals will provide varying justification for their development and propagation according to variations in the socio-economic-political milieu of the host countries, especially in the Third World. Guidelines for their selection and operations will need be based on a clear perception of a host country's needs and aspirations on the one hand, and its socio-economic traditions, values and adaptability of the same, on the other. These can, to start with, be based on the conclusions and recommendations made by the UN Committee 'Eminent Persons' under the Chaimanship of Mr. L. K. Jha. □

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Contribution of the Crop Improvement Research to Agricultural Productivity

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In a rural economy, like that of India, the role of agriculture and the need for enhancement of agricultural productivity is of paramount importance. It is more so for a hilly state like Himachal Pradesh, where transport facilities are still not so well developed, especially in the remote areas. Transportation to such areas may sometimes cost as much or even more than the cost price of the commodity transported. It will, therefore, be doubly advantageous to make such inaccessible areas self-sufficient in at least their basic requirements, especially food.

Food is such an item that no country in the world, howsoever industrialised or progressive it may be, can afford to ignore its importance in its economy. Sometimes, self-sufficiency in foodgrains becomes vital for the independence and existence of a country, e. g., India could take up a bold and independent stand during the Indo-Pakistan war of 1971 against the direct/indirect pressures of the most powerful nation of the world and win it. One of the major factors that boosted its morale and enabled it to take up a bold stand against such a powerful nation was its self-sufficiency in foodgrains at that time due to the ushering in of the green revolution, mainly due to the evolution and propagation of the high-yielding varieties of wheat. Had India been weak on the food front at the time, it would have been almost impossible for it to take up this challenge and win the war. A starving nation cannot but follow the dictates of its donor. The latest thinking in world politics is that during the next quarter of a century, by the end of which the world population is likely to double itself, food is going to be the greatest weapon in the arsenal of the powerful nations of the world. Henry Kissinger is the author of such an idea in USA who has suggested the use of this powerful weapon against the overpopulated and underfed nations of the world to influence their national policies for its own advantage and ulterior motives. It thus becomes clear that a nation can ignore the subject of food only at its own peril, no matter what the state of progress it might achieve in other spheres.

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In view of the importance of providing food to all in the state, the pivotal role played by the department of Genetics and Plant Breeding of H.P. University cannot be minimised. This is because crop varieties constitute the basic input, the sheer lack of which will result in poor output, as has been the case prior to the so-called green revolution. Evolving suitable plant types for different situations can appropriately be called "Bio-Engineering" or "Bio-Architecture", which calls for a multi-disciplinary approach, in which not only the geneticists and plant breeders are involved but also the agronomists, the soil scientists, the pathologists and the entomologists or at least the knowledge of these subjects is involved. The plant breeders, therefore, consider these specialists their equal partners in this effort, without the help of which they are not likely to succeed to the extent to which they have done so far.

In view of the changing biotypes of diseases and pests, the plant breeders are required to keep ready in the pipeline a number of varieties for meeting the situation. It is, therefore, a continuous war between the breeders and nature. To accomplish this huge task expeditiously, among other things, availability of multi-location testing centres and off-season nursery facilities are a must.

Problems and Progress of Research in Different Crops of HP

The Department has been engaged in the problem-oriented research on various crops of Himachal Pradesh and would like to step up the same further if additional facilities in term of staff, contingencies, and suitable research/testing stations are made available, which are urgently required to do so in a systematic and efficient manner in view of the following :

Himachal Pradesh is one of the few hilly states of India where crops are grown right from the plains upto an altitude of about 13,000 ft. in Lahaul and Spiti. The state can be broadly divided into atleast six agro-climatic zones : (1) Plain/Foot Hills, (2) Low Hills, (3) Mid Hills with high rainfall, (4) Mid Hills with normal rainfall, (5) High Hills, and (6) Dry temperate zone. The situation is accentuated further by the fact that the agro-climatic conditions in the state change within very short distances due to the undulating topography. The problems—challanges faced by our crop breeders, therefore, are so diverse and great that there may be only a few parallels in India.

The problem-oriented research that is being conducted by the Department on different crops and the progress made so far with the existing facilities are discussed in the following pages.

(i) *Rice* : Cold tolerance and blast disease are the major problems. The sources of resistance to these problems have been identified through international cooperation and utilised in hybridisation/mutation breeding for rice improvement. The other problems in rice being tackled are direct-seeded upland rice, hailstorm resistance, wild rice and grain quality, etc. Sufficient progress has been made, but a lot more needs to be done, particularly for high-altitude areas, because the crop is highly sensitive and the high-yielding varieties of rice evolved in the warm areas are not suitable for cold hilly areas.

From 1941 upto 1974, nine varieties of rice were released for cultivation under different agro-climatic conditions of HP, viz., Ram Jawain 100 and Phul Pattas 72 in 1941, Lal Nakanda 41 and Dhundar 43 in 1955, China 988 in 1958. R 575 in 1962, Norin 18 in 1967, Norin 8 in 1968, and T 23 in 1971.

All these varieties, except Norin 18 and Norin 8, were tall and highly susceptible to lodging and the dreaded blast disease. R 575, a tall purple-leaved variety, was specifically meant to fight the wild rice problem in Kangra district. Norin 18 and Norin 8 were the only semi-dwarf, fertiliser-responsive, and high-yielding varieties of rice, suitable for high-altitude cold areas of H. P., which, however, could not become popular with the farmers because of their *Japonica* type of short bold grain and sticky rice as the farmers themselves were the consumers. The release of these varieties did make an impact but not to the desired extent. It was only in 1975 that IR 579, a high-yielding-cum-high-quality variety of rice, which was resistant to lodging and blast disease, was released after thorough testing for cultivation upto an altitude of 1100 metres. Its cultivation in the state has spread considerably during 1975 and 1976 and has even caused storing problems for some progressive farmers who were not used to such high yields (upto 70 qtls./ha) from rice thus far.

During 1977, IR 579 is likely to become the major cultivated variety of rice upto an altitude of 3,500-4,000 feet above m.s.l. The early selections of IR 579 with the same yield potential, notably ES 29, ES 38 and

ES 44, which are 8-10 days earlier in maturity and have greater resistance to the dreaded blast disease than the parent variety, are likely to do well in the colder mid hills upto an altitude of 4,500 feet and will be tried on the farmer's fields during *Kharif* 1977.

R × T-42, a progeny of the cross R 575 x T (N) I, exhibited a very stable performance over a number of years and locations in H. P. It has a yield potential of more than 60 qtls. and recorded consistently high yields in different multi-locational trails in the state during the period 1971 to 1976, yielding 12.63 percent higher than the control, China 988. It is as tall as China 988 and matures only two days later than the variety. But because of its stiff straw, it is highly resistant to loding and also to the blast disease. Its grain type is like that of China 988. In view of this, R x T-42 has been proposed to be released under the name of HIMDHAN for general cultivation all over H. P. wherever China 988 is cultivated, which needs to be replaced because of its susceptibility to lodging and blast disease. Kulu, a cold tolerant variety from Australia with long slender fine grain and fairly good field-resistance to blast disease, is another variety which will be tried on the farmers' fields in 1977 in the mid hill areas. AC 71, AS 11, AC 3828 and HP 46 appear to be promising for rainfed conditions.

During 1976, some very promising, high-quality selections, suitable for mid and high hills have been made. These are now being multiplied during the off-season at Hyderabad for large scale testing during the next season. To expedite the tempo of work, fresh crosses are being attempted twice in a year, during the *Kharif* in Himachal and *Rabi* at Hyderabad.

During *Kharif* 1976, an International Team of eleven Rice Scientists from Korea, Indonesia, Philippines, Nepal, IRRI and India visited different centres for testing rice for cold tolerance in Kashmir, HP and UP under the International Rice Testing Programme (IRTP). They were impressed by the work being done in HP, particularly with regard to the incorporation of blast resistance into the cold tolerant varieties. K 78-13, a good cold tolerant japonica-type variety of rice which is being multiplied extensively for cultivation in high altitude areas of Kashmir, proved to be highly susceptible to blast in HP both at the leaf and neck stages. They were all surprised to see its behaviour under our conditions and realised the importance of our blast resistance work, as it is a hot spot for the blast disease. However, we are utilising the good

cold tolerance of this variety in our hybridisation programme. This year we have been able to contribute 109 varieties/cultures for the International Rice Testing Programme of IRRI for cold tolerance.

(2) *Maize* : The non-availability of hybrid seed, late maturity, lack of drought resistance in the recommended hybrids and composites, particularly for high altitude areas, quality consideration and susceptibility to *Helminthosporium* leaf blights, bacterial stalk rot and *Rhizoctonia* stalk/cob rot are the major problems in maize on which research work is in progress and considerable progress has been made to evolve high-yielding, early-maturing, disease-resistant good-quality composites and hybrids.

Our Maize research station at Bajaura in Kulu Valley has identified a new double cross hybrid variety of Maize, known as VL-42, for high altitude areas of Himachal Pradesh ranging from 4000 to 7000 ft. above m. s. l. Based on the experimental results, this variety was tested extensively at farmers' fields during *Kharif*, 1976. The results obtained so far have revealed that this variety, on an average, yielded about 40 percent or 8-9 qtls./ha. higher than the commonly grown local varieties. Its maximum yield potential, however, is 60 qtls./ha. Since the earlier released varieties, namely Vijay and Him-128, were late in maturity, these could not become popular with the farmers, particularly in high altitude areas. The VL-42 hybrid variety matures 5 to 10 days earlier than even the farmers' local varieties at many places and on account of its attractive grain colour like that of the locals, with medium tall plants, which makes it fairly resistant to lodging, this variety has caught the imagination of farmers in high altitude areas. Morever, this variety is comparatively more resistant than the locals to *Helminthosporium turcicum* (leaf blight disease), which is the only major disease of maize in high altitude areas. This variety has, therefore, been proposed for release in the high altitude areas of HP and steps have been taken for large scale seed production and dissemination of this variety in HP during the ensuing *Kharif* season. About ten quintals seed of this variety will be distributed in HP during 1977.

In addition, another new composite variety of maize, namely Early Composite, has been developed at the Maize Experiment Station, Bajaura, by combining the yield potential and early maturity of thirteen elite varieties from Russia, Hungary and India. This variety has given very good

performance during the last two years of its testing, giving 15 to 20 percent higher yield than Vijay composite, the present recommended variety. This composite variety, the seed of which can easily be produced and maintained by the farmers themselves, is almost equal in maturity with that of the local types and matures ten days earlier than Vijay. On account of its early maturity and higher yield potential than Vijay composite, this variety has also been proposed for release and is likely to become very popular with the farmers in areas between 2000 ft. to 5000 ft above m. s. l. in Himachal Pradesh. About eight quintals seed of this variety is likely to be distributed in HP during *Kharif*, 1977.

Under high fertility and assured irrigated conditions, an experimental hybrid E. H. 2380 and L_3 composite of maize held great promise for low and mid hills of HP.

The maize breeding research work is also being expedited by growing an off-season nursery at Hyderabad, where extensive multiplication and hybridisation programme is being undertaken by our maize breeder.

The facilities provided by the HP University authorities and the Crop Coordinators for raising the off-season nurseries of rice and maize at Hyderabad are greatly appreciated. However, still greater facilities, as provided by IARI, P.A.U. and other premier institutions of India, are required if the agricultural production in the state is to be increased expeditiously and in sufficient measure to make the state not only self-sufficient but surplus in foodgrains, which is the basic ingradient of any economy.

(3) *Wheat and Triticale* : Yellow rust is the major problem in wheat. Even Sonalika wheat is becoming susceptible to this disease. Loose smut and bunt are the other important diseases of wheat receiving attention. High-yielding rust-resistant strains of wheat are under field tests. Efforts on wheat research are being intensified at Solan, Bajaura, Palampur and Keylong and high-yielding strains of wheat for irrigated and rainfed conditions of HP have been identified. Research work is aiso in progress for evolving strains of Triticale, an artificial species produced by hybridising wheat with rye grass, suitable for hilly areas with poor soil and irrigation conditions.

(4) *Barley :* Yellow rust, lodging and poor grain quality are the major

problems in barley. Barley constitutes the staple food of the population in high altitude areas of HP and mostly naked barley is grown and consumed in these areas. There was no recommended variety of naked barley in the whole of India till 1971, when the HP University got LSB-2, a high-yielding, semi-dwarf, non-lodging, rust-resistant variety with high protein content (18%), released by the Central and the State Variety Release Committees. Dolma, another hulless variety of barley, with still better performance and greater yellow rust resistance was got released from the Central and the State Variety Release Committees in 1974.

A good deal of work on barley is beinng done at Bajaura, Palampur and Keylong and good progress has been made towards the release of 2-rowed and 5-rowed hulled barleys. Among the three hulled varieties of barley, HBL 87, HBP 89 and HBL 98, evaluated against Kailash (HP 109) on the farmers' fields, the last-mentioned variety turned out to be the best. HBL 98 is early maturing, dwarf with long impressive spikes and resistant to yellow rust but susceptible to *Helminthosporium gramineum*. Among the hulless varieties, Dolma continues to perform well. HBL 108, HPL 109 and HBL 110 varieties of 2-rowed hulled barley, suitable for malting and brewing purposes, appear to be promising.

(5) *Oilseeds* : In linseed, rust, powdery mildew and wilt diseases are the major problems being tackled and varieties suitable for cultivation under "Uttera" conditions (standing paddy) in paddy growing areas are under development. In addition to Himalini, a wilt and rust-resistant brown-seeded variety of linseed released for general cultivation, LC 255, has been identified and found to be resistant to powdry mildew. 'EC 41628' linseed, found to be resistant to all the three diseases, is being used in hybridisation programme. In soyabean, varieties of suitable maturity duration, to fit into the cropping pattern and mixed cropping are being developed. Hardee, Bienville and Hampton varieties of soyabean have shown high-yield potential in the mid-hill region. Himachal Pradesh has been found to be very suitable for the good quality soyabean seed production. In Brassica, suitable early maturing varieties are under development, particularly for multiple cropping. Varuna variety of Raya from Kanpur has been found to be suitable for cultivation in our state. In sunflower, EC 68414 was found quite suitable for this area and work on Sesamum has just been started.

(6) *Pulses* : Very little work has so far been done on pulses. However, a new variety of Arhar, HPA-1, isolated at Palampur from the available germplasm, yielded 21 qtls./ha, on an average during the last two years and holds good promise, because it is early in maturity (150-160 cays). HPA-2 which is dwarf, compact, determinate, and 10 to 15 days earlier than HPA-1, is another promisisng strain of Arhar. Varieties KTS-52, KTS-32 and KTS-16 of *mash* yielded significantly higher than Kulu-4. In Rajmash, KTS-1 has been isolated as a promising line having attractive bold seed, determinate growth-habit, earlier maturity and higher yield potential than Him-1. 'Katrain-9' Kulthi out yielded the local variety by significant margin of 38%. In peas, 450-B outyielded the local peas by a margin of 34%. Nine strains of lentil have been identified to be promising. In gram, 6 promising strains yielding higher than C-235 have been isolated and we are collaborating wlth the ICRISAT for the development of gram varieties. Suitable assistance for the development of high-yielding varieties of different pulses is expected from the ICAR.

(7) *Fodders* : The research work conducted under the All India Coordinated Project for Research on Forage Crops during the period 1971-1976 has been compiled into an abridged report by our Economic Botanist (Fodders) and is a good reference work for forage research in hilly areas. From a review of this report it appears that the technical know-how for fodder production in hilly areas is already available in sufficient measure and that its exploitation needs more extension work and other facilities, particularly with regard to the seed production and root stock multiplication.

Good progress has been achieved for the improvement of pastures and grasslands by the introduction of legumes and nutritive grasses, and for evolving varieties of different fodders and management practices for obtaining maximum tonnage of green fodder per unit area for dairy.

Evaluation of different pasture grasses and legumes showed that New-Zealand strains of Rye Grass, Tama and Parao gave the highest dry yields. Among legumes, lucerne *cv* Wairau and red clover *cv*, Palampur synthetic were the most superior. Introduction of Siratro and velvet bean in grasslands of sub-tropical regions were found to be quite successful, increasing crude protein content significantly. Variety Dollard of red clover and legume of Timothy were found to be the most suitable

for Chharabra area. In cultivated fodders, 'Palampur 1' and '2688' oatp were found to be superior for single cut and '3021', 'FOS 1/29' 'HFO 114' and 'Palampur 1' for multiple cutting. In berseem and lucerne, varieties IGFRI-B-5 and Karnal, respectively, were found to be superior. Of the several pure and mixed stands of fodder crops studied, mixture of teosinte and cowpea gave maximum fresh fodder yield of 808.3 qtls./ha. in two cuttings between March and September. Path-coefficient analysis in cowpeas showed that direct effect of plant height and number of leaves per plant on dry matter yield was high and positive, whereas dry-matter yield per plant had low negative direct effect on dry matter digestibility.

(8) *Other Crops*: Reseach work for evolving high-yielding varietles of Ragi, Cheena, *Amaranthus* and buckwheat is in progress and promising strains of these crops have been identified. USDA-1 variety of buckwheat *(Fagopyrum esculentum)* which has good quality grains, uniform maturity, resistance to frost and shattering, has been released for farmers' field trials in Lahaul and Spiti. Some work is also beingdone on Kuth and Kala zira.

The Department produces nucleus seed of various crops, depending upon the facilities available, and supplies the same to the State Deptt. of Agriculture for further multiplicatlon at their farms and distribution to the farmers.

Table 1 shows the significance of the contribution of varietal improvement in terms of tonnage and money value. The Department can take pride in contibuting several thousands of rupees to the nation by introducing different varieties of seeds, thereby increasing the yield/ha under various crops.

Rice: Out of 100,000 ha under rice in HP 50,000 ha area lies below 3,500 ft. elevation for which IR 579, with an average yield of 37 ha against 10 qtls./ha average of the state, has been released in 1975. With the introduction of early selections of IR 579, it will be suitable for a much bigger area of the state. If this variety were to cover only 50 percent of this area, i.e. 25,000 ha, the additional tonnage @ 27 qtls./ha comes to 67,500 tonnes per season and @ Rs. 100/qtl. the increase in terms of money amounts to Rs. 67 5 million. This may sound to be too much of an exaggeration. Let me take the least possible advantage that

Table 1 : Significance of the Contribution of Yarietal Improvement in Himachal Pradesh in Terms of Tonnage and Money in Recent Years

Crop Improved variety (year released) improved practice	*Tota l area (Thousand Ha)*	*Minimum area under improved variety (Thousand Ha)*	*Average yield of the State (Q/Ha)*	*Average yield of the improved variety (Q/Ha)*	*Lowest expected average yield of the area under improved variety (Q/Ha)*	*Rate Q/Ha)*	*Increase in terms of*			
							Tonnage (Thousand Tons)		*Money (in Rs. 000)*	
							Highest	*Lowest*	*Highest*	*Lowest*
Rice IR 579 (1975)	100	25	10	37	15	100	67.5	12.5	67500	12500
R×T-42 (HIMDHAN) (1977) —		25	10	41	15	70	77.5	12.5	54300	8800
Maize VL-42 (1977)	265	25	18	35	22	70	42.5	10.0	29800	7000
Early Composte (1977) —		25	18	35	22	70	42.5	10.0	29800	7000
Wheat Sonalika (1968)	305	230	8.5 (1968)	30	12.5 Present actual	100	494.5	92.0	494500	9200
Barley LSB-2 (1971) & Dolma (1974)	40	5	9	30	15	80	10.5	3.0	8400	2400
Linseed Himalini (1974)	6	2	2.5	8	5	200	1.1	0.5	2200	1000
Total :	—	—	—	—	—	—	736.1	140.5	686500	130700
Fodders Removal of bushes & application of fertilizers @ N120 P 40kg/Ha or a minimum of N-40 kg/Ha	1,000	100	—	Rs. 845/ Ha	Rs. 100/Ha	6	—	—	84500	10000
Introduction of superior grasses and proper cutting management practices.	—	50	100	300	150	6	1000.0	250.0	60000	15000
Grand Total :									777000	155700

can accrue to the HP farmers, i.e., if the release of this variety raises average yield of this area from 10 qtls./ha to 15 qtls./ha only (instead of the 37 qtls./ha potential), then the additional tonnage available per annum will be 12,500 tonnes and in terms of money it will be Rs. 12.5 million. Somewhat similar calculations hold good for RXT-42, which has recently been proposed to be released under the name of HIMDHAN for areas upto an altitude of 4,500 ft.

Maize : HIM-123 hybrid and Vijay Composite are the high-yielding varieties of maize recommended for low and mid hills of the state. These varieties, however, could not become popular with the farmers because, of their late maturity and susceptibility to disease etc., and no suitable variety for high-altitude areas was available. VL-42 hybrid, suitable for cultivation from 4000 ft to 7000 ft, and Early Composite, suitable for areas from 2000 to 5000 ft altitude, both with an average yield of 35 qtls./ha, have just been proposed for release in HP. Out of total area of 265,000 ha under maize in HP, if these two varieties were to cover only 25 thousand ha each, and raise the average yield of their respective areas from 18 qtls./ha to 22 qtls./ha only, the minimum increase in tonnage would amount to 100 thousands qtls., worth Rs. 7 million for each variety per season at the rate of Rs. 70/ha.

Wheat : The veracity of above-mentioned modest calculations is borne out by actual impact of the high-yielding wheat varieties like PV-18, Kalyan Sona and Sonalika, released in the late sixties. As ompared to the average yield of 8.5 qtls./ha for wheat in HP before the release of these varieties, the present state average yield of wheat is 12.5 qtls./ha. If Sonalika is supposed to cover 75% of the wheat area in the State (305,300 ha) amounting to 23 thousand ha and the increase in average yield of wheat is taken as 4 qtls./ha (actual), the increased production amounts to 920 thousand tonnes worth Rs. 92 millions @ Rs, 100/- qtls.

Barley : Approximately 25% of the total area under barley, amounting to 10,000 ha, may be under hulless barley. Two varieties of hulless barley, namely LSB-2 and Dolma, with average yields of 30 qtls./ha as against the state average 9 qtls./ha, have been released for such areas. If the additional production of barley in half of this area is considered to be only 6 qtls./ha (instead of 21 qtls./ha), the increased production due to the impact of these varieties will amount to 30 thousand qtls., worth Rs. 240 thousand @ Rs. 80/ qtls. The additional advantage of these

varieties will be the provision of almost 50% more protein to the population of high altitude areas, which uses it as food.

Linseed : Himalini, with an average yield of 8 qtls./ha against the State average of 2.5 qtls./ha has recently been released. If this were to result in raising the average yield of linseed by 3 qtls./ha only in 2000 ha or one-third area of the state under this crop, the increased production will amount to 5000 qtls., worth Rs. 100 thousand @ Rs. 200/ qtl.

Fodders : Milk is another important human food, the supply of which is very limited in hilly areas. Concerted efforts are being made to increase the milk supply in HP by Cattle Improvement Projects, the success of which, to a great measure, depends upon the supply of nutritive fodders in adequate quantities.

The area under natural grasslands and meadows is 100 thousand ha in HP. If, as recommended by our E.B. (Fodders), 10% area is improved by removing bushes and appropriate fertiliser dose (P_{40} N_{120} Kg/ha) added, an additional return of Rs. 845/ha can be obtained. If however, only 40 Kg N/ha is applied, then the additional return amounts to Rs 100/ha. and the total additional income from 10 thousand ha amounts to Rs. 10 million.

By obtaining two cuttings, at least 50% increased production is possible. In addition, the forage will be of high nutritive value, good palatability and digestibility. The crude protein of the forage obtained by multicut is 7%, as compared to 3% in the local hay.

By the introduction of superior grasses in only 5 percent of the existing grasslands and meadows, 50% increase amounting to 2.5 million qtls. of green fodder is possible, the value of which will be Rs. 15 million @ Rs. 6/qtl.

Conclusion

From the above discussion it can be seen that the maximum increase possible in terms of tonnage due to the varietal improvement in HP in recent years amounts to 736.1 thousand tonnes, worth Rs. 686.5 million at the current prices. The minimum advantage that can accrue to the HP

farmers due to this amounts to 1405 million tonnes, worth Rs. 130.7 millions. The figures improve still further if improvement in fodder production is also taken into consideration. The amount spent on crop improvment research in HP is not more than Rs. 1.2 million per annum at present. The return from this investment is many times the amount spent. It is, therefore, amply clear that the investment in crop research is an abundantly rewarding proposition and the cheapest and safest method of raising agricultural production in the country. The evolution of the disease-and pest-resistant varieties of different crops ensures higher production at lower costs of production (without the use of fungicides and insecticides) and no environment pollution. Improved grain quality provides better nutrition to the population.

Himachal Pradesh has at present a food deficit of about 10 thousand tonnes. If the varieties developed by our Department and other recommendations made by us are properly implemented through adequate extension service to the field level, this small deficit can not only be wiped out but also the state can easily be made self-sufficient/surplus in foodgrains and milk production, bringing prosperity to the Himachal populace. □

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Weight Control by Statistical Methods

A. D. Gupta*, T. Thomas & S. K. Saxena**

The accurate measurement and effective control of packed weight of some consumable items such as soap, detergent powder, edible oils, chemicals etc., is essential to meet the state regulations and also to keep the average quantity of overpacking to minimum. Any weighing or filling machine, howsoever accurate, has some natural variability and, therefore, the packed weight is influenced by chance cause of variations. The machine operation should not be disturbed as long as the variation in weight is due to inherent variability of the process. If an assignable cause is present or if there is a shift in the statistical universe, the feedback system must be effective to detect this change quickly and then corrective control action taken to readjust the process setting. For this purpose, one must determine the parameters of probability distribution of the process variable (weight) and fix appropriate control limits.

A study was undertaken for designing methods of statistical weight control of detergent powder in a process industry. There are certain regulations laid down about the packed weight of detergent cartons.

Weight Regulations

There are two basic concepts of weight legislation : (a) Minimum weight concept, and (b) Average weight concept

Minimum Weight Concept : The legislation based on minimum weight concept, which is in general use throughout the U.K. and some Commonwealth countries, states that no pack whose weight is below the declared weight should be offered for sale. In order to meet this basic requirement, the factory must produce packs having excess than declared weight, the amount of excess weight being a function of the characteristics of the powder filling machine. This type of legislation completely protects the customer against the purchase of any under-

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weight product.

However, this legislation necessitates the centering of process average at a level appreciably higher than the declared weight. Average amount of overpacking (Fig.1) is reflected in selling price of the product. This legislation has another disadvantage from consumer's point of view, in that it makes difficult for him to judge 'value for money' based on declared weight and selling price. If two manufacturers A and B have packs with different weight distributions (Fig. 1), the average overpack of B being higher than that of A, then B must charge a higher price for the product, if both A and B ensure same quality level The consumer, on inspection of price and declared weight, would expect that the higher price charged by B is due to better quality product which is not true.

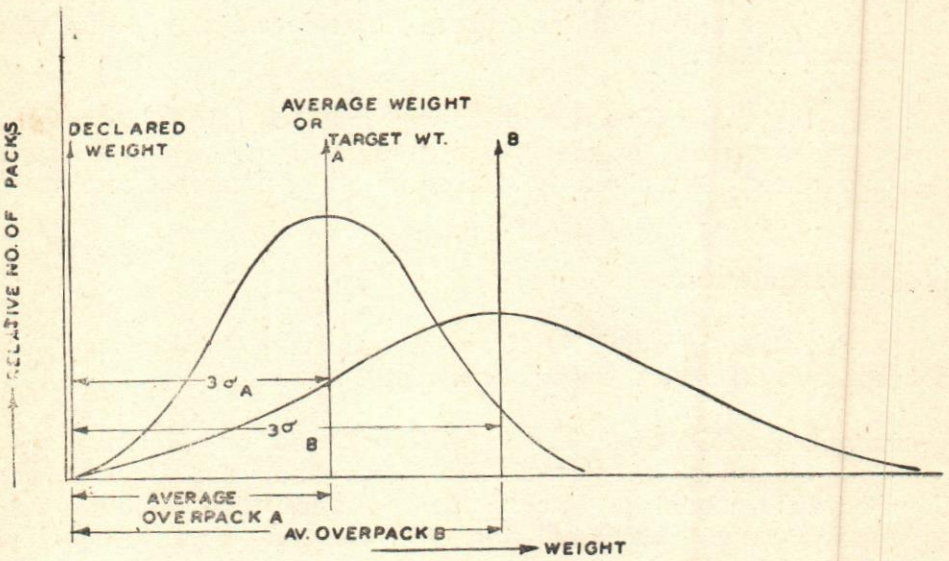

Fig. 1

Average Weight Concept : The average weight of a random sample drawn from a lot must be greater than or equal to the weight declared on the pack. In order to ensure that customers do not receive many underweight packs even if the sample average weight meets the specification, the ligislation has defined another requirement.

The random sample should not contain more than 5% of the packs whose weight is less than 95% of declared weight (under-weight tolerance limit). In other words, if a sample of 200 cartons is selected, weight declared on cartons being 1000 gms, the number of defective cartons (with weight less than 950 gms) should not exceed 10, for the lot to be accepted.

These restrictions necessitate the setting of detergent filling machine at a certain average weight or target weight which is higher than the declared weight (Fig. II).

Let σ = standard deviation of distribution of individual weight values

σa = standard deviation of distribution of sample average

If the number of packs below the underweight tolerance limit is set at 5% (maximum specified), then from unit normal distribution tables, $z\sigma = 1.645\sigma$

$\therefore$ Average overpack = $1.645\ \sigma - .05 \times$ Declared Weight

We know from Central Limit Theorem that the sample average follows normal distribution with same mean (target weight) and standard deviation $\sigma a = \frac{\sigma}{\sqrt{n}}$ where n is the sample size. 3–σ limits can be safely adopted for determining the separation between declared weight and target weight of packing machine.

$$\therefore \quad \text{Average overpack} = 3\sigma a = \frac{3\sigma}{\sqrt{n}}$$

$$\therefore \quad 1.645\ \sigma - .05\ D\ W = \frac{3\sigma}{\sqrt{n}}$$

$$\therefore \quad \sigma = \frac{DW}{20\left(1.645 - \frac{3}{n\sqrt{n}}\right)}$$

If declared weigt is 750 gms and sample size is 200,

$\sigma = 26.2$ gms.

$$\text{and Target Weight} = DW + \frac{3\sigma}{\sqrt{n}}$$

$$= 750 + \frac{3 \times 26.2}{\sqrt{200}}$$

$$= 755.56 \text{ gms.}$$

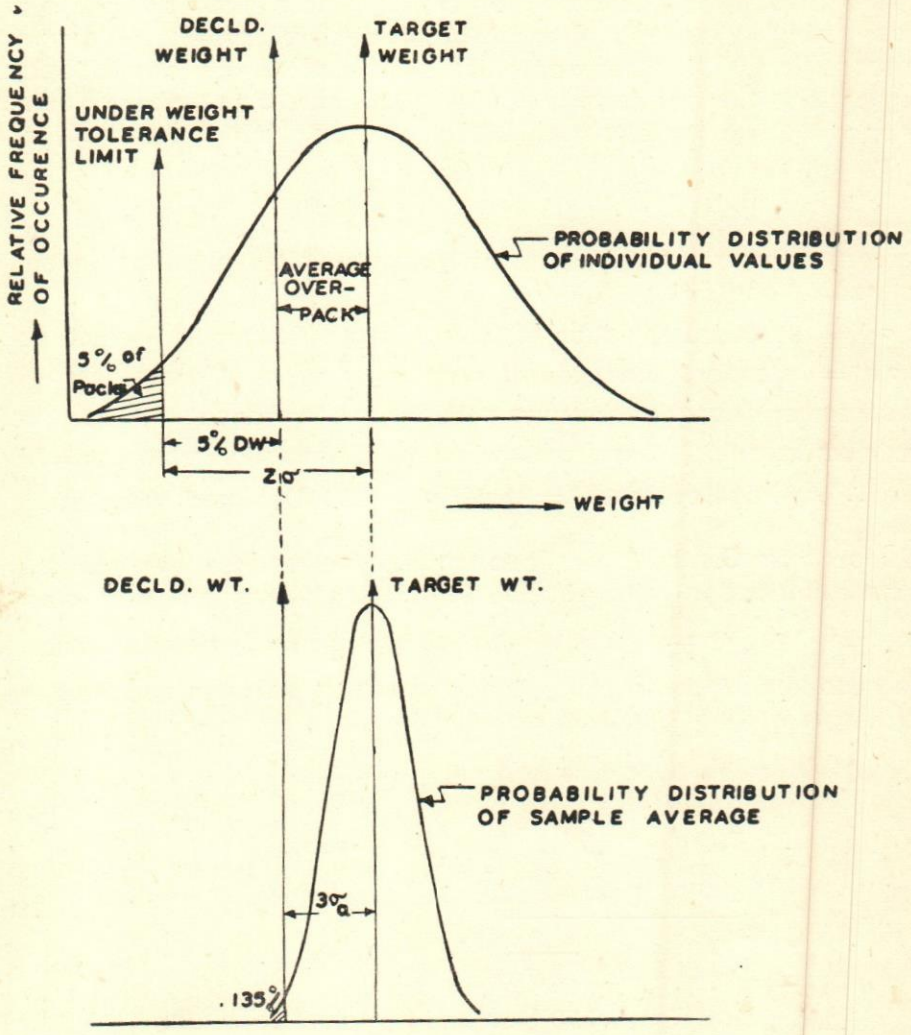

Fig. 2

Therfore, packing machine should be centered at 755.56 gms. and dispersion (s. d.) of filling process should not exceed 26.2 gms. (critical standard deviation) in order to produce packs conforming to the legislation.

Data Collection

Most of the high-speed filling machines used in detergent industries have a carousel containing a number of flasks and the volume of these flasks is adjusted to get proper weight. Number of flasks varies according to the pack size, but it is usually 8 to 16. The amount of powder being filled in a carton is controlled volumetrically. The weight of packed carton depends upon following factors :

(i) Accuracy of volume adjustment of packing machine.

(ii) Bulk density and moisture content of powder.

(iii) Ability of the product to flow freely out of the flasks into empty cartons.

Out of the parameters mentioned above, it is feasible to control only the mechanical adjustment of filling machine (at that stage) to control the weight per pack. Therefore, in the event of the process getting statistically out of control, the corrective action required to be taken is readjustment of the volume of flasks which can be accomplished simply by turning a knob meant for the purpose. Automatic machines have packing capacity of the order of 100 cartons per minute.

For process control, existing practice in the plant was to take out a sample of four successive cartons every five minutes. The cartons were weighed and indication given to operator about sample average. Then, on the basis of his past experience and judgement, he performed corrective action by turning the knob. This practice was not capable of controlling the process efficiently. The operator adjusted the machine very frequently which, we know, tends to increase process dispersion. One of the objectives of the study was to design an effective process control plan to provide adequate feedback informaton to reset the process. The plan should provide accurate and timely feedback and the action taken by machine operator on the basis of this information must be logical and near-optimal. An important feature of good process control is that it tells the operator when to allow the process to continue, thus minimising the possibility of unnecessary readjustment.

The packing machine for 750 gms. detergent powder has nine flasks. Data was collected by removing from the line, in consecutive order, the

number of packs produced by four revolutions of the carousel. Sets of observations were taken after every half hour and the pack weights recorded. Table 1 shows the readings for five sets of observations. It is most appropriate, in a situation like this, to use 'Group Control Charts' for achieving effective weight control.

Group Control Charts

There are nine subgroup sources (flasks) doing the same operation and aiming at the same value of quality characteristic 'weight'. Anticipating that they exhibit identical dispersions, a group control chart can be run for all of them. A group control chart combines subgroups from different identical sources and provides control information in a compact form (in a single chart) which can be easily interpreted.

in all, 45 subgroups were taken during study and control limits calculated for $\bar{X}$ and R charts.

Mean of subgroup averages $\bar{\bar{X}} = \frac{\Sigma \bar{X}}{45} = 15.25$

Mean of subgroup ranges $\bar{R} = \frac{\Sigma R}{45} = 10.10$

For average group control chart,

Uper control limit $= UCL_{\bar{X}} = \bar{\bar{X}} + A_2\bar{R}$

$= 15.25 + .73 \times 10.10$

$= 22.62$

$(A_2 = .73 \text{ for } n = 4)$

Lower control limit $= LCL_{\bar{X}} = \bar{\bar{X}} - A_2\bar{R}$

$= 7.88$

For range group control chart,

Upper control limit $= UCL_R = D_4\bar{R}$

$= 2.28 \times 10.10$

$(D_4 = 2.28 \text{ for } n = 4)$

$= 23.0$

Lower control limit $= LCL_R = D_3\bar{R}$

$= 0 \ (D_3 = 0 \text{ for } n = 4)$

Table 1 : Measurement of Weight Above or Below the Declared Weight of 750 gms.

Set 1

Round No. *Flask No.*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1	17.5	16.0	14.0	17.5	13.0	15.0	16.0	19.0	14.0
2	16.5	14.0	12.5	9.0	9.50	13.0	12.0	17.0	10.0
3	15.0	13.0	14.5	21.5	12.5	13.5	14.0	17.0	10.0
4	10.0	9.0	14.5	8.0	8.0	23.0	8.0	12.0	8.0
Average $\bar{X}$	14.8	13.0	13.9	14.0	10.8	16.1	12.5	16.3 H	10.5 L
Range R	7.5	7.0	2.0 L	13.5 H	5.0	10.0	8.0	7.0	6

Set 2

Round No. *Flask No.*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1	18.0	15.5	17.5	18.0	17.5	14.5	14.5	18.0	15.0
2	16.0	16.0	14.0	13.0	16.0	17.0	16.0	14.0	14.5
3	18.0	17.5	22.5	18.0	17.0	20.5	16.5	20.0	15.0
4	18 0	15.5	19.0	13.0	15.0	16.0	17.0	18.0	21.0
Average $\bar{X}$	17.5	16.1	18.3 H	15.5 L	16.4	17.0	16.0	17.5	16.4
Range R	2.0L	2.0L	8.5H	5.0	2.5	6.0	2.5	6.0	6.5

Set 3

Round No. *Flask No.*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1	24.0	17.0	11.0	14.0	30.0	12.0	10.0	15.0	7.0
2	10.0	0.0	11.0	11.0	10.0	10.0	7.0	20.0	14.0
3	18.0	14.0	20.0	20.0	16.0	16.0	12.0	20.0	9.0
4	11.0	6.0	12.0	12.0	8.0	13.0	12.0	20.0	7.0
Average $\bar{X}$	15.8	9.3L	13.5	14.3	16.0	12.8	10.3	18.8H	9.3L
Range R	14.0	17.0	9.0	9.0	22.0H	6.0	5.0L	5.0L	7.0

Set 4

Round No *Flask No.*	*1*	*2*	*1*	*4*	*5*	*6*	*7*	*8*	*9*
1	7.0	12.0	2.0	7.0	11.0	10.0	17.0	15.0	20.0
2	12.0	12.0	9.0	12.0	12.0	13.0	13.0	10.0	17.0
3	16.0	11.0	22.0	17.0	18.0	18.0	22.0	24.0	17.0
4	4.0	24.0	14.0	18.0	13.0	10.0	11.0	9.4	13.0
Average $\bar{X}$	9.8L	14.8	11.8	13.5	13.5	12.8	15.5	14 5	16.8H
Range R	12.0	13.0	20.0H	11.0	7.0L	8.0	11.0	15.0	7.0L

Set 5

Round No. *Flask No.*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1	15.0	24.0	22.0	24.0	20.0	14.0	10.0	23.0	10.0
2	11.0	5.0	8.0	11.0	9.0	14.0	22.0	12.0	32.0
3	26.0	17.0	25.0	23.0	24.0	27.0	17.0	24.0	22.0
4	27.0	22.0	20.0	16.0	15.0	23.0	19.0	19.0	16.0
Average $\bar{X}$	19.7	17.5	18.8	18.8	17.0L	19.5	19.5	19.5	20 0 H
Range R	16.0	19.0	17.0	13.0	15 0	13.0	22.0H	12.0L	22.0 H

Group control charts for average and range are shown in Fig. 3. All plottd points lie within control limits. If any point had fallen outside the limits, it should have been deleted and control limits re-determined. Data used for calculating control limits must belong to the same universe. Once control limits are fixed, they can be used for future control purposes.

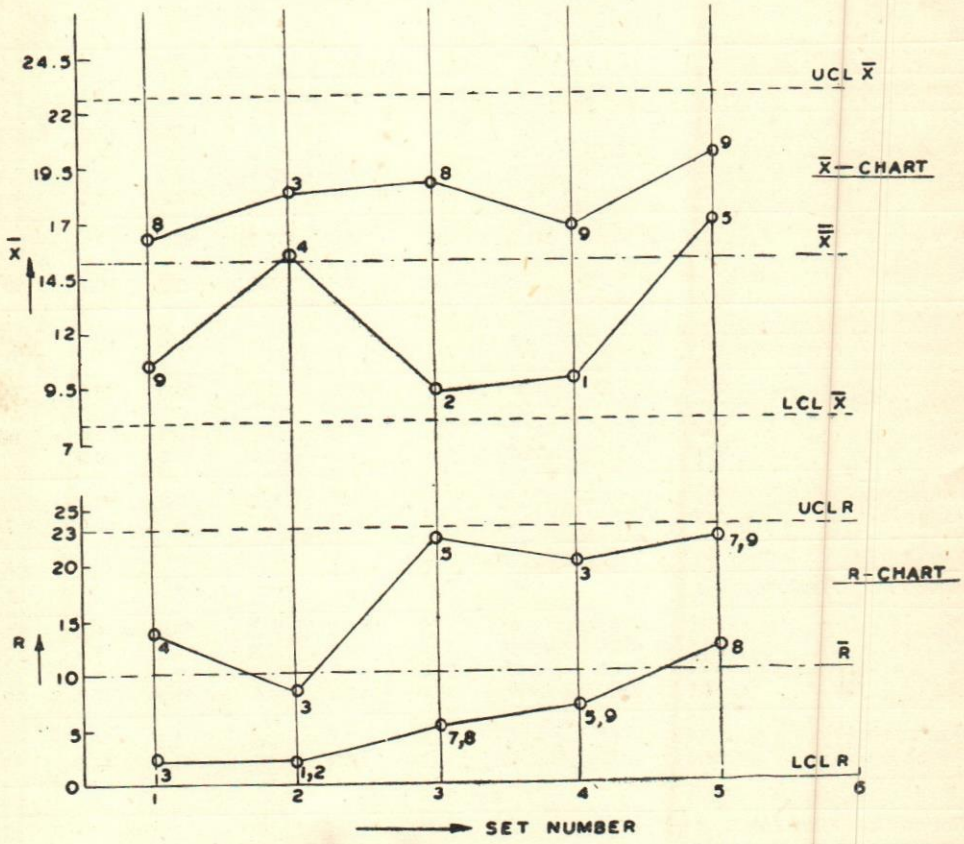

Fig. 3 : Group Control Chart

For each set of subgroups, we need plot only highest (H) and lowest (L) values of averages and ranges on group control charts. The flask

numbers contributing to highest and lowest values are indicated along with plotted points. If any point falls outside control limits, corrective action must be taken by readjusting carefully the volume of the corresponding flask.

It can be easily judged whether certain subgroup sources are running consistently high or low. If all sub-group sources have identical mean and dispersion, the max-min. points would occur at random for any flask. If majority of max. or min. points belong to one flask, it should be isolated and its alignment adjusted.

Process Capability

The control chart analysis shows that the filling process is centered at 765.25 gms with standard deviation

$$\sigma = \frac{\bar{R}}{d_2} = \frac{10.1}{2.059} = 4.91 \text{ gms.}$$

Therefore, the packing machine is set at higher value than that required to satisfy weight regulations, though the spread of the process is much smaller than the critical value (26.2 gms). This may be due to the incentive plan in operation which is based on the number of lots accepted as per weight regulations. The operator has a tendency to overfill the packs since there is no upper limit specified in the regulations. In such a situation, multifactor wage incentive plan is best suited. There should be some penalty fixed in the plan for the amount of give away.

Target weight at which process should be centered (Fig. 2)

$$= \text{Declared Weight} + 3\frac{\sigma}{\sqrt{n}}$$

$$= 750 + \frac{3 \times 4.91}{\sqrt{200}}$$

$$= 751.04 \text{ gms.}$$

$$\% \text{ give away (or } \% \text{ loss)} = \frac{765.25 - 751.04}{751.04} \times 100$$

$$= 1.9\%$$

In other words, the Company is losing, on an average, 14.2 gms. of detergent powder per pack due to wrong process setting.

It is recommended that the machine setting be changed to a target weight of 751.04 gms. The % number of packs below the underweight tolerance level (95% of declared weight) would be just negligible, which meets the requirements of weight legislation very well. □

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Validity Study of a Selection Test Battery Used for a Business Management Course

S. Chatterji,* Manjula Mukerjee & P. Chakraborty**

An Indian University conducts a two-year Post-Graduate Programme in Management and Business Administration. The aim of the course is to impart knowledge, develop qualitative and quantitative skills, foster attitude and understanding which will enable the students to understand business functions and operations, to realistically appraise a business problem and formulate an appropriate plan of action. It will thus constitute a foundation for their growth into competent and responsible business administrators in future.

The minimum qualification for admission to this course is a Bachelor's degree in any discipline with not less than 50% marks in aggregate.

The screening of the applicants for admission to this course is based on the following three aspects :

i) Academic qualifications and extra-curricular activities as assessed through information given in the application;

ii) Performance in aptitude tests;

iii) Mental maturity, qualities of character, motivation, evidence of leadership as assessed through group discussion and interview.

After the initial screening as judged primarily from their academic background and extra-curricular activities (information available from the application), the candidates who qualified are required to sit for a selection test. Next, those who qualify on the basis of this also, are called for interview and group discussion.

The Psychometric Research and Service Unit of the Indian Statistical Institute has been entrusted to handle the selection tests. The present study was undertaken to evaluate the efficacy of the selection tests developed in this connection.

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**Manjula Mukerjee and P. Chakraborty are also with ISI, Calcutta.

Description of the Test Battery

In the year 1969, a tentative battery consisting of the following tests,

(i) General Ability,

(ii) Breadth of Knowledge,

(iii) English Knowledge and Comprehension,

(iv) Mathematics, was prepared and used for screening the applicants. In the next year this battery was revised on the basis of item analysis and was used for purposes of selection which was followed by successive revision on the basis of validity study. The revised form on the basis of such study was, however, ready in the year 1971, and this form was used in the year 1972 also. The tests included in the battery are briefly described here.

General Ability : There are three parts in this test : (a) Verbal Reasoning, (b) Quantitative Reasoning and (c) Data Interpretation. The first two aim at measuring one's ability to grasp the inherent relationships among different factors presented in a problem. This relationship may be explicitly or implicitly presented in a quantitative or a qualitative form respectively. The presence of this ability helps one to tackle a given problem analytically. As future business administrators, the MBA graduates would be called upon to interpret data presented in a tabular or graphical form, and so the test of Data Interpretation was included.

Breadth of Knowledge : This is a test of general knowledge covering areas about which an educated and cultured person is expected to know. As in future these MBA graduates, in all probability, will be exposed to various types of persons and situations, a good amount of general knowledge is expected to be an asset for them in establishing an effective interpersonal relationship.

Mathematics : It is expected that some amount of mathematical aptitude would be necessary in order to complete the course successfully, and the test of Mathematical Comprehension included in the battery measures this aspect.

English Knowledge and Comprehension : Good knowledge and comprehension of English are necessary for following the instructions etc., during the course as well as for becoming a successful business administrator in future. In consideration of these facts, a test of English Knowledge and Comprehension was included in the battery.

All these tests were objective in nature and multiple choice items were used, so the standard correction formula for guessing was used while scoring the answer papers.

Administration of the Tests

As already mentioned for both the years 1971 and 1972, the same test battery was administered. Candidate's manual was sent to each candidate in advance to brief them regarding the nature of the tests. Administration of the test at the various centres was kept uniform by the use of a detailed supervisor's manual.

Analysis of Test Scores

To start with, the mean and standard deviation of the scores for each of the tests (used in 1971 and 1972), the inter-correlations among them were calculated and the values are presented in tables 1 and 2.

From the values presented in tables 1 and 2, it follows that the tests were suitable for the groups so far as the difficulty levels were concerned, and the inter-correlations among the tests were not very high which indicated that the tests were measuring different dimensions. It may be added that the reliability values obtained were adequate for the purpose.

Predictive Ability of Selection Test Scores

The criterion against which this validity study was done is being briefly discussed here.

Table 1 : Showing Mean Values, Standard Deviation, Reliability and Maximum Possible Score for Each of the Tests Used for Selection in 1971 & 1972

Subject	Mean		S.D.		Maximum possible score	Reliability (KR-21)
	1971 N=314	1972 N=393	1971	1972		
1. Verbal Reasoning	14.20	14.63	4.08	4.16	27	.63
2. Quantitative Reasoning	15.16	15.66	4.52	4.02	26	.72
3. Data Interpretation	13.43	13.78	4.38	3.72	26	.69
4. Mathematics	10.69	11.31	4.10	4.29	20	.75
5. Breadth of Knowledge	15.52	15.25	5.05	5.05	30	.73
6 English Kng. & Comp.	15.14	15.06	4.39	5.39	31	.75

Table 2 : Showing Intercorrelations Among Different Tests Used in 1971 and 1972

Test / Year	1	2	3	4	5	6
			1971			
1		.49	.43	.46	.37	.54
2	.53		.46	.53	.22	.41
3	.50	.54		.48	.34	.40
4	.31	.54	.50		.27	.43
5	.48	.28	.33	.33		.49
6	.59	.40	.48	.43	.67	

The duration of the course is two academic years, and there are two semesters in each year, providing for 13 to 15 weeks of effective teaching per semester. The curriculum for the first year is compulsory and includes subjects which are relevant to management, viz., economics, mathematics, statistics, behavioural sciences, marketing, accounting, etc. The second year involves two semester courses in Business Policy, including elective subjects. The marks obtained in each subject were first converted into percentages and then added to get the final criterion score. In this follow up study, the candidates selected in three successive years, viz., 1969, 1970 and 1971 were considered.

As in 1969 and 1970 the selection test battery was in the process of revision to suit the special requirements of the MBA course, instead of considering the score on the various tests separately, the composite aptitude score was considered for the follow up study and data for these two years were pooled for purposes of analysis. To start with, selected candidates were first classified as high scoring (stanine 9) or low scoring (stanines 8 and below) on the basis of composite aptitude score; then each of these two groups were further divided into High (securing 60% and above) and Low (securing less than 60%) with respect to each of the four criterion marks separately. This gave a set of contingency tables corresponding to each of the four criterion scores. The independence of the variables in these 2x2 contingency tables was tested with the usual χ^2 test and the obtained values are presented in table 3. In order to study the predictive ability of the other three selection variables, viz., interview marks, application evaluation and group discussion ratings, similar procedure was followed and the obtained values are presented in the same table. To provide a direct comparison of the effectiveness of the four selection variables, viz., aptitude, interview, group discussion and application evaluation, the percentages in the contingency tables mentioned above are presented in table 4.

It may be noted that the observed relationship between "aptitude composite" was statistically significant with respect to all the semester marks except that for the first semester. At the same time it is seen from this table that the corresponding figures for none of the other selection variables was statistically significant.

The figures in table 4 indicate that only for the aptitude composite, positive relation with later semester grades earned was present; for the other selection variables the relation was rather poor and was even in the negative direction at some places.

Next, the selection data for the groups selected in 1971 were analysed against the first two semester results of the first year of the course. For this group of candidates the results of the first two semesters were only available at the time of this analysis. The same process of analysis as used for the earlier groups, was followed here also and the obtained χ^2 values are presented in table 5 and the corresponding percentages of the contingency tables are presented in table 6. In

this case, in addition to considering the composite aptitude score, the marks obtained in each of the tests of the battery were also taken into account.

Table 3 : Showing the Chi-square χ^2 Values Corresponding to the Sixteen Contingency Tables (1969, 1970 groups)

Criterion/Selection variable	*Aptitude Composite*	*Interview*	*Application Evaluation*	*Group Discussion*
First Semester (1st year)	0.68	1.69	0.03	0.03
Second Semester (1st year)	2.70*	0.07	0.03	0.03
First Semester (2nd year)	4.75**	0.36	0.90	0.33
Second Semester (2nd year)	2.70*	1.08	0.33	0 36

* indicates significant at 10% level. ** indicates significant at 5% level.

Table 4 : Showing the Percentage of the Sixteen Contingency Tables

Criterion/Selection variables		*Aptitude Comp.*		*Interview*		*Application Evalution*		*Group Discussion*	
		H	*L*	*H*	*L*	*H*	*L*	*H*	*L*
1st year	H	55	39	58	33	46	43	46	43
First Semester	L	45	61	42	67	54	57	54	57
1st year	H	78	45	58	47	54	57	54	57
Second Semester	L	22	55	42	53	46	43	46	43
2nd year	H	78	33	42	47	46	64	54	43
First Semester	L	22	67	58	53	54	36	46	57
2nd year	H	78	45	67	53	54	43	62	50
Second Semester	L	22	55	33	47	46	57	38	50

Table 5: Showing Chi-square (χ^2) Values Corresponding to Contingency Tables for the Group Selected in 1971

Criterion/Selection variable	*First Year First Semester*	*First Year Second Semester*
Verbal Reasoning	0.03	1.15
Quantitative Reasoning	0.39	0.06
Data Interpretation	1.15	1.15
Breadth of Knowledge	2.39	6.11**
Mathematical Comprehension	0.05	3.83*
English Know. & Comp.	0.39	2.30
Aptitude Composite	1.80	5.74**
Interview Rating	0.05	3.83*
Application Evaluation	5.84**	0.44
Group Discussion	0.39	0.06

* indicate significants at 5% level. ** indicates significant at 2% level.

A study of the figures presented in table 5, shows that criterion-I, i.e., the marks obtained in the first semester were not related with any one of the selection variables except with the application evaluation, while criterion-II, i. e., the second semester marks were positively and significantly related with composite aptitude score, interview rating and also with the individual test scores on Mathematical Comprehension and Breadth of Knowledge.

It may be observed that in none of the three successive years the group discussion rating had any predictive usefulness so far as later performance in the course was concerned. Aptitude composite was the only selection variable which was significantly positively related with later performance in the course in a consistent manner over these three years.

The first semester marks, however, need to be studied a bit carefully and it may be necessary to add something new in the list of selection variables so that this can also be predicted consistently.

Table 6 : Showing the Percentages of the Eight Contingency Tables for Group Selected in 1971

Criterion/Selection variable		*First year First Semester*		*First year Second Semester*	
		H	*L*	*H*	*L*
Aptitude Composite	H	60	40	70	30
	L	27	73	18	82
Interview Ratings	H	50	50	70	30
	L	45	55	27	73
Agplication Evaluation	H	73	27	55	45
	L	20	80	40	60
Group Discussion	H	50	50	60	40
	L	64	36	55	45

Conclusions

The findings from this study can be summarised as follows :

1. Aptitude composite was significantly positvely related with later performance in the course in a consistent manner. Some modification in the battery by way of adding one or two new dimensions may further improve the accuracy of prediction and this point is being actively considered.

2. Interview and Application evaluation need to continue as selection variables, as they were found to be related with later performance though not consistently.

3. Group discussion ratings were not at all related with later performance as observed so far. □

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A Quarterly Journal of Translations

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Book Reviews

Economics for Trade Unionists

H. C. Gupta

Minerva Associates Pvt. Ltd., 7-B, Lake Place, Calcutta, 1976

Reviewed by J. D. Verma*

Like other countries, the Trade Union Movement in India took its birth to give vent to the grievances of the working class, may these be for increase in wages, provisions of welfare facilities, rehabilitation of retrenched/dismissed fellow workers, etc. It continues to remain so even today. No doubt, in its evolution the Trade Union Movement in India has embraced a lot both from West as well as the Centrally-controlled economies. Unfortunately, however, in doing so the rational of the need and extent of the adaptaibility of the Western and other norms have been lacking, e. g., the claim for increase in wages has always been based more on the high cost of living to which the working class is subjected, and less on their increased productivity as also their contribution to the income/profits of the employers. It is here that the importance of the principles of economics emerges.

If any claim for increase in wages is based on the rationale of economic principles, the employers obviously do not have stronger ground to withhold it. Unfortunately the "agitation approach" on the part of the employees' unions and the lock-out weapon threatened to be used by the employers over-shadow the economics of such a "wage-increase" demand. Furthermore, the prestige issue echoed both by the employer and the employees substitutes the economic reasoning. Perhaps, one of the reasons which accounts for such a situation is the lack of knowledge of principles of economics among the leadership of the Trade Unions and to a lesser extent among the representatives of the employers.

While the employer is in a better position to engage the services of experts in economics to represent his case, the employees have to remain content with the negotiable capacity of their leadership which, very often is not possessed of the general principles of economics having bearing on matters under discussions. The structure and composition of the Trade Unions in India, more often comprises the labour class drawn from a section of the population who had practically no

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opportunity of attending regular schools and colleges, where the principles of economics are being taught. In most of the cases, their leadership is also in the hands of politicians who have somehow found it convenient to get a following from the mass of labour class by giving them promise of fighting their cause on various platforms in the government, within and outside legislature.

Trade Unions are thus faced with horns of dilemma : on the one hand they cannot provide strong and effective leadership from amongst themselves so that an objective approach could be adopted while negotiating with the employers for securing their legitimate rights, and, on the other, they have to depend on the people, whose approach, very often, is devoid of the said objectivity. Under these circumstances, therefore, the thesis of H. C. Gupta, that the stimulation of economic with functional orientation to trade unionists in the context of the fast-changing economic and social milieu in developing countries have been widely recognised and stressed, is very appropriate. However, as he himself admits, so far, very little attempt has been made by the writers in India to educate trade unions in general and their leadership in particular, with the principles of economics. Gupta's book is, therefore, an attempt in the right direction.

The author starts with a discussion on the changing trends in the powers of the trade unions and the growing role of the young leadership which is emerging among trade unions in India. He passes on to highlight the functional problems which every nation has to tackle, i.e., what to produce, how to produce and for whom to produce. The role of capital and technology in tackling these problems is equally appreciated and recognised. This is followed by a discussion on the concepts of the "free and competitive market" as also how far the working of Indian economy is free and competitive. Discussion on how prices are determined in a socialist economy is followed by the conceptual clarification of terms like National Output and Income, their importance particularly on its distribution, etc. After discussing the impact of the pressure of growing population, particularly how it erodes the fruits of development and results into the falling living standards, the author finally discusses the wage policy in India and some of the developing and developed countries. The author concludes his thesis by discussing the possibilities of increase in wages leading to inflation in socialist economy and how trade unions have reacted to some of the measures adopted by

the government to combat inflation.

Undoubtedly, the book under review is a step forward in bringing to light some of the fundamental issues which affect the life of the workers engaged in manufacturing and other sectors of economy. The reviewer, however, differs with the author's assumption that the working class and their leadership in the trade unions is educated enough to understand and chew some of the fundamentals of economics, as discussed in the book. As mentioned earlier, the working class has so far rallied around the trade unions and their leadership only, because they feel that individually they are neither educated enough nor well equipped to negotiate with the employers

Moreover, the general principles of economics which have a bearing on the determination of wages, functioning of the demand and supply in the open market and, above all, the determination of various policies and programmes connected with the economic lot of the working class do not have an exact bearing on the realities of the situation as it prevails in our national economy. The knowledge of the various principles of economics discussed by the author may, no doubt, be useful in the technical sense. How far these would prove their usefulness in the practical operational sense will again depend on the comprehension, adaptability and rationality of approach of those who actually occupy the position of leadership in the trade union movement in India.

Nevertheless, it may be useful to make a beginning by teaching various principles of economics of labour as enunciated in this book, in the programmes which are being organised by the Faculties of Industrial Management in various Universities and particularly by the specialised institutions concerned with different aspects of the Indian working classes. □

Real Wages of Industrial Labour in India

B. K. Madan

Management Development Institute, New Delhi (1977) pp. 64+vii, Rs. 15.00

Reviewed by N. K. Nair*

The very same old inquiry, the workers' real income which time and again has eluded analysts' capability to measure forms the theme of B.K. Madan's objective in this monograph. The book deserves a serious reading because of the contemporary importance of the subject and more so because of the authors' association with the Bonus Review Committee. Workers (and non-workers), a wage bill (and a salary bill too), a cost of living index of industrial workers (not applicable to the salariats) etc. form essential ingredients in the analytical mould as in the case of any typical inquiry in the context. Howsoever conservative the analytical framework is, there is certainly a bold conclusion stated clearly and eloquently, that contrary to the popular belief, the real earnings of workers have been increasing at a modest rate during the post-independence period. Yet, the reviewer asked himself a relevant question : who, after all, constitutes the so-called industrial worker in the Indian conext ? The author has not defined his concept of 'worker' or 'non worker' anywhere in the text. This omission reflects a serious limitation in the approach of the monograph, more so because of the emphatic denial by the author of the concept of worker as employed by the National Labour Commission, viz., one who draws a monthly wage income of less than Rs. 200/ revised to Rs. 400, in the sixities. Apparently, the author accepts the definition extended in the CMI-ASI Reports.

The author's main contentions in the monograph are the following :

1. The returns collected under the Payment of Wages Act (1936) have an in-built downward bias in the real earnings because of the ceiling imposed on the wage level (Rs. 200 per month) in defining the worker itself. Therefore, earlier studies based on this data, including the Report of the National Labour Commission, tend to understate the gains in the real earnings of workers. Rectification of the conceptual error yields to the author, an increase in the real earnings of workers

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to the extent of 1.6 percent per annum compound during the period 1951-1970, as against a real income per capita increase of about 1.5 per cent per annum compound.

2. The observed decline in the share of worker compensation in the value added by manufacture cannot be interpreted to imply a corresponding decline in the real wages because of the simple fact that other inputs (capital and employees other than workers) are increasing relatively faster than labour.

3. The real earnings of workers are found to have significant correlation with the partial productivity of labour.

A careful analysis of the concept of labour employed by the author would show that his results are not wholly free from conceptual errors which invalidated the results of the National Labour Commission. The difficulty lies in the definition of workers in the CMI-ASI Reports. The term worker in these reports connotes the same sense as in the Factories Act (1948) but excludes persons holding position of supervision or management or employed in confidential positions. This concept has the disadvantage of a flexible definition, the distinction between worker and non-worker being very subtle, particularly across industries. It leaves a lot of discretion on the part of the unit to classify an employee as a worker or as a non-worker. This is a very important limitation because of the tendency on the part of the reporting units to understate the number of workers they employ for fear of implementing the provisions of various labour legislation. Thus, atleast, part of the upward shift in the share of non-workers in the total employment may be attributed to errors in the source of information. Further, what use can there be of a concept which does not remain rigidly fixed across the units and industries?

The author devotes quite a few pages in order to establish the inverse relationship between price increase and real earnings. This was, perhaps, not necessary since this inverse relationship is implicit in the difinition of real earnings itself. However, the painstaking arithmetical exercises undertaken by the author are commendable.

In view of the author's reservations to accept output-labour ratio as representing labour productivity, the usefulness of the entire chapter

VI wherin he discusses the correlation between wages and productivity is in doubt. Can we reason out the cause-and-effect relationship of the correlation between the two ? Methodologically, one can point out that since both the series are found to have strong time trends, the correlations may not be real.

To conclude, the reviewer is of the view that a discussion of the real earnings of workers *vis-a-vis* non-workers is not of any particular significance. This stems mainly from two issues : first from the flexibility of the concept of worker in the source of data and second from the imperfections in the price indices which are used to deflate money wages. In a way the very concept of real earnings is questionable because of the lack of information regarding the utility function to which the prices and incomes can be related to. This utility function undergoes considerable shifts between two time periods, rendering the estimated real earnings meaningless, atleast, from a welfare accounting point of view.

Management : Theory, Principles and Practices

S. B Rao

Vora & Co. Publishers Private Limited, Bombay, 1977, pp. 235, Rs. 25.00

Reviewed by (Mrs.) B. Chopra*

The book is a welcome addition to the existing inadequate management literature by Indian authors, even though, the contents do not either promote an indigenous management concept or discuss, analyse or solve any management problem peculiar to India.

The tractable manner of explaining, in separate parts, five major functions of management : planning, organising, staffing, directing and controlling makes it a fairly good text-book. These five parts follow the first part of introduction where the author very briefly introduces various

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theories of management. He rightly gives comparatively more details of theories emphasising importance of human behaviour. In a separate section, of about one page, he briefly comments on how national policies like centralised planning, nationalisation and departmentalisation, financial situation, like dependence of some industries on foreign aid and social conditions, like poverty and general attitude of people towards business, affect management in India. Then the features of each of the five mangement functions are explained in separate chapters in relevant parts. Topics are handled concisely and clearly. Some of the chapters conclude with a section "Some Practices" where the author refers mostly to a study of 15 US Companies to tell the reader how the managers felt or what was the common parctice in those companies.

The author consistently illustrates from the survey of 15 US Companies. There are very few references to Indian cases and situations except in chapters on Reward System, Motivation, Manager Development and Recruitment The brief commentary in the beginning, 'Management in Indian Environment', and the few brief references to Indian situations do not go far to Indianise the subject. On the whole the, book appears a well-integrated gist of existing management concepts and principles.

References to practices appear cursory and not well-woven with the theoretical text. Thus, the book remains basically an introduction to principles and theories without a discussion on or analysis of practices, as the subtitle might suggest.

The book can certainly make a good introductory material for those junior or middle level practitioners and managers who have had no formal exposure to management discipline. It can also be recommended to management undergraduates. But, for those in professional institutions or at post-gradute level at various universities, it is exiguous.

Better printing and paper could have added to the appeal of the book. □

India's Export Pattern : Analysis on Potential Diversification

Amalesh Halder

Minerve Associates (Publications) Pvt. Ltd., Calcutta, 1976, Rs. 36.00

Reviewed by V.D.N. Rao*

The publication, which deals with India's export performance during 1957-66, also contains valuable guidelines on the future scope of the country's export diversification both in terms of composition and destination. It appears that it has stumbled into topical relevance viewed in the context of the current exercises being made by the new Government at the centre in reformulating the National Export Policy, and more particularly in revising the Export Policy Resolution, 1970.

The foremost premise on which the analysis has been attempted in the publication is that India's foreign trade should act as a 'leading sector', not a 'balancing sector'. Indeed, it is so from two points of view: firstly, exports earn valuable foreign exchange with which to pay for import needs of defence, development and maintenance as also to service and eventually pay off foreign debt obligations. Secondly, the importance of exports and imports alike ought not to be overstated in the context of self-reliance as these cannot attain a dominant position in the economy in terms of GNP, employment potential, etc. Therefore, a selective approach would have to be adopted in the matter of export promotion, keeping in view criteria such as value added realisation, employment opportunity arising out of export production, raw material availability, comparative cost advantage *vis-a-vis* other suppliers abroad, extent of assistance required for export marketing and so on. The broad theme of the publication under review fits into this thinking which perhaps is also the new strategy sought to be formulated by the new Government.

As regards the limitation on export expansion, the publication concludes that the factors responsible were not so much related to structural composition of the trade but lack of competitiveness in the world

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markets. The increased share of manufactured items in the export trade, especially in the engineering field and the improved rate of exports in terms of know-how, turnkey project, and consultancy services would, to some extent, bely the belief that lack of competitiveness proved responsible for insufficient export growth. Incidentally, the rate of export development in recent years looked up so well that even in the dark years of unprecedented inflation and economic malaise in general, it was the export sector only that came to be relied upon. No doubt, consistent competitiveness of a product is the most fundamental factor influencing export promotion. And the whole range of raw material costs, domestic infrastructure, quality control and standardisation, export assistance measures, marketing techniques and so on would have to be tied up systematically and effectively to be able to build up competitive strength of the product meant for overseas sale. But there must be a willing buyer too. The problems on the demand side cannot be ignored. Nor the inadequate progress of international trade forums in dismantling tariff and non-tariff barriers against the products of developing countries in general and of India in particular.

International trading is a complex phenomenon. It is well nigh difficult to identify a set of factors on supply and demand sides and seek solutions once for all. Yet, each country tends to develop its own trade policy in tune with its marketing capabilities. More particularly so, with a fast developing economy like India. The nuances of the policy need to be replaced, revised and sometimes reversed on a continuous basis. What was relevant during the 50s and 60s may not be so today. But the contribution that Amlesh Halder's book has made is to enable us to look back and plan for the future and in the process avoid the pitfalls of export planning that the nation might have committed in the past; or at any rate, adjust the emphasis on exportable products, destinations etc. in a manner that it would lead to overall export growth.

The publication contains nine chapters on Scope of the study; Exports and Economic Development; India's Export Performance During 1957-66; Elasticities of Demand for Indian Export; Structural Characteristics of India's Foreign Trade; Indian Export Instability; Export Trade with Smaller Countries; Supply Possibilities of Indian Exportables and finally Conclusion and Policy Recommendations. The book is recommended to researchers and planners alike. □

Anatomy of Depreciation

G. D. Roy

The World Press Pvt. Ltd., Calcutta, 1977, Rs. 50.00

Reviewed by P. Chattopadhyay*

Serious and original studies on different topics in accounting in this country have been few and far between. The noticeable propensities have been in favour of writing textbooks on the mechanics of accounting, willy nilly undermining and somewhat underplaying the conceptual foundations on which accounting practices have taken shape. The mechanics of accounting has its forte in the provisions of the law like the Companies Act, the Income-Tax Act, etc. The lion's share of professional attention has gone into these machanical aspects rather than to building structures ot accounting theory specifically relevent from the point of view of a developing economy like ours.

The present volume stands out as an important contribution to the theory of depreciation, having in view both the concepts and the practical shapes that depreciation theory has taken in different contexts and in different countries. Approaches to depreciation have been several and inter-country, inter-industry and inter-disciplinary differences in these approaches have been pronounced in the multiplicity of methods and ways of understanding what in fact constitutes depreciation, its treatment in the accounts, its fate in the hands of tax authorities and its fulfilling the basic purpose behind it, which is ultimately the provision of enough funds, so that replacement is facilitated at the end of the stipulated period of life of the asset concerned and real profitability is displayed in accounts. This study comprehends most of these questions and analyses the rationale behind them. More significantly, it puts into view the various contour lines that depreciation has provided so that the theory of depreciation and its manifestation in practice could be better related for pinpointing issues that require serious consideration, with respect particularly to the adequacy of provision or otherwise in the light of technological improvements and changes in the value of money.

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Divided into nine chapters, the book deals with the treatment of depreciation as a charge against revenue, the idea of cost less depreciation, allocation of expired deferred cost, recovery of capital outlay, asset revaluation and its limitations, internal investment of depreciation provisions, depreciation of human resources and depreciability. The varied aspects of depreciation and its treatment in accounts have prominently figured in the earlier chapters of the book wherein the author has applied different methods of analyses to pinpoint issues. In this treatment the current state of the subject and its dimensions have come out clearly. The alternative ways of calculating depreciation have been dealt with in detail, identifying different plus and minus points of each method. Significant observations have been recorded in the context of analysis on different aspects of the concepts of depreciation from different points of view.

Of particular interest to students and researchers is chapter eight on Depreciation of Human Resources. Though, in the ultimate analysis, the question lends itself to different types of arguments as to whether human resources at all depreciate or, on the other hand, they appreciate in value with the gaining of experience and assimilation of different lessons from failures and successes, it has recently gained considerable attention in western countries. Detailed methodology has been developed for accounting for human resources, However, it can be proved also that the fatigue element in human beings is more than a mere symptom of depreciation; unless replenished, it results in diminution of creative ability. In the context of farm management studies, our agricultural economists have adopted a system of depreciation for cattle resources engaged in tilling land. Depreciation of human resources in the organised sector as envisaged by the author may be an extension of the practices adopted for calculating costs on the farm front.

In the light of growing literature on human resources accounting, the discussion on depreciation of human resources and the various factors underlined by the author may initiate a debate before its possible integration in the normal scheme of accounting in industry. The methodology of depreciation of human resources suggested by the author should be found interesting and instructive in the light of what he observes : "The cost of maintenance or livelihood of the employee is also considered deferred for the entire expected length of his stay in the employment of the enterprise. Its life is, therefore, coextensive with the life of

the human asset and usually remains added to the value of the same. But the human asset can rightly be depreciable when the said deferred cost of livelihood is excluded from it. Otherwise, both the human asset in the said composite structure and the said deferred cost as a separate item by itself are more amenable to amortization than depreciation although the 'limitation of life' in either case stands evidently to be uncontrollable." (pp. 205-206).

Though the present exercise of the author is essentially a conceptual one, there is ample evidence in different sections of the book of the author's wide range of knowledge of the current thinking on the subject and also of the depreciation practices in this country and abroad. The exposition is lucid, albeit occasionally interspersed by models and formulae. The conclusions drawn from these models have been succinct and clearcut, helping the reader to understand and appreciate the complicated overtones of different strands of thought and practice.

Management Accounting Problems in Small Industries

Institute of Cost & Works Accountants of India, Calcutta, 1975, pp. 183, Rs. 40.00

Reviewed by N. L. Dhameja*

This study is an attempt to demonstrate that the simple techniques of management accounting can throw light on areas in which small-scale entrepreneurs are interested for the purpose of effecting economies in their operations. It relates to an appraisal of small entrepreneurs from management accounting point of view and includes both pre-establishment planning and operational efficiency while the enterprises have started functioning. The application of management accounting techniques has been illustrated by relating them to a few units in West Bengal.

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The study is divided into two parts. The first part relates to different tools of analysis for appraising the efficiency of small scale entrepreneurs as going concern. This part deals with the definition, characteristics, problems of small-scale units and the management accounting techniques for solving these problems.

The small industry is stated to signify different ideas for different purposes and embraces all different organisational forms so long as it confirms to criteria of small scale. But different criteria have been adopted for determining whether a unit belongs to small scale. For example, for purposes of financial assistance and for various other facilities, smallness is defined in terms of investment upto Rs. one million, in plant and machinery while for other purposes, like Factories Act, Industrial Disputes Act, the emphsis is on the number of workers for power-using units and non-power using units.

The problem of small-scale entrepreneurs may be due to external environmental factors like Government policy, or due to the management of input and output. Some of the problems as discussed in the book are: relatively underdeveloped status of information system due to various organisational forms of small scale entrepreneurs, inadequate capital and credit availability, lack of necessary skills in the management group, and obsession of small scale units due to the problem of inefficient operations.

The first part also illustrates techniques of anticipated cash flow, inter-firm comparison and ratio analysis with respect to a number of small scale entrepreneurs in West Bengal. Cash-flow statement depicting the movement of cash, has been illustrated by emphasing on qualites of estimation and the comprehension of different elements of operations that go in the preparation of cash flow.

Inter-firm comparison is described as a tool for knowing and judging the trends of operations in different spheres of an enterprise's activities so as to pinpoint areas which require managerial attention for corrective action. It is not only an absolute measure of superiority or otherwise of a unit, but it stresses on the relative efficiency among the units. The study shows that the use of inter-firm technique by the management accountant can help the managements to know the efficiency of performance of the units so as to take corrective action for improvement of

productivity of various factors.

Inter-firm comparison can be in absolute terms or the ratio of two terms. The ratio analysis emphasises financial as well as operating aspects of the units. The simplified financial and cost accounting records have been presented for determining profits return on assets, capital employed, price fixation, technical and financial performance and liquidity. This analysis shows how cost and management accountants can be of service to small scale units.

The second part of the book deals with issues concerning the conception and establishment of small scale enterpreneurs, like preparation of feasibility report and the investment appraisal of the project. The feasibility study also called 'an enterprise on paper', incorporates fairly minute details for the justification of the unit covering the environments and constraints under which it is to operate. Appraisal of the investment project and the various techniques of appraisal are illustrated for five projects involving different investments in the small scale sector belonging to the chemical industries.

In short, the study illustrates in lucid and simple manner the problems of small-scale enterpreneurs and how management accounting techniques can be of use in solving them. However, the study would become more meaningful by classifying and presenting ratios linked with return on capital by expressing ratios between similar items (like cost of goods sold to current assets rather than sales to current assets), by avoiding presentation of the same ratio in reciprocal order, and by analysing some of the physical, and physical-cum-financial ratios.

The technique of inter-firm comparison has been illustrated on the assumption of uniform accounting but the assumption does not hold good for published accounts. It may also not be true for the units under study due to different treatments of financial transactions (like inventory valuation and depreciation on fixed assets), and in the absence of normalistion for the varied treatment of financial transactions. The conclusions drawn may not be correct. Further, the feasibilty report, to be meaningful, should have been discussed and presented in the format followed by financial institutions. □

Books Received

1. **Gratuity Law**	Mahesh Chandra;	N.M. Tripathi Pvt. Ltd.,	1973 ;	pp, 280 ;	Rs. 25.00
2. **Domestic Enquiry**	Markanday Katju;	N.M. Tripathi Pvt. Ltd.,	1975 ;	pp. 303 ;	Rs. 40.00
3. **Commentary on the Payment of Wages Act, 1936**	Mahesh Chandra;	N.M. Tripathi Pvt. Ltd.,	1972 ;	pp. 345 ;	Rs. 30.00
4. **An Anatomy of Peaceful Industrial Relations**	Paresh Majmumdar;	N.M. Tripathi Pvt. Ltd.,	1973 ;	pp. 291 ;	Rs. 80.00
5. **Workman & Wages**	Nagaraj, DR (Ed.)	Nagaraj Management Services;	1977 ;	pp. 18 ;	Rs. 12.00

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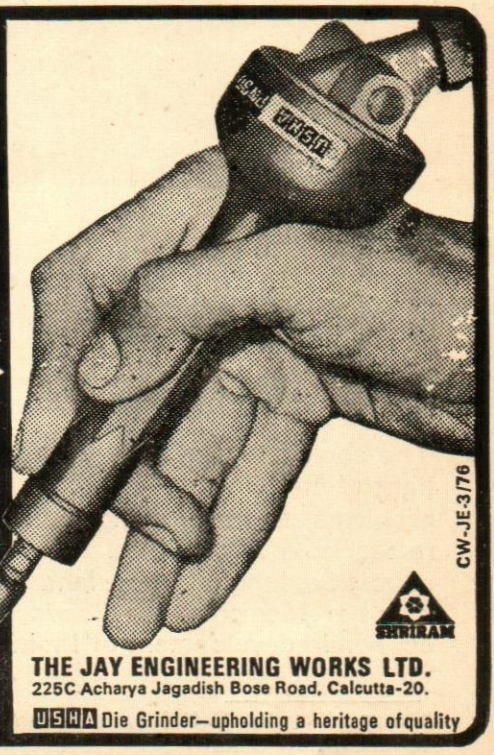
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New Books : Annotated List*

Advanced Systems Development Management

Coutinho, John de S

New York, John Wiley & Sons, 1977, pp. 433, $ 23.00

This book describes the management principles needed to minimise the gamble of creating such systems by concentrating on the entire development cycle. The author first explores the recognition of a need for the new system and then examines its technical definition, source selection, contracting, development, qualification, acceptance, operational testing, and release for production. His work is evolved from the military and space programmes that developed since World War II. It explains how systems engineering technologies outgrew their government confinements, necessitating a much more widespread knowledge of the special management techniques required to develop an advanced system.

Agricultural Problems of India

Bansil, PC

New Delhi, Vikas Publishing House Pvt. Ltd., 1977, pp. 659, Rs. 40.00

The book analyses lucidly the evolution of agricultural policy in the light of the five-year plans. It examines comprehensively such recurring problems as famines, floods, and drought and also suggests practical remedies. Agricultural finance, agricultural marketing, agricultural education, labour policy, land policy, cooperative movement and community development are discussed in the context of the overall socio-economic development of India.

*Prepared by Mr. S. N. Vig, Documentation and Information Officer, National Productivity Council, New Delhi

The Board and Management Development

Frean, David

London, Business Books Limited, 1977, pp. 188, £ 8.50

This book dealing with management for the board, is a non-academic appraisal for all board members of the management development activities required for continued organisational health. The author aims to provide some insight into the processes of management development and the ways in which these affect the working of the total organisation rather than to provide a set of ready-made forms or systems. Starting right from scratch with a management effectiveness audit and a management inventory, the author goes on to discuss how to plan for future management manpower resources. He advocates a distinct policy of management development. This will necessarily involve appraisals of performance and potential, selection and appointment of new managers, training, promotion, organisation development, pay and rewards. Each major activity is explained and accompanying digests can be used as a basis for discussion at board level.

Decision Making and Planning for the Corporate Treasurer

Bierman, Harold Bierman, Jr.

New York, John Wiley & Sons, 1977, pp. 195, $16.50

This book offers a prime source of guidance on today's most successful techniques of corporate financial decision making. It not only clarifies the methods that will improve the quality of these decisions, but also presents many specific recommendations on how to proceed. Providing a wide range of experience-tested ideas on developing realistic financial strategies, the book is a major aid in defining objectives and predicting the effects of alternative plans on the fortunes of the corporation.

Increasing Employee Productivity

Sibson, Robert E

New York, AMACOM, 1976, pp. 210, $ 17.95

This book sets up a guide for companies who wish to organise their own employee productivity improvements. Topics discussed include: unproductive practices, environment, staffing, manpower controls, organisation structure, delegation, incentives, personnel management productivity and the responsibilities of the unit personnel manager. The author points out that new levels of employee productivity ultimately depend on the careful training and thorough support of the supervisor. His sense of responsibility for increased productivity and his effectiveness in accomplishing it are the cornerstone of a full utilisation of human resources management programs.

Manpower in the Cement Industry

Agarwal, BL and others

New Delhi, Institute of Applied Manpower Research, 1977, pp. 190, Rs. 30.00

Based on a survey of the manpower pattern—occupational/educational distribution—obtaining in the Cement Industry, this study analyses the issues involved in manpower planning, development and utilisation. It examines the existing manpower planning and forecasting practices in the industry, establishes relationships between economic and manpower parameters and suggests guidelines for micro and macro-level estimates of demand for technical and non-technical personnel.

Manual on the Planning of Labour-Intensive Road Construction

Allal, M, Edmonds, GA & Bhalla, AS

Geneva, I.L.O., 1977, pp. xi+253, 50 Swiss francs

The authors of this study give systematic descriptions of how the choice of technology can be incorporated into planning and design. They then describe how labour-intensive techniques should be analysed, and the range of technological options available. They also show how to analyse road construction costs proper as well as maintenance costs, road users' costs and indirect benefits, and suggest criteria and methods to be used in evaluating different possible combinations of design and technology, both in orthodox financial terms and in terms of shadow prices using cost-benefit analysis. The manual is intended mainly for those who are engaged in the planning, evaluation and design of road construction projects.

Strategies for Planned Change

Zaltman, Gerald

New York, John Wiley & Sons, 1977, pp. 404, $ 19.95

This book describes in succinct ways the various strategies and tactics available for creating social change. With ample illustrations from a broad array of contexts, various criteria are discussed as guidelines for selecting particular strategies and tactics. The authors bring together the literature on innovation diffusion and organisational change, both theoretical and practical, and stress the action implication of theory about change.

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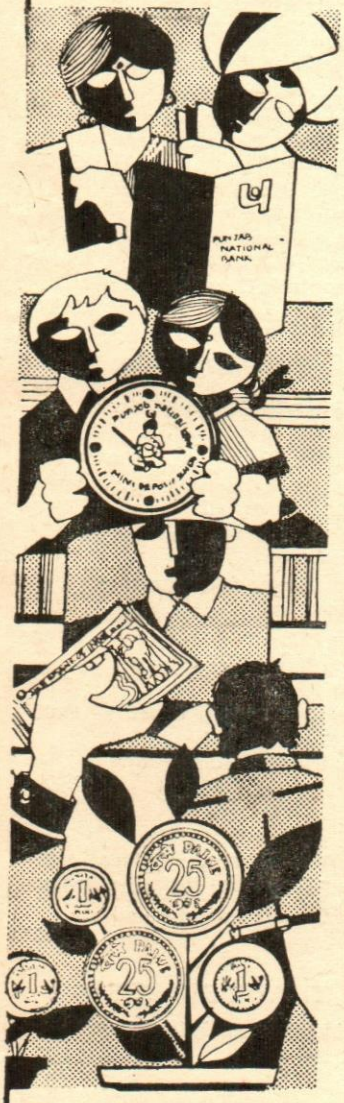

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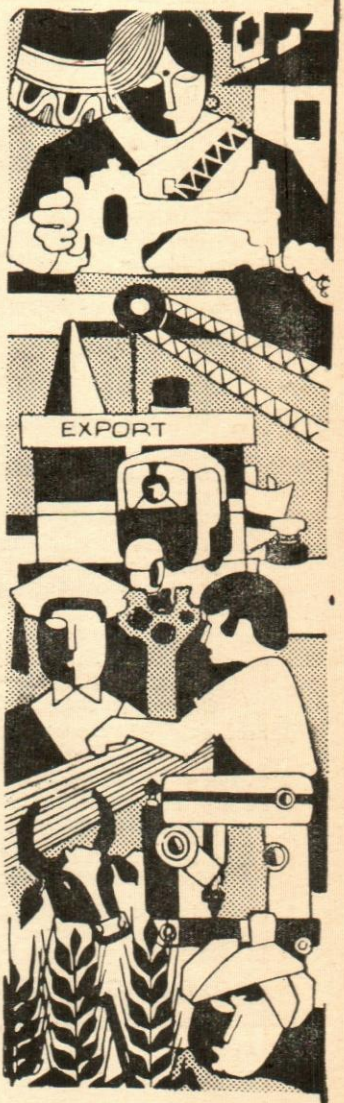

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