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Quality of Life and Quality of Work Life : Toward an Appreciation

NITISH R. DE

The active inter-action between an organisation and its environmental ecology provides us the dimensions of the quality of life. The centre-piece in the chain of humans—work—organisation—environment is the human being. In the dynamics there can be two options : people can become "collective actors" in providing the edifice of work and organisation or they can become "vessels" to work and organisation. There is a choice. This article discusses that choice.

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Introduction

An organisation fulfils itself through work. Work gets accomplished through persons in their mental and manual engagement. One essential postulate of this paper is that the quality of organisation is dependent on the quality of work; and the quality of work is co-determined by human beings, the way work is designed and the specific context of organisational structure. The interlinkage is not complete till we also take into account the transaction between organisation systems and environment (the society). The active inter-action between an organisation and its environmental ecology provides us the dimensions of the quality of life. The centre-piece in the chain of humans—work—organisation—environment is the human being. In the dynamics there can be two options : people can become "collective actors" in providing the edifice of work and organisation or they can become "vassals" to work and organisation. Our choice is for the first option. We also accept the proposition that the actors do create work and its habitat—the work—organisation, and that the latter two shape and nurture the human actors. Environment similarly influences organisations and organisations make their impact on environment. It is inter-active, a two-way street.

Quality of Life

Such an exercise, however, does require some focus so that we do not commit the mistake to offer an

unattainable utopia. Let us then begin with the meaning and message of the quality of life because that is what we are concerned within the design of human future. Undoubtedly, there will be multiple criteria for assessing the quality of life. One of several such attempts has been made for the rich 15 OECD countries (Scheer, 1980). Examining these criteria, we shall discover two phenomena. One, the omission of certain crucial items. Secondly, the inadequacy of the listed criteria for application to the less developed countries (LDCs). We shall, therefore, present the one that has been offered and a revised version that may have relevance to the LDCs.

Table 1
Criteria for Quality of Life (QL)

Criteria for OECD Countries	Relevance to L.D.Cs	Alternative Criteria LDCs
1	2	3
1. Per capital GNP increases at constant prices.	Relevant	
2. Life expectancy of a new born boy.	Relevant	
3. Life expectancy of a new born girl.	Relevant	
4. Life expectancy of a 40 year old man.	Relevant	
5. Life expectancy of a 40 year old woman.	Relevant	
6. Life expectancy of a 60 year old man.	Relevant	
7. Life expectancy of a 60 year old woman.	Relevant	
8. Excess consumption of calories.	Irrelevant	
9. Physicians per population (Note : Let us say per 10,000 persons).	Relevant	
10. Child mortality (2 to 12 months) per live births.	Relevant	
11. Fatal work accidents (average for sectors included) :	Relevant	
(a) mining		(b) manufacturing
		(c) railways.
		(d) construction.
		12. Homicides per hundred thousand and population.
		13. Fatal traffic accident per hundred thousand population.
		14. Expenditure on food and tobacco as percentage of total spending.
		15. Discretionary spending as per unit of total (included here are total consumer expenditure after rent, heat, light, food, clothing and shoes have been deducted).
		16. Private cars per hundred thousand population.
		17. Average number of persons per room.
		18. (a) Percentage of dwelling units with running water
		(b) Percentage of dwelling units with bathroom.
		19. Telephones per hundred thousand population.
		20. TV set per hundred thousand population.
		21. Primary school children per teacher.
		22. Women as percentage of student in higher education.
		23. Change in the ratio of economically active persons to population of working age.
		24. Unemployment as percentage of labour force.
		25. Average work week of full-time workers in manufacturing in hours.

(Additional criteria to be included)

1	2	3
26. Ratio of expenses on defence/ law and order and social services.	Relevant	
27. Percentage of scientists and technologists on defence research and production.	Relevant	
28. Percentage of GNP as aid to third world countries.	Relevant	
29. Income from arms and armaments export as percentage of total export earnings.	Relevant	
30. Ecological balance	Relevant	
(a) Extent of air/water pollution		
(b) Extent of consumption of non-renewable resources.		
<i>(Additional items to be included for Less Developed Countries)</i>		
29. Percentage of population below the poverty line at constant prices.	Relevant	
30. Persons suffering from malnutrition and its consequences (percentage of total population).	Relevant	
31. Literacy percentage.	Relevant	
32. Collective violence.	Relevant	
(a) Loss of life due to inter-group conflict; ethnic, religious, caste-related etc.		
(b) Loss of property due to inter-group conflict.		
33. Ratio of lowest and highest income.	Relevant	

We do not claim that these criteria are all-inclusive. We have, however, included a number of items for rich countries as well as the LDCs. Their significance can be appreciated from what we mention below :

Evidence One :

	The Price of Wars	Expenditure
World War I	10 million killed 20 million maimed	\$ 260 to \$ 360 billion

World War II	50 million killed 90 million maimed	\$ 3300 to \$ 4000 billion
Over 160 wars since 1945 till 1982, almost entirely in the third world	Over 16½ million killed including 9 million civilians	About \$ 8000 billion

Evidence Two :

Nuclear weapons (strategic)

1971	1983
USA 4000	About 10,000
USSR 2100	7,400
World total	50,000

Evidence Three :

The military assistance from the rich countries to the third world during the past 20 years totalled \$ 400 billion as against \$ 25 billion of economic aid.

Evidence Four :

Every minute the world spends \$ 1.3 million on arms and armaments while 30 children die of hunger in the Third world.

(The Tribune, October 18, 1983 and The Times of India, October 19, 1983).

Evidence Five :

“If only 10 percent of the money used for military purposes were devoted to the development of the poorer countries, it would be possible to overcome hunger in the world within a few years” (Alfred Kastler, 1966 Physics Nobel Laureate, in 1983).

Evidence Six :

- (a) For every \$ 100,000 million spent on military purposes, it would be possible to build :
- (i) 300 thermal power stations, each one generating 120,000 kilowatts;
 - (ii) 300 oil refineries, each one with an annual refining capacity of 3.25 million tons;
 - (iii) 1000 Chemical fertilizer plants;
 - (iv) 200 synthetic rubber

works, each producing 25,000 tons; and (v) 1600 sugar mills.

(b) The share of the developing countries in world military expenditure rose from 4.5 per cent in 1960 to 16.1 per cent in 1980. The military expenditure of these countries is 1.3 times greater than their expenditure on education and over three times as much as their expenditure on health.

(c) \$ 600 million are needed annually (less than 1 per cent of the developing countries' military budgets) to inoculate new born babies against infectious diseases. 1200 million people living in towns and villages of Asia, Africa and Latin America could be provided with drinking water at a cost of \$ 3000 millions, 3 per cent of their annual military expenditure.

(Faramzian 1983)

We do postulate that the QL will increasingly daunt accentuated militarisation in favour of education, health care, housing, productive employment and ecological balance. The criteria used, appropriately consolidated, will provide country-wise comparison from which insightful social planning can emerge.

There exists, however, a more simplified concept of physical Quality of life index (PQLI) to which can be added the Disparity Reduction Rate (DRR). The PQLI combines infant mortality, life expectancy at age one and literacy into a composite index. These criteria represent a range of social conditions-availability of nutrition, clean drinking water, well-being of expectant mothers, healthy general environment, skill to participate effectively in society and to share the benefits of economic growth (Morris, *et al* 1982; Thomas, 1982).

The DRR designed to measure the rate of progress in meeting essential needs seeks to correct the distortion inherent, particularly in the LDCs, by sticking to GNP growth ratio. It is an indicator of the rate at which a country is closing the disparity between its level of performance in any social indicator and the best performance expected, say, in the year 2000. The DRR can thus be applied to composite social indicators, such as PQLI.

Applied to India, the following picture emerges. The average PQLI during the early 70s for 141 developing countries was 56. Among the LDCs the average was 39. India scored 41, slightly above average. That the PQLI need not necessarily have correlation with per capita GNP is evident from the fact that the upper middle income group countries, Algeria, Iran and Iraq had a low indicator of 42, 38 and 48 respectively, while the index for a low income country like Sri Lanka was 82.

The inter-state comparison presents the following profile as given in Table 2 and Table 3 :

We observe that on PQL index Kerala is at the top with 70 points and Punjab with 50 is in the second position. On per capita income and average size of operational holding Punjab is far ahead of Kerala. In addition, on the basis of people below the poverty line, Punjab is distinctly in an advantageous position compared to Kerala. Yet Kerala steals a march over Punjab on infant mortality rate and literacy. Similarly, Urban-rural and male-female dichotomy is more pronounced in Punjab. The difference between these two States can be explained by the fact that *social transformation* has been more effective in Kerala. Economic transformation in Punjab has not been matched by such development-oriented social institutions as could upgrade the quality of health-care and primary education particularly geared to the needs of rural population and women. "In 1979, India happened to be the only country for which all three indicators registered worse performance for women than for men." The main contributory cause was low female literacy rate (Thomas, 1982).

Despite the numerous advantages of PQLI including its elegant simplicity, it cannot really be a replacement for more comprehensive criteria. Certain vital aspects will still be missing. Let us refer to one recent phenomenon. Over the past 15 years life expectancy is on a decline in Soviet Union and some of the East European countries. In the USSR the decline for men is from 66.2 years to 61.9 years. The relative position for men was sharply worse than that of women. Over the period, it grew by 2.5 years in Hungary and 3.4 years in the Soviet Union, where

Table 2
PQLI for Selected Indian States

States	PQLI	Indices of life expectancy	Infant mortality rate	Literacy	Nations with same PQLI
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East	Assam/Meghalaya	37	34.1	41.1	36.0	Haiti, Papua New Guinea, Pakistan.
	Orissa	37	37.4	42.8	31.1	-do-
	Uttar Pradesh	25	27.9	21.2	24.6	Sengal, Nepal, Nigeria.
South	Andhra Pradesh	43	47.9	54.1	28.2	Egypt, Algeria, Bolivia.
	Karnataka	48	46.9	61.3	35.8	Indonesia, Lesotho.
	Kerala	70	63.6	77.0	69.3	People's Republic of China, Columbia.
	Tamilnadu	46	43.1	51.8	42.8	Rhodesia, Tunisia.
West	Rajasthan	33	32.1	45.9	21.9	Zaire, Peoples Republic of Yemen.
	Maharashtra	49	46.6	55.0	44.8	Indonesia, Honduras.
North	Punjab	50	67.4	52.7	28.8	Botswana, Burma.

(Morris, *et al*, 1982)

Table 3
Comparison between Kerala and Punjab

	PQLI		Per Capita GDP (Rs.)	Percent people below poverty line	Average size of operational holding (ha)
	Urban	Rural			
Kerala	74	69	68	47	0.7
Punjab	65	48	45	15.1	2.7

(Morris, *et al*, 1982; Nair, 1983)

the average woman now can expect to outlive a man by more than 11 years (compared with 4 years in Britain). On the other hand the Hong Kong Chinese, over-crowded and poor, are doing better. Jamaica and Cuba are showing a better record than the Soviet Union. The reasons are variously attributed to effects of recession, increasing expenditure on armaments, growing shortage of essential items, alcoholism, less per capita expenditure on health care, etc. (Moynihan, 1983).

necessarily contribute to productive efforts. In fact, it may be from a national point of view, an expensive venture without adding anything substantive to the quality of work life. Moreover, the indigenous com-

pradors depress the quality of work life. This is indeed a grave prognosis. At the same time, a country such as India is still getting strong on production activities—farming, mining and manufacturing and therein lies the challenge of making work life qualitatively superior. We shall now seek to identify some dimensions of the quality of work life.

1. Organizational Form, Hierarchy and Staffing Pattern

Organizations are indeed complex. One contributing factor happens to be the way we design the structure. It gives rise to confusion and hence complexity. This is avoidable. Basic simplicity of form can contribute to flexible style of working and bringing autonomous working down to levels where such functioning is warranted. Matrix Organization, unless imaginatively conceived, can create confusion. Boeing, essentially a project-type system, deploys, employees in a binary way: they are either a part of a project team and responsible to that team for the allotted task to be accomplished or they are part of a technical discipline, in which they spend some time making sure that their technical department is keeping up with the state of the art. "Most Japanese Companies don't even have a reasonable organization chart. Nobody knows how Honda is organized, except that it uses lots of project teams and is quite flexible.... Innovation typically occurs at the interface, requiring multiple disciplines. Thus, the flexible Japanese organization has now, especially, become an asset." (Ohmae, 1981).

Related to the value of simple form and flexibility is the need for dehierarchisation or comparatively flatter form of organization structure. The conventional wisdom about the optimal span of control is not taken seriously by the Japanese. "One of the biggest contrasts between Japanese and U.S. Corporations, is in the number of middle management levels.... whereas, there are five levels between the Chairman and the first line Supervisors at Toyota, Ford has fifteen." (Peters, *et al*, 1982). In the Indian context, the hierarchical levels are often far too many to require documentation.

Relevance of Quality of Work Life

We have just mentioned the quality of social institutions. The quality of work in productive organizations thus acquires salience, Kiuranov (1980) persuasively argues that "the quality of work is a specific and very basic feature of the quality of life. The determination of the quality of life on the basis of the quality of work would mean...., the replacement of the consumers' attitude to the quality of life by that of man as a productive or even more as a creative being." The concept of productive work, however, carries with it several implications. In the first place, one cannot altogether ignore the socio-economic character of work, that is, the mode of production. Marx and Engels (1960) defined the term as "a definite form of the activity of...individuals, a definite form of expressing their life, a definite mode of life on their part...". There are adequate indications, which we shall not present here, that this ideal remains to be realised in all the current economic systems. That is why it is all the more significant. Secondly, with scientific-technological innovations the nature of productive work is undergoing a radical change. "Automated work is, in principle, very akin to an uninteresting, repetitive, routine working process". (Kiuranov, 1980). De-skilling components are on the increase making productive work less and less interesting while the objective should be to make work more interesting, challenging and quality-wise meaningful. Thirdly, the economic crunch, which over-shadows the world, has led the industrialised countries to resort to tertiary activities—sales, finance and speculation—and less on industrial expansion. USA is a glaring example of this trend. (Swezey and Magdoff, 1983). As a result, goods and services tend to surrender their intrinsic worth to commodity-like character thereby threatening work to acquire instrumental and im-

Hawken (1983) has perceptively offered the explanation that the mass economy has increasingly resorted to a process of intermediation leading to diversified and well ramified "intermediary institutions whose function is to interconnect all aspects of the ever-growing, expanding world of material civilization." Proliferation of middle-men and brokers with emphasis on elongating the chain of transactions does not

A government office provides an obvious example. As somebody, not so jokingly commented, too many levels work as multi-layered brakes—stopping ideas going up and going down. More the levels and more rigidly the boundary is drawn, more will be the “transaction cost” in terms of delays and unproductive correspondence.

Yet another issue is that lesser the number of staff in the control office, better is the quality of work life. In the USA, some of the better management corporations have adopted a rough “rule of 100”.

*Emerson Electric has 54,000 employees and makes do with fewer than 100 in Corporate office.

*Dana employs 35,000 persons and its Corporate staff are around 100.

*Schlumberger, the \$ 6 billion diversified Oil Service Co. runs its world wide operations with a Corporate staff of 90.

The saying is “less is more”. The idea is simple. Less the number more will be the priority for significant work. (It does not, however, imply that we plead for over-work and exploitation of mental and manual labour).

Conditions for “elbow room” and “breathing space” for employees to participate in meaningful work are required to be ensured. What damage—physical and psychological—can be brought by centralised remote-control, not altogether unfamiliar in the Indian peninsula, can be assessed from the following incident :

“A Russian factory management complained... that it had 500 workers turning out goods which nobody wanted, and said the Central Planning system was to blame.

The factory chiefs wrote in Pravda that they had been fighting for months to have their production plan altered without success. The factory, in the north Caucasus had been ordered to turn-out low-quality curtain material for which there was no demand. As a result, lorries spent more time bringing back unsold materials to the factory than

taking out new production. Referring to President Andropov’s call for crack-down on drunkenness and absenteeism at work, the plant managers said the demoralisation caused by doing a pointless job was a much more dangerous and damaging factor.” (The *Guardian Weekly*, week ending August 28, 1983).

Earlier we referred to the gigantic proliferation of “intermediation” processes into the market-economy system. We suggest that too many staffers styled as experts—will make an organization to wade through many vicious circles. Planning and controlling will induce divorce from implementation process giving way to circuitous infructuous complexity. Doers can be planners and planners can be doers. Expertise need not, beyond a point, become a hot-house operation. More the staff specialists more is likely to be the phenomenon of intermediation whereas, the aim is disintermediation.

2. Work Group Size, internal net-work and communication

No employee is an island in his work place. If so, the emphasis should be on work-group and not only on individuals. Let us take the example of the 1983 Physics Nobel laureate S. Chandrasekhar for whom, according to a colleague, “it would be out of character to drop down to something he knows a whole bunch of us could do”. (Tierney, 1983). It may give the impression that he was a loner pursuing the mysteries of the universe for over five decades. For his about fifteen hours rigorous work-schedule per day round the year, his interdependence on his self-effacing wife and close colleagues is an essential *sine qua non*. Despite our often repeated emphasis on individual responsibility and accountability, effective and meaningful work demands qualitatively superior work-group. We see examples of this in the Japanese industry. “Small groups such as quality circles and zero defect groups primarily perform three functions. First, they identify production problems and analyse the causes. Secondly the same groups formula concrete action plans to solve the problems. Finally, the groups implement solutions and review the results. Thus, the group activities constitute a self-contained, perpetual process

in which production workers participate for the sake of improving organizational work performance. Group members are provided with the training necessary for this part of work, such as basic statistics, use of analytical tools, knowledge on product and work methods and other relevant information and skills required for creative problem-solving and work investment on the spot. (Takezawa, *et.al.*, 1982). We have observed distinct "quality" improvements in work life with small group working at Tiruchirapalli plant of B.H.E.L. (De, forthcoming) Quality of work-bonds is built on quality of camaraderie at work.

We propose to mention that the size of the work group is critically relevant. It has been observed that with a large work group there is a strong probability that lost time in productive activities will go up more than proportionately, (Child, 1977). There are other problems too. A large work group may involve higher "Transaction cost", as already mentioned. Cost of supervision may go up. More over, the members may not succeed in establishing the core norms for work behaviour which are essential for quality of life at work. It has also been established that research effectiveness was inversely related to group size : assemble more than seven persons and research effectiveness goes down (Blume, 1980). We find that the quality circle groups—thirtyfive in number—in Rourkela Steel Plant do not have more than six members in each team. (Rourkela Steel Plant, 1983).

One essential aspect of small group is the semi-autonomous characteristic of work. This will imply that work will be re-structured in such a way that numerous small groups will be at work. There will be logical integration of tasks so that there is an evidence of concrete achievement by each group. Yet in a large organization the wide range of activities engaging many groups will require linkage through inter-group transaction. We may refer to it as internal work-group inter-linkage. There will be several aspects of such inter-linkage. The self-regulatory groups will further their range of responsibility by regulating their activities at the interface in a non-bureaucratized and non-hierarchical manner. There will no doubt be negotiating posture but the power equation will be governed by the principle of mutuality. This net-work of small groups will expand simultaneously the horizon of appreciation of

tasks at hand and operation effectiveness. We may call this an aspect of organization work as horizontal coupling.

These structural alternatives will bring out a change in the communication structure as a context for imparting higher level value to the content and process of communication. Emery (1977) in a comparative study communication net-work between a typical bureaucratic system and a democratic structure calculated the formal reporting channels and task mediated relations which he presented in a tabular form.

Table 4
Formal Reporting channels and Task Mediated Relations

Steps removed from policy maker	Bureaucratic	Democratized
1 Step	3	1
2 Step	4	1
3 Step	18	4
4 Step	26	—
5 Step	34	—
Total for formal reporting channels	85	6
Task mediated hierarchical relations (formal reporting channels)	85	6
Task mediated relations between peers (max)	—	744
Paper generating functions (Channels multiplied by steps)	339	15

We have earlier suggested certain structural properties of alternative design principles which will facilitate valid communication. An additional contribution may come from the physical architecture of the work place. Taking up a "linked-dispersion" circular model of office building, Steele (1983) has shown how social architecture can be improved upon making communication flow easy and authentic. The salary saving scheme group of Life Insurance Corporation in New Delhi

divisional office improved its quality of work including face-to-face communication through more imaginative of work-plan lay-out. (De, forthcoming). Peters, *et. al.*, (1982: 121-123) provide some interesting examples from some of the U.S. Corporations. "Open door" policy is a vital segment of effective working in IBM, Delta Airlines, Hewlett-Packard and others. Authentic communication is to an enterprise what breathing is to human life.

3. Concern for Quality

Quality of goods and services implies upgradation of skills and knowledge, application of relevant knowledge, craftsmanship, use of discretion at work and interest in the customers. Concern for quality manifests a spirit of commitment.

What is of particular significance is an emerging trend of a new dimension to the concept of quality. A product maintains a balance between the amount of mass and the information embedded in the product. Let us remind ourselves that a US citizen consumes as much energy in six months what a person in a developing country consumes in a life time. The implication is clear. In richer countries the consumers will seek better quality product and service keeping in view the need for more *information* regarding design, utility and durability. In the third world too, the temptation to go for more expensive products and services will be tempered by concern for quality. So, the world over, there will be an accent on informative economy based on human and physical ecology oriented knowledge. (Hawken (1983) has articulated this new orientation to the next economy. The parameters of informative society has been identified by him :

—*Contractive* : With crunch caused by limited resources, the trend will be on contraction for business survival. This will make consumers smarter and business leaner.

—*Differentiative* : Production will become more flexible to meet specific needs of smaller groups. Sense of consumption utility will bring forth the question : "Does the product really work for me ?" We see this trend in respect of food items. Unpolluted natural foods are becoming popular.

—*Mutual* : Instead of accretion (hoarding propensity or its obverse throw-away propensity), society will benefit from mutuality of interests in order to maintain living standards.

—*Influent* : Fewer overall goods would mean benefits of goods are likely to be achieved by widespread use rather than single ownership. There will be a trend towards sharing of "use" of certain types of goods.

—*Conservation* : Overconsumption ethic is likely to be replaced by conservation ethic of which the universal ecological concern is an evidence.

—*Disintermediative* : As already mentioned, too many meandering processes engaging intermediaries may be short-circuited in favour of more direct transactions to conserve energy, resources and do away with unproductive human labour.

—*Information-rich* : More information may be built around products and services. There may be a danger of exaggerated unethical advertising claims, but enlightened consumer net-works may step in to caution the unwary public.

—*Adequate income* : With conservation as a major triggering stimulus in the economy, income level will stabilize rather than chase the spiral of affluence.

—*Board skills* : In informative society people will need to have general skills, be more self-sufficient and less dependent on specialists. Higher ratio of information to people will demand more knowledge by members of a productive enterprise.

Concern for high quality products rather than cheap and indifferent products and services is well acknowledged in the Japanese success story in the international scene and perhaps this will set a trend towards informative society. The issue can be stated this way : information about what ? The response is : quality and relevance in an ecologically conscious world.

4. Concern for People

In a study of successful leadership in a variety of

organizations, Maccoby (1981) has identified four ingredients:

- (a) a caring, respectful and responsible attitude;
- (b) flexibility about people and organizational structure;
- (c) a participative approach to managing and willingness to share power;
- (d) self-aware, conscious of own weaknesses as well as strengths and concerned with self-development for themselves as well as others.

Commenting on the prevailing values of majority of managers, the author observes that "for most managers, organizational development is evaluated solely in terms of productivity and profit. Paradoxically, this total concern for profit is what causes distrust and limit efficiency. People only trust leaders who articulate a moral code, who care about people and are competent in the exercise of power". About effective leadership Maccoby elaborates his thesis: "They involve subordinates in planning and evaluation of work, spending time in meetings so that the whole team shares an understanding of goals, values, priorities and strategies. They spend more time up front developing consensus, but they spend less time reacting to mistakes and misunderstandings. They are skilled at leading meetings and turning off people who ramble or attempt to dominate."

Essentially, what it amounts to is a new version of humanistic work-ethic which enshrines an ambience of stout head and strong heart: a sense of the situation, knowledge about and respect for people. The Japanese executives are fond of saying: "we are very different from the rest of the world. Our one natural resource is the hard work of our people." Yet there is a lurking danger in being obsessed with the "only natural resource". Its exploitation cannot be ruled out. Describing the life of a worker in one of the Toyota Automobile plants, Kamata (1982) mentions the inhospitable work climate in which a worker has to fix six bolts into transmission boxes that roll past him every 80 seconds, the disgruntled workers displaying their hostility on the walls of the lavatories, supervisors bringing in constant pressure on the workers to forego due leave and prying into the private lives of workers and the trade unions' collaboration with the

management in not attending to individual grievances. (also, Boyle, 1983).

Be that as it may, genuine concern for people in an enterprise will show up in a number of ways. One is a healthy attitude towards learning culture, that employees can and do unlearn and learn, provided a congenial atmosphere is created for purposeful learning. Secondly, incentives of numerous kinds are not installed to generate unhealthy competition among employees. On the contrary, their objective is to reward excellence in performance in a co-operative spirit. Lastly, equity principle will become a corner-stone for differentials in reward structure. Thurow, (1980), the U.S. Economist, has made an interesting observation. "If you look at the earnings gap between the top and bottom 10 per cent of the population, the West Germans work hard for 36 per cent less inequality than we, and Japanese work even harder with 50 per cent less inequality. If income differentials encourage individual initiative, we should be full of initiative, since among industrialised countries, only the French surpass us in terms of inequality." May we add that if the yawning disparity of total outlay on top-bracket employees and their bottom-most 10 per cent colleagues in the Indian Corporate is to be taken as a valid indicator, India should be among the high-fly productive countries.

Concern for people is something deeper and inescapable. Taking into account the technological aspects of the informative society, automation, microprocessors and genetic technology advancements, it is but moral and societal obligation that the displaced persons are trained, retrained and appropriately deployed in productive activities and that obsolescence is encountered squarely and fairly. (Hart, 1983). One may echo the sentiment of a humanist: "What a beautiful castle! Alas, there is none to live here".

5. *Ideals and Values*

We have had occasions to allude to values earlier particularly when we referred to concern for quality and people. In organizational context, the concept of value causes certain confusion. There are two reasons for this. In the first place, the concept is not easily given to operational meaning. The generally accepted definition is: "a value is a conception, explicit or

implicit, distinctive of an individual or characteristic of a group, of the desirable which influences the selection from available modes, means and ends of action." (Kluckhohn, 1951). Understandably, such a formulation provides a wide berth and it is not easy to agree upon a set of values which will have near unanimity. Secondly, most organizations and their leaders tend to peg themselves to tasks at hand, short and intermediate term goals. These priorities may circumscribe their value-orientation. This is reflected in the narrow-band values of many US organizations as we find below :

- (a) A belief in being the "best".
- (b) A belief in the importance of the details of execution, the nuts and bolts of doing the job well.
- (c) A belief in the importance of people as individuals.
- (d) A belief in superior quality and service.
- (e) A belief that most members of the organization should be innovators, and its corollary, the willingness to support failure.
- (f) A belief in the importance of informality to enhance communication.
- (g) Explicit belief in and recognition of the importance of economic growth and profits". (Peters, *et al*, 1982)

These values and beliefs are desirable and if they endure in an organization it is a distinct advantage. However, in the contemporary context, certain elements are missing. Concern for physical and social ecological balance, the ethical proposition that ends and means are to be judged against the crucible of global human concern and that productive activities should not be geared as instruments of senseless human destruction can no longer be treated as extraneous to value premises in an organization.

It seems that it may be worthwhile to make a distinction between values and beliefs on the one hand and ideals on the other. This is not to suggest that ideals are exclusive of values and beliefs. Ideals belong to super-ordinate category. An ideal is an ultimate intended outcome which can never be obtained

but can be approached without limit. Ideal is thus a beacon which can be conceived in terms of being pursued. (Ackoff and Emery, 1981).

We suggest, following the analysis of Ackoff and Emery, that faith in certain ideals can elevate our mental horizon in a productive organization beyond specific goals to the level of purposes, which are broader and more comprehensive. Individuals can provide such a vision when they are committed to certain ideals which propel them to create socially desirable organizational metaphors.

Values, if not ideals, are to be shared properly. Members of an organization can find the cementing and energising bond in sharing the values. Value system is like an "invisible college" of which members are bound by a common, voluntarily evolved heritage. The spirit of freedom, openness, informality, flexibility and mutuality are indeed premised on an enduring foundation. At one level, the foundation is offered by values and at another level the inspirational base is the ideal.

6. *External net-work in a sustainable Society*

In conclusion, let us now turn to the interface between an enterprise and its environment. QWL, as mentioned, co-exists with the QL and that brings us to confront the environmental forces.

The context for the external linkage is provided by a scenario of future society by Robertson (1978). After evaluating various alternatives he opted for the sane, human and ecological (SHE) future. The transformation involves six modes of action.

(a) *Life Style*: Changing one's personal way of life so that it is most consistent with the SHE future.

(b) *Enabling (Liberation)*: Fostering new growth points which help people to liberate themselves from dependence, to become more self-reliant and to develop their autonomy.

(c) *Enabling (Decolonisation)*: Managing the breakdown of existing institutions, relationships, etc., so as to assist previously dependent people to become more

self-reliant and to develop their own collective autonomy.

(d) *Metaphysical Reconstruction*: Creating new visions of the SHE future, developing new paradigms and communicating them.

(e) *Strategy*: Mapping the transition to the SHE future; identifying pitfalls and unresolved problems; providing opportunities for communication, information exchange and cross-fertilisation.

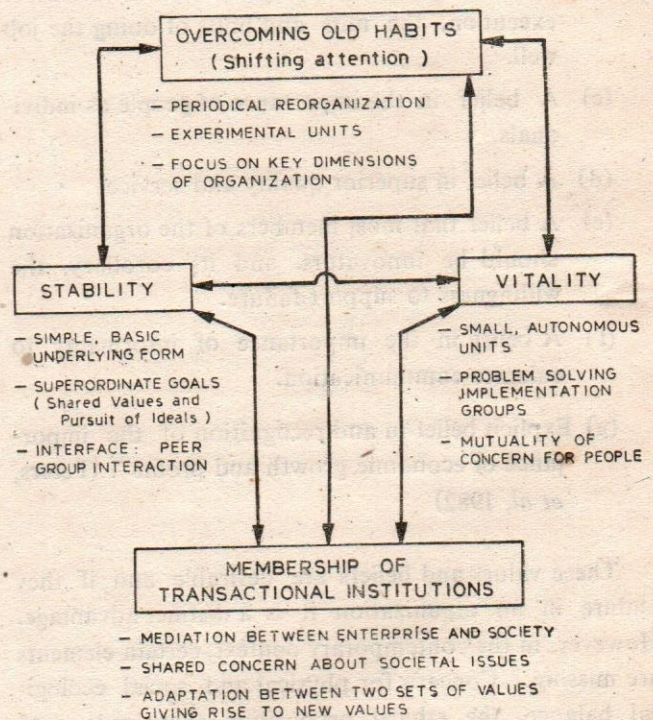
(f) *Opposition*: Opposing and attempting to obstruct activities which discriminate between person and person, groups and groups, nations and nations and in addition tend to counter the alternatives whose relevance to the future world is palpably questionable.

How does an enterprise positively respond to the emergence of this socially desirable future? An attempt at bridging enterprises and the society has been made by Trist (1983). Members of an organization, engaged in their goal-directed activities, are related to variety of societal problems, which "constitute a domain of common concern for its members,..... Inter-organizational domains are functional social systems that occupy a position in social space between the society, as a whole and the single organization." Such a situation can be handled by a "referent organization" which provides the mediation between the two. Various chambers of commerce and industrial associations today fill up this social space but in a limited fashion. Their primary concern happens to be to protect and advance the business interests of their constituents.

The referent organization will perform an expansionist assignment. Productive mediation will involve sympathetic understanding of the complex issues and seek to optimise social benefits. Organizations will acquire societal legitimacy and society will appreciate the purposeful mission of the organization. There will, thus be no scope for competitive confrontation between the two parties. To respond to this new responsibility it is conceivable that certain new types of voluntary associations will emerge, as did in the USA and Canada. Jamestown Area Labour-management Committee (Keidel & Trist, 1980) and Sudbury 2001 (1979) are two successful examples of referent organisations.

We tend to believe that such referent organizations will make their appearance in the third world with the characteristics of transactional institutions. Innovative and non-bureaucratic in their orientation, these institutions will be free from interest-group syndrome. Their concern will be with over-all societal interests with long-range-perspective.

We may now seek to wrap up our discussion in the form of a diagram. Leaning on the contributions of Peters, *et al* (1982) and Trist (1983), we present the following form integrating certain aspects of QL and QWL:



We are still in search of a vocabulary to describe an organisation system that can adequately capture the meaning of what we have sought to establish. Terms such as matrix, adhocry, net work, ensemble groups fall short of our need. What, however, we do know is this: for a productive, as opposed to parasitic, work organisation, we need such structures and processes as will advance the cause of the quality of work life; and when we place such an organisation in the galaxy of its active environment, we look for a meta-system which will facilitate the assertion of the quality of life.

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Assembly Productivity

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Proper productivity management, together with a new heuristic approach to assembly line balancing can lead to significant productivity gains in assembly operations. This paper presents the general philosophical framework for productivity management of subfunctions of organisations and discusses the updated version of a heuristic assembly line balancing technique developed by these authors. When managing productivity at a bicycle manufacturing plant in Taiwan, this heuristic assembly line balancing technique was used to improve the line efficiency by approximately 20%.

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Introduction

While on the one hand, rational approaches to productivity measurement in companies are still in an initial stage of implementation and while, on the other hand, industrial surveys show that productivity measurements are mostly being performed on a corporation or plant/division level, it is necessary to manage the productivity of each subfunction of the organization if one is going to get actively involved in improving the company's overall productivity level. In particular, one must manage the productivity of the production design function, the process planning function, the plant planning function, the material handling function, the production function, the inventory function, the maintenance function, the quality control function, etc...

Productivity management as it relates to a subfunction of the organization comprises of five basic interlocking activities: measurement, evaluation, improvement, planning and dissemination.

After appropriate productivity ratios for the subfunctions are defined one must *collect input and output data*. Some of that data may be found in existing data bases of the firm while other data will have to be collected. Because productivity management must become an ongoing activity of the company and because

several subfunctions may share similar input/output data in calculating productivity ratios new data bases will emerge. All existing data must clearly be defined before new measurements and data collection are undertaken, since data gathering is a tedious and often expensive proposition.

After *evaluating* the productivity of the subfunction one must identify how productivity can be improved. In order to manage and improve the productivity of various subfunctions, one must think in terms of technology based strategies, procedure based strategies, maintenance, capital investment, management by objectives, team committees, brainstorming, employment involvement, human factors, cost control, strategic planning, work measurement, zero-based budgeting, annual goal setting, co-ordinating, etc... Most important factors in *improving productivity* in an organization depend on better planning, more effective management on improved job procedures, on effective human effort and personnel policies, on better communications, on new technology, on better maintenance parts, etc...

When changes need to be made in the operation of various subfunctions, careful *planning* of such changes is necessary. The need of such changes must be well explained to all people who will be affected by them. It is imperative that their full co-operation is sought. People must be motivated to welcome the changes and must become involved to see those changes through. Their motivation and work ethics with which changes are accomplished have a significant impact on work performance and therefore the function's overall productivity.

Finally, *dissemination* of data, information and improvement from one subsystem to another is necessary so that the whole organization can benefit from productivity management. Dissemination is best accomplished when reference data is in computer format. This reference data must be validated, updated and controlled on a regular ongoing basis in order to maintain its accuracy and integrity. This control function of data and information is enhanced by techniques used to validate and maintain the information in the form of non-redundant, up-to-date, accessible collection of data items called a Data Base.

Special generalized computer programs, called Data Base Management Packages, can be designed to organize, maintain and summarize data elements for the purposes of productivity analysis and its dissemination amongst all functions of the organization.

Balancing the line is the key to Assembly Productivity

Since the introduction of the conveyORIZED progressive assembly technique into the manufacturing industry in 1913, line balancing has been recognized as one of the most important factors of production efficiency. Many techniques have been suggested; starting with the traditional trial-and-error procedures to the sophisticated computer assisted line-balancing techniques. The following discussion presents the algorithm of a multiple decision rule line balancing technique that was used to improve the bicycle assembly line productivity at K.H.S.

I. Introduction

The initial assignment of the multiple decision rule (MDR) line balancing technique is a systematic procedure whereby work elements, or jobs, are assigned to each work station, or each operator. The assignment of jobs to work stations is on an individual basis i.e., to assign one job at a time, except the last two jobs in each station. The last two job assignments in a work station may be considered jointly in order to generate a minimum station slack time for this station.

The station slack time, Δ , in the MDR program is defined as the difference between the average station time, S_{avg} , and the actual station time, S_k . This can be expressed by the following mathematical formula :

$$\Delta = S_{avg} - S_k$$

The basic objective of the MDR technique is to minimize the absolute values of Δ for all stations.

A job which can be assigned to a work station must satisfy two conditions :

- (1) All precedecessors of this job are already assigned;
- (2) This job meets the block restriction of this specific work station (block restriction is incorporated in the MDR program to cover

several types of physical restrictions which are often encountered in the assembly line. Such restrictions are : work zone restrictions; side of conveyor; fixed equipment or stock supply; similarity of job class, etc.)

If there is more than one job that satisfies these conditions, then we select the job which has :

- (1) The highest positional weight; or,
- (2) An element time that is the most close to the unassigned station time, i.e., the slack time.

In order to thoroughly understand the discussion of the decision rules and the step-by-step procedure for the initial assignment, it is necessary to become familiar with the term "Average Station Time". The average station time in the MDR line balancing technique may indicate to different time values. When speaking about the general characteristics of an assembly line, the average station time is equal to the sum of work element times, E_i , divided by the total number of work stations or operators, N . This "absolute" average station time is calculated as follows :

$$S^*_{avg} = \sum_{i=1}^n E_i/N$$

Along with the initial station assignment, one can speak about the "moving" average station time, S_{avg} . This time is equal to the sum of unassigned work element times divided by the number of stations which have not been assigned, $(N-K)$:

$$S_{avg} = \sum_{j=k+1}^n E_j/(N-K)$$

where : N is the total number of work elements;

K is the number of stations already assigned;

k is the last work element just assigned into the K th station.

2. General Rules

The following general rules must be considered during the initial assignment phase of the MDR line balancing technique.

- (1) The higher ranked jobs are assigned first except for the last one or two jobs in each station.
- (2) For the last job in each station, we always assign the job which results in the smallest slack time even though it may have a lower positional weight.
- (3) The station slack time may be positive or negative. When a station has a positive slack time, Δ_p , this station is considered to be under-loaded. When the slack time is negative, Δ_n , then the station is considered to be overloaded. Since the under or over-load is in respect to the average station time, S_{avg} , an underload condition would increase the average station time for the remaining stations. An overload condition would reduce the average station time. An under-loaded station will always result in one or more over-loaded stations. When we must make a choice between Δ_p and Δ_n we always select the one which will most likely minimize the largest station time of the assembly line. In the MDR technique, we make a choice by comparing the following two values :

$$\Delta_n$$

$$\text{and } 2\Delta_p/(N-K+1)$$

If $|\Delta_n| \geq 2\Delta_p/(N-K+1)$, then we select the work element which resulted in Δ_p i.e., to under-load this station. If $|\Delta_n| < 2\Delta_p/(N-K+1)$, we select the work element which caused the Δ_n .

- (4) The overloaded stations cannot have a station time that is larger than the work cycle time, C . In other words, the absolute value of Δ_n must be smaller than or equal to the difference between the work cycle time and the average station time :

$$\Delta_n \leq C - S_{avg}$$

3. Procedure for Initial Assignment

The following fifteen steps describe the initial assignment of the MDR line balancing technique.

Step 1 :

Based on the precedence diagram or the precedence

matrix, compute the positional weight for each work element and establish the rank list.

Step 2 :

Based on the given work cycle time, compute the minimum number of work stations required, N_{min} .

$$N_{min} = \text{total work content/work cycle time}$$

$$= \sum_{i=1}^n E_i/C$$

Step 3 :

Compute the average station time for the remaining stations, S_{avg} .

Step 4 :

Compare the average station time, S_{avg} , with the cycle time, C . If S_{avg} is greater than C , increase the number of work stations, N , by one and return to step 3.

Step 5 :

Continuously assign the first job from the rank list of jobs to the work station until one of the following conditions is met :

- (1) $\Delta_n^* \leq \Delta \leq 0$, where $\Delta_n^* = S_{avg} - S_{max}$ if $S_{max} \neq S_{avg}$, or $\Delta_n^* = 0$ if $S_{max} = S_{avg}$; OR
- (2) $i = n$, i.e., all work elements are assigned; OR
- (3) $\Delta_n^* > \Delta_n$.

Step 6 :

In case of "(1)" of step 5, return to step 3 for the next work station.

In case of "(2)" of step 5, the initial assignment is completed and one may proceed to the second phase, the "Smoothing Routine". In case of "(3)" of step 5, continue with step 7.

Step 7 :

Supersede the high rank first rule and generate a candidate job list. The jobs in this list all satisfy the

precedence relationship and the blocking restriction. The last assigned work element, the k th work element is also included in this list.

Step 8 :

Compute the slack time of the station, Δ_i , for each job i in the list as if this job substitute the k th job of the work station :

$$\Delta_i = S_{avg} - (S_k - E_k + E_i) \text{ is the revised station time.}$$

If one of the Δ_i 's satisfies the condition of :

$$\Delta_n^* \leq \Delta_i \leq 0;$$

assign the i th job to the station and return to step 3.

If more than one E_i satisfies that condition, select the one with the highest positional weight and return to step 3. Otherwise, continue with step 9.

Step 9 :

Let us denote the second last job time assigned to the station as E_{k-1} . List all jobs that give negative Δ_i 's in step 8 and do not take the $(k-1)$ st job as their immediate predecessor. Call the time elements in the new list as E_j . Compute the slack time of the station, Δ_j , for each job j in the new list as if this job substitute the $(k-1)$ st and the k th work elements of the assembly station :

$$\Delta_j = S_{avg} - (S_k - E_{k-1} - E_k + E_j).$$

Check Δ_j for the condition, $\Delta_n^* \leq \Delta_j \leq 0$, as in step 8. If failed to satisfy this condition, continue with step 10.

Step 10 :

If there are more than one Δ_j in step 9 that have a positive value, create a new list and call the time elements in this list as E_m . Combine any two of these E_m 's and compute the slack times of the station, Δ_m , as if they substitute both the k th and the $(k-1)$ st jobs :

$$\Delta_m = S_{avg} - (S'_k - E_{k-1} - E_k + E_{m1} + E_{m2}).$$

Check Δ_m for the condition, $\Delta_n^* \leq \Delta_m \leq 0$, as in step 8. If again, no Δ_m satisfies this condition, continue with step 11.

Step 11 :

From all the Δ_i 's, Δ_j 's, and Δ_m 's select only the two which are the closest to zero, one having a negative value, Δ_n , and one having a positive value, Δ_p .

Step 12 :

The work element choice must be made according to the following rules :

(1) If $\Delta_n \geq 2\Delta_p/(N-K+1)$, then assign the job to the work station that resulted in the Δ_p

(2) If $\Delta_n < 2\Delta_p/(N-K+1)$, then assign the job to the work station that resulted in the Δ_n .

When assigning jobs to the workstation respect the substitution rule as mentioned in steps 8, 9 or 10 whichever is appropriate.

4. Station Time Smoothing

For most cases, the MDR line balancing technique gives a good initial assignment. However, further improvement of the initial assignment is often possible. For the MDR technique the further improvement of the initial assignment is done by the smoothing procedure. This procedure can only be used to increase the line speed, or the line productivity. The number of work stations cannot be changed by this procedure. The smoothing procedure consists of the following seven steps :

Step 1 :

From the current station assignment, determine the largest and the smallest work station.

Step 2 :

Check the blocking and precedence restrictions for each individual work element to determine the legality of this element as a candidate for trading. If there is no work element available for trading, drop this smallest station and take the second smallest work station. Thereafter, the third smallest one and so on. If no station is legal for trading with the largest station, the smoothing procedure will stop.

Step 3 :

Compute the trading values for each work element

which is assigned to the largest station and is in the candidate list. The trading values will be.

either (1) The standard time E_i of job i , as if we would transfer job i directly from the largest station into the smallest station without trade-in :

$$V_{i,j} = E_i$$

or (2) The difference between E_i of the job i and E_j of the job j , where job j represents a candidate job in the smaller station and where job i represents a candidate job in the largest station :

$$V_{i,j} = E_i - E_j$$

Construct a list of acceptable trading values :

$$0 \leq V_{i,j} \leq S_{\max} - S_{\min}$$

Step 4 :

Examine all acceptable trading values—If $V_{i,j}$ satisfies the following condition :

$$\text{Min}(\Delta_p, |\Delta_n|) < V_{i,j} < 1/2(S_{\max} - S_{\min})$$

then trade job i with job j and proceed to step 7 of the smoothing routine.

Step 5 :

When the conditions of step 4 do not exist, combine the elements to pairs for both the largest and the smaller stations. Do the same as for a single element trading and generate a new list of acceptable trading values.

Step 6 :

Examine the complete set of acceptable trading values (original and new list) under the light of the criteria described in the introduction of this section.

Select the best trading value and trade the respective jobs.

Step : 7

Readjust the station times and return to step 1.

K.H.S. Bicycle Assembly Productivity Improvement Plan

The following sequence of events ensured the success

of our productivity management plan in the bicycle assembly plant of K.H.S. Firstly . . . the departmental manager, supervisor and line workers were informed about the productivity analysis and improvement plans. It was deemed necessary to ensure their full co-operation and to get them motivated to welcome any possible change.

Secondly . . . a thorough survey of all activities was conducted and measurable output units were identified. This was the original scouting work that was necessary to acquaint the work study people with the actual job performed. During this survey period we identified the following problems: 1. some work stations were very busy and others were not, 2. the bike handling operation seemed to be a bottle-neck, 3. the conveyor speed was questionable. At this point of the plan it

was decided that the assembly line was not properly balanced and that the balance delay factor combined with the production rate should be used as a productivity measurement.

Thirdly . . . an assembly chart was constructed and a precedence matrix was set up. Since no time study had been performed in the past, a stop-watch time study was performed on all work elements of all assembly stations. Fourthly . . . line balancing statistics for the old line were now calculated based on the normal times of all work elements. These statistics are summarized in table 1. Note that there are two stations (station 8 and 10) with two operators each. This creates human delays which must be considered in the assignment of work elements to that station (20% human delay or 80% efficiency). A

Table 1: Line Balancing Statistics for old assignments

Station Number k	Operator Number n	Station Time (0.01 min.) $\sum E_i$	№ of Operators N	Efficiency Factor F	Operator Time $S = \frac{\sum E_i}{N_k \times F_k}$	Operator Slack Time $(S_{max} - S_n)$
1	1	75.101	1	100%	75.101	0
2	2	60.750	1	100%	60.750	14.351
3	3	38.743	1	100%	38.743	36.358
4	4	60.063	1	100%	60.063	15.038
5	5	74.125	1	100%	74.125	0.976
6	6	33.550	1	100%	33.550	41.551
7	7	45.650	1	100%	45.650	29.451
8	8 9	93.913	2	80%	58.696 58.696	16.405 16.405
9	10	25.675	1	100%	25.675	49.426
10	11 12	63.250	2	80%	39.531 39.531	35.570 35.570
11	13	50.146	1	100%	50.146	24.955

$$S_{max} = S_1 = 75.101 \text{ Standard Production Rate} = \frac{60 \text{ min/hr.}}{0.75101 \text{ min/pc}} = 69.51 \text{ pc/hr}$$

$$\text{Total Slack Time} = \sum_n (S_{max} - S_n) = 316.056$$

$$\text{Balance Delay} = \frac{\sum_n (S_{max} - S_n)}{n S_{max}} = \frac{316.056}{13(75.101)} = 32.37\%$$

$$\text{Line Efficiency} = 100\% - 32.37\% = 67.63\%$$

balance delay of 32.37% is a poor performance figure for this assembly line.

Fifthly . . . the multiple decision rule line balancing technique was now used to rebalance the line. Its statistics are shown in Table 2. A line efficiency of 85.40% or balance delay of 14.60% reflects a significant improvement in the assembly productivity of 26.30% ($85.4\%/67.63\%=1.263$). The productivity index of 1.263 is, however, slightly exaggerated because three stations exhibit human delays. The labour productivity index is a better measurement, since it does not allow for human delays. Because there was no change in the standard production rate of 69.51 pcs/hr,

the labour productivity can be calculated by looking at the ratio of number of operators now versus before the change. It is 1.182 (13/11) or reflects an 18.20% improvement.

Sixthly . . . Improvements are implemented and work force adjusted. This could have been a very difficult step of the overall plan. However, since a reduction in the labour force was anticipated, management informed the workers well before the start of the project that some of the assemblers may be shifted to other activities in the plant. As a result of timely motivation and the use of proper work ethics three workers volunteered to move to other activities in the plant long before the study was completed.

Table 2 : Line Balancing Statistics for the new Assignments

Station Number k	Operator Number n	Station Time (0.01min) ΣE_i	off Operators N	Efficiency Factor F	Operator Time $S = \frac{\Sigma E_i}{N_k \times F_k}$	Operator Slack Time ($S_{max} - S_n$)
1	1	75.101	1	100%	75.101	0.000
2	2	60.750	1	100%	60.750	14.351
3	3	106.806	2	80%	66.754	8.347
	4				66.754	8.347
4	5	107.675	2	80%	67.297	7.804
	6				67.294	7.804
5	7	93.913	2	80%	58.696	16.422
	8				58.696	16.422
6	9	62.200	1	100%	62.200	12.901
7	10	61.174	1	100%	61.174	13.927
8	11	60.778	1	100%	60.778	14.323

$$S_{max} = S_1 = 75.101 \text{ Standard Production Rate : } \frac{60 \text{ min/hr.}}{0.75101 \text{ min/pc}} = 69.51 \text{ pc/hr}$$

$$\text{Total Slack Time : } \sum_n (S_{max} - S_n) = 120.608$$

$$\text{Balance Delay} = \frac{\sum_n (S_{max} - S_n)}{n S_{max}} = \frac{120.608}{11} = 14.60\%$$

$$\text{Line Efficiency} = 100\% - 14.60\% = 85.40\%$$

$$\text{Line Efficiency Productivity index} = \frac{85.40\%}{67.63\%} = 1.263$$

$$\text{Labor Productivity index} = \frac{13}{11} = 1.182 \text{ (Adjusted by station efficient factor)}$$

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The Crucible Industry Retrospect and Prospect

DR PSRVK PRABHAKARA SHARMA

The crucible industry is one of the least publicised in the country perhaps because its products are less directly used by the common consumer. Nevertheless crucibles are very important components in several industries big and small. The small size crucibles are required for melting precious metals and those of larger size are needed by the metallurgical industries for melting ferrous and non-ferrous metals. An attempt has been made in this paper to highlight some of the problems of the crucible industry and a few suggestions have been made for better production methods and marketing.

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Utensils of brass and other alloys are traditionally made in India on a cottage industry basis. Graphite crucibles used for melting these alloys are mostly imported. Attempts had been made around the year 1924 to use Indian graphite and clay in making crucibles on a cottage and small scale industry basis to replace the imported variety.

Originally, crucibles were made of clay and ash. They could not withstand the required temperature and would crack and collapse resulting in the loss of metal. In the year 1740, Huntsman noticed that the life-span of a crucible increased greatly with the addition of graphite to clay, and that fuel consumption was also reduced. Thereafter clay-bonded graphite crucibles began to be manufactured in England and Germany in the later part of the 18th century. In India, according to investigations made by historians, casting of steel dates back to 1400 B.C. Chandra Gupta Maurya's Stupa near Kutub Minar in Delhi is a single casting piece of about 24" Dia \times 40' length and does not form rust even to-day. It may, therefore, be said that the know-how of casting metals had been with us once but became extinct with the passage of time and with the hostile atmosphere under the foreign rulers in India. India's requirements of crucibles were wholly met by imports from U.K., U.S.A., Japan and other countries before 1939. The crucibles manufactured in England were popular and they utilized a good variety of graphite material from Kerala. It is on

record that from 1901 to 1912 Travancore exported 23,873 tonnes of graphite. Industrialists of India did not make use of this raw material as they were little acquainted with its usefulness in crucible making.

In India the first crucible factory was started in 1924 at Rajahmundry in Andhra Pradesh. The pioneering of the manufacture of graphite crucibles should be attributed to the late Sri Y. Kumar Samy Naidu of Rajahmundry. The crucible units in India have grown through the genius and hard work of few local men who were associated with Mr. Naidu in one capacity or other, with improvised tools, indigenous sources and know-how. Graphite crucibles are refractory containers made of refractory materials such as fine graphite, fire clay, silicon carbide, borax and other locally available chemicals. The formula varies from one unit to another and remains a strictly guarded secret. A composition usually employed contains graphite 40 to 50 per cent, clay 30 to 40 per cent, silicon carbide 10 to 20 per cent, grog upto 5 per cent and some other locally available materials. The knowledge of the formula and the process was arrived at only after a life-time of close association with the industry. Crucibles vary in size from the small laboratory type to the larger industrial ones. The size of the crucible has a fixed ratio its melting capacity expressed in numbers. Each number shows the kilogram capacity of brass or copper that could be melted in the containers of specified sizes ranging from zero capacity to several thousand tonnes. Smaller size crucibles are used for melting precious metals such as gold and silver, whereas the larger sizes are used for metallurgical purposes. The crucible industry in India plays a key role in many industries like metallurgy and aluminium and indirectly helps the Railways, Mints, Thermal Projects and other allied industries.

The object of this paper is to illustrate how far the industry is able to utilise the indigenous resources and to contribute to the development of the country's economy. Keeping this in view a study had been made during the period 1978-81 by the author wherein 42 units of the industry in Andhra Pradesh had been covered. A few observations made in this context are highlighted in this paper.

The crucible industry has spread from its place of

birth Rajahmundry to Bombay, Mirzapur, Begampore (Hoogly), Madras, Surat, Titlagarh and Varanasi etc. About 50 years ago the industry had 6 units all over India but gradually increased to 100 units by the year 1981. Out of the 100 units, 84 are located in Andhra Pradesh and the remaining 16 are in Orissa, West Bengal, Maharashtra, Gujarat, Tamil Nadu, Uttar Pradesh, and Delhi. Rajahmundry accounts for 58 out of the 100 units in India, thus making it the 'the Crucible Town of India'. The industry gained footing at Rajahmundry mainly because of the (1) availability of graphite and blending-clay in and around Rajahmundry, (2) easy availability of skilled labour and 'know-how' of manufacture of crucibles, (3) local demand from the aluminium and brass utensils industry.

The Second World War gave an impetus to the development of crucible industry, because of the heavy demand for and the non-availability of imported crucibles. In order to protect the local industry, in the beginning, a ban was imposed on imports upto number 50 size and subsequently it was extended upto number 300 size. In 1958, a Demonstration Centre of crucible manufacturing was established at Rajahmundry. It revolutionised the manufacturing technique of crucibles. Crucible manufacture in India is a post war phenomenon which kept stride with the development of metallurgical industry. The industrial development in the Five year Plans has further stepped up its demand. The installed capacity of crucible industry in 1960 was about 2,327 tonnes and has increased about three-fold to 9,500 tonnes in 1981, worth Rs. 3.50 crores, while the total consumption of the country is estimated at 9,000 tonnes per year. But since the actual production is only around 4,500 tonnes, the deficit of 4,500 tonnes is met partially through imports from U.K., U.S.A., Germany, and Sweden. The industry has an estimated investment of Rs. 1.50 crores, and the turnover is around Rs. 3.50 crores. It provides employment directly to about 3,500 skilled and unskilled people, while the ancillary units employ nearly 10,000 people.

Limitations and Potentialities of the Industry

The modern bias for the electrical furnace as an alternative to the crucible is proving to be a damper in

the expansion of the crucible industry. There are however, many small scale industrial applications where crucibles continue to be as important as before. Crucibles have a particular use in some of the processes of the metallurgical industries even at a large scale. As such, the manufacture of crucibles as an ancillary industry to the ferrous and non-ferrous foundry practices is indispensable. The expansion of metallurgical industries and the adoption of newer and higher metallurgical processes are sustaining factors for the crucible industry and they even call for a Research and Development dimension in the crucible industry to keep pace with the sophisticated demand of modern industry and technology. The crucible industry has to make much lee way in the export field. The superior quality and finish of imported crucibles is inhibiting our own exports. The crucible industry should come up with products qualitatively equal if not superior to their foreign counterparts. The government on its parts has to provide the necessary technical expertise and credit facilities adequately and ensure a profitable export market for Indian crucibles. The mere imposition of restrictions on import, say upto 300 no. size. as is prevalent now, is no positive encouragement to the local industry. A few Indian units are exporting their ware to countries like Behrain, Dubai, Ethiopia, Mauritius, Saudi Arabia, Mascat etc. The low prices they offer in the foreign measures may not for long continue to be an attraction even to out weigh the machine finished and better working products available in the international market. There is thus every reason why, the government should evolve a better strategy than mere import restriction to add sinews to the industry for domestic growth and foreign export.

Process Technique:

The dry powders according to the formula, are carefully and thoroughly mixed manually with nearly 15 per cent water content. The paste is aged for 5 days in a cool place and repeatedly pugged to improve plasticity. It is worked-up in a pug mill to make it homogenous. The extruded column of graphite body is cut to the required size and shape of the crucible. The dried crucibles are burnt in kilns. Table No. 1 shows the process for one tonne mix which indicates that in order to produce one tonne mix of raw material to final

Table 1
Process Showing Time Factor at Each Stage for
One Tonne-mix

Stage	Process	No. of Hours or Days
1	Mixing	4 hours
2	Ageing	5 days
3	Pugging	4 hours
4	Shaping	10 hours (jigger-jolly machine)
5	Drying	40 hours (manual) 4 to 5 weeks (Sun drying)
6	Glazing	4 to 6 hours
7	Loading to kiln	4 hours
8	Firing	45 to 50 hours
9	Cooling	12 to 15 hours
10	Un-loading & Stocking	4 hours

Source: Field Study

product takes nearly 40 to 45 days. Generally, a kiln can accommodate 6,000 nos. size crucibles. The operations are labour oriented in many units. Mixing and kneading are being done by feet, powdering with wooden mallets and leg pugging. These traditional method should be replaced by simple and systematic machines viz., pugmill, jigger jolly and others in order to obtain uniformity in the quality of crucibles. Some units follow traditional methods of firing crucibles. It is suggested that the kilns must be built under the guidance of technical officers from Small Industries Development Organisation. A model furnace should be built for demonstration so as to provide some training facilities in the firing of crucibles, preferable at Rajahmundry.

Shortage of graded graphite : The natural, graphite mineral of above 80 percent carbon, contributes towards the refractoriness and heat conductivity of the mass and produces a smooth surface for pouring. A crucible should also resist at a high temperature reaching upto 1200°C. Procurement of graphite of the required grade is a major problem. In India the graphite resources are abundant. Annexure I explain

measures. Hence the scope for detection and rectification of faults in the process of manufacture are remote. Manufacturers are unable to plug the shortcomings in the performance of the end product. Adequate inspection at every stage is a must to produce quality crucible.

I.S.I. Specifications : I.S.I. Standards cover the size and shapes. At present Indian standard shape of crucible similar Morgans 'A' I.S. 1748-61, I.S. size of crucible U.D.C. 666-78 (083-74) (5407), but majority of

STC should conduct training classes on Export Aid for Small Industries (EASI) Schemes through which assistance is given in selection of products, export pricing, credit documentation, shipping and insurance etc.

Transport Barriers : In the modern era transport and communication facilities play a vital role in the socio-economic and cultural relations of the human race. Crucibles have to be supplied all over the country

Annexure I
Graphite Reserves with Grade in India (State-wise)

State	Indicated	Inferred	Total	(in tonnes)	
				Grade	Fixed Carbon %
Andhra Pradesh	...	1,12,720	to 1,12,720	15	to 80
		1,59,720	1,59,720		
Bihar	...	61,05,000	16,05,000	20	
Gujarat					

as well as abroad mostly from Andhra Pradesh. Within the country the suitable and economical source for the transport of crucibles is the Railways. The crucible industry is declared as priority Sector by the Central government in view of its national importance. However, the industry is facing a big problem in wagon allotment by the Railways. Proper arrangements may be made for the allotment of wagons so that the goods reach their destination within the scheduled time in order to avoid number of complications.

Location of the units: Most of the units are at present housed in congested areas with little or no space for expansion. It is suggested that they should shift to the industrial estates where facilities for power, water etc. and services are available for their growth.

Productivity and Management: Productivity is a measure of economy of means which is meant to increase the rate of production in terms of minimum labour and time. Productivity is the balance between all factors of production that will give the greatest out-put for the smallest effort.

Mechanisation is a measure of productivity and is vital to the crucible industry. It helps to increase the phase of production and reduce the process time. The 'Disintegrator' is used to crush graphite ore into powder form. If disintegration through hand-pounding and sieving of graphite lumps, chips to fineness 20-80 mesh of a given quantity, it takes 10 days for 8 workers at 8 hours shift per day. This comes to 640 man hours costing about Rs. 400 but now the same quantity with the use of simple mechanical means takes only 8 hours in all costing about Rs. 75. As a result, there is 5.35 fold decrease in processing cost and also time-saving of nearly a week.

The intermediate technology is suitable to the conditions of Indian graphite crucible industry. The main object of introducing the intermediate technology is to bring out a compromise between sophisticated automation followed in advanced countries and antiquated manual process prevailing in undeveloped countries. This technology should be such a one that mechanisation so introduced in our industrial units should not eliminate man-power altogether but should

only help the workers to increase labour productivity. By observing scientific work study principles, the industry can make rapid strides in productivity.

Proper utilisation of materials in production process will ensure a considerable saving in production. This is achieved by observing material productivity. Material productivity can also be secured by eliminating or reducing waste in the utilisation of materials. It is further secured by substitution of cheaper and easily available other materials. Thus, the material cost can be minimised. Out of the total units surveyed so far, it has been found out that no unit maintains any proper method of stores accounting which is not a difficult task. Even the smallest unit can maintain a regular stock account, receipts and issues register accompanied by physical verification at regular intervals. Similarly loss of material in transit can also be minimised if proper care is taken, which means planning of stocks, despatches, inventory controls proper documentation and claims settlement machinery. Even the smallest unit can adopt the modern productivity and management techniques to ensure its scientific functioning schedule.

Suggestions for future Growth: For a healthy growth of the industry, industrial co-operatives should be established to look after the purchase of raw materials from home and foreign markets and to distribute them to their users as per their requirements. These societies should market crucibles in India through, proper product market strategies, eliminating in the process, the prevailing cut-throat competition. Another important step for the future growth of the industry is modernising the production process by scientific and open methods. It is pity that the conservative habits of many of the crucible makers in keeping the processes as family preserves are acting as serious deterrents to growth in the industry. In the industry Research and Technological institutions should start courses and training in crucible making and keeping and maintenance of Accounting including Cost structure and the government should provide the necessary funds in this regard.

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Even her mother forgets how she has changed



Those who are nearest are often the last to notice the change—because they see her every day. But she minds it when they do not treat her as a different person. So sometimes she has to tell them how she has changed.

To most housewives in India, Hindustan Lever is the supplier of well-known products—Sunlight, Dalda, Lux, Lifebuoy and a host of others. But this company has grown and changed especially in the last five years—so much, that we thought we should tell you something about it.

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Trends in Regional Disparities

AJIT KUMAR SINGH

Since the colonial period Indian economy has been characterised by marked regional imbalances. These imbalances have become a major political issue since Independence. Consequently reduction of regional disparities has been accepted as one of the important objectives of economic policy. In this context a study of trends in regional inequalities assumes high practical importance.

Since the colonial period Indian economy has been characterised by marked regional imbalances. These imbalances have become a major political issue since Independence. Consequently reduction of regional disparities has been accepted as one of the important objectives of economic policy. In this context a study of trends in regional inequalities assumes high practical importance. Although States of the Indian Union do not always correspond to a natural economic region, the discussion on regional disparities has mostly centred on inter-State differentials for a number of practical considerations. This paper presents a profile of inter-State differences in the levels and rates of total and per capita output and examines the trends in inter-State disparities during the Plan period.

Nature and Source of Data

The analysis is based on the behaviour of net State domestic product estimated at State level constant prices. While this concept does not present problems as far as the study of growth of State income over time is concerned, it is open to criticism when used for inter-State comparisons of levels of per capita income and trends therein, for which, purpose 'income accruing' rather than 'income produced' concept is theoretically preferable. To what extent the two magnitudes vary is a question for empirical verification for which adequate statistical information is not yet available. The discussion of inter-State comparison is further complicated

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by the fact that there are differences in the methodology and quality and coverage of data for income estimation in different States. Hence the results of the study should be seen as indicative of the general trend in growth behaviour of States rather than as precise estimates of the magnitude of change.

We do not have a single time series of State income estimates for the entire period. However, NCAER has prepared *Estimates of State Income* at constant process of 1960-61 for the years 1950-51, 1955-56 and 1960-61 for 14 States. These estimates have been used for the study of change during the first decade of planning. For the latter period two sets of State income estimates are available year-wise, namely, those prepared by the State Statistical Bureaux and C.S.O. The two estimates diverge from each other because of differences in methodology and data coverage. Usually the C.S.O. estimates are on the higher side. A comparison of per capita State incomes in 1970-71 on the basis of the two estimates shows that in as many as 12 States the divergence was less than 5%. In 3 States (i.e. Assam, Haryana and Tamil Nadu) the divergence was between 5.0 and 7.5 percent. Only in Orissa and Kerala the divergence was large being 12.2 percent and 14.2 percent respectively. Thus, it appears that the broad pattern of disparities and changes therein is not likely to be seriously affected, whichever series one chooses to select for purposes of study. Our study is based on the income estimates prepared by the SSBs, which covers a longer period. The same have been published in *Reserve Bank of India Bulletin* April 1978, June 1979 and September 1981. These are also presented in *Indian Economic Statistics* compiled by Ministry of Finance, Government of India.

Growth of State Income

In order to eliminate the impact of annual fluctuations we have taken the average of three years of net SDP at constant process of 1960-61 at five year intervals. The average of SDP for the years 1975-78 and 1978-81 (for which data is available only at 1970-71 prices) has been calculated by moving the SDP for 1970-73 at 1960-71 prices at the same rate at which the SDP has increased over this period at constant prices of 1970-71. The absolute figures of SDP at the index with 1960-61 = 100 has been given in Table 1.

During the decade 1960-63 to 1970-73 the percentage increase in SDP has ranged from 25.2 percent in U.P. to 69.2 percent in Punjab. The States which recorded increases above the country's average during this period in descending order are : Punjab, Karnataka, Assam, Kerala, Gujarat, J & K, Haryana and Orissa. For the eighteen year period 1960-63 to 1978-81 the increase ranged from 48.3 percent in M.P. to 146.5 percent in Haryana. Apart from Haryana, SDP more than doubled over this period in the States of Punjab, Maharashtra and J & K.

Table 2 shows the annual compound growth rate of SDP over different time periods. The rates of growth vary from 2.30 percent to 4.64 percent in the fifties; from 2.07 percent to 5.20 percent in the Sixties and 1.34 percent to 5.42 percent in the Seventies. There are also differences in the pattern of growth rates in the three decades. In seven States the rate of growth in the Sixties was less as compared to the growth rates in the fifties. The decline was marked in the case of Tamil Nadu, Maharashtra, M.P., Bihar and West Bengal, but moderate in Andhra Pradesh and U.P. On the other hand, the rates of growth showed marked increase over this period in Assam, Gujarat, Karnataka, Kerala, Orissa and Punjab.

During the Seventies 7 States showed an increase in rates of growth over the past decade, i.e. A.P., Bihar, Gujarat, Haryana, J & K, Maharashtra and U.P. On the other hand there was a marked deceleration of rate of growth in this period in the States of Assam, Karnataka, Kerala, M.P., Orissa and Tamil Nadu and a moderate one in the States of Punjab, Rajasthan and West Bengal.

The States which have shown clearly above average performance in the Sixties as well as Seventies are Punjab, Haryana, Gujarat and Jammu and Kashmir. On the other hand the laggard States in both the periods are Rajasthan, U.P., Bihar, West Bengal and Tamil Nadu.

Taking the period 1960-63 to 1978-81 as a whole the States can be grouped into 4 categories according to the level of rates of growth of SDP :

- (a) Very High Growth : Haryana, Punjab, Maharashtra (4.0% and above).

Table 1
Net State Domestic Product at Constant Process (1960-61), Rs. Crores

State	1960-63	1965-68	1970-73	1975-78	1978-81
Andhra Pradesh	1032 (100.0)	1134 (109.9)	1334 (129.3)	1777 (172.2)	1739 (173.4)
Assam	268 (100.0)	328 (122.4)	408 (152.2)	511 (190.7)	531 (198.1)
Bihar	1032 (100.0)	1048 (101.6)	1268 (122.9)	1489 (144.3)	1530* (148.3)*
Gujarat	785 (100.0)	910 (115.9)	1127 (143.6)	1260 (160.5)	1448 (184.4)
Haryana	245 (100.0)	314 (128.2)	443 (141.1)	556 (226.9)	604* (246.5)*
Jammu and Kashmir	97 (100.0)	106 (109.3)	138 (142.3)	173 (178.4)	199 (205.1)
Karnataka	577 (100.0)	695 (120.5)	908 (157.4)	1027 (178.0)	1104 (191.1)
Kerala	441 (100.0)	517 (117.2)	648 (146.9)	738 (167.3)	753† (170.7)†
Madhya Pradesh	823 (100.0)	865 (105.1)	1106 (134.4)	1269 (154.2)	1232 (149.7)
Maharashtra	1612 (100.0)	1795 (111.4)	2156 (133.7)	2880 (178.7)	3424 (206.2)
Orissa	400 (100.0)	489 (122.3)	563 (140.8)	622 (155.5)	673* (168.3)*
Punjab	383 (100.0)	501 (130.8)	648 (169.2)	833 (217.5)	916* (239.2)*
Rajasthan	594 (100.0)	639 (107.6)	795 (133.8)	868 (146.1)	995 (167.5)
Tamil Nadu	1120 (100.0)	1219 (108.8)	1486 (132.7)	1773 (158.3)	1791 (159.9)
Uttar Pradesh	1857 (100.0)	1963 (105.7)	2325 (125.2)	2641 (142.2)	2855 (153.7)
West Bengal	1348 (100.0)	1545 (114.6)	1696 (125.8)	2045 (151.7)	2027 (150.4)
India	13754 (100.0)	15748 (114.5)	19334 (140.6)	23394 (170.1)	25830 (187.8)
Coefficient of Variation	64.9%	61.7%	58.6%	61.0%	62.5%

Note: * = Average for 1977-80; † = Average for 1976-80.

Figures in parenthesis show index with 1960-61 = 100.

Table 2
Annual Rates of Growth (Compound) in SDP at Constant Prices

States	1950-51 to 1960-61	1960-63 to 1970-73	1970-73 to 1978-81	1960-63 to 1978-81
Andhra Pradesh	2.61 (12)	2.57 (13)	3.67 (6)	3.05 (10)
Assam	2.78 (10)	4.20 (3)	3.30 (7)	3.79 (5)
Bihar	3.87 (4)	2.07 (16)	2.68* (9)	2.33* (14)
Gujarat	2.94 (6)	3.62 (5)	3.86 (5)	3.41 (7)
Haryana	N.A. —	3.45 (7)	4.44* (4)	5.33* (1)
J.K.	N.A. —	3.53 (6)	4.57 (3)	3.99 (4)
Karnataka	2.83 (9)	4.53 (2)	2.45 (13)	3.60 (6)
Kerala	2.84 (8)	3.85 (4)	2.49† (12)	3.34† (8)
Madhya Pradesh	4.34 (3)	2.96 (9)	1.34 (16)	2.24 (16)
Maharashtra	4.62 (2)	2.91 (11)	5.42 (1)	4.02 (3)
Orissa	2.43 (13)	3.42 (8)	2.55* (11)	3.08* (9)
Punjab	3.17 (5)	5.20 (1)	4.94* (2)	5.14* (2)
Rajasthan	2.90 (7)	2.92 (10)	2.80 (8)	2.86 (11)
Tamil Nadu	4.64 (1)	2.83 (12)	1.90 (15)	2.60 (12)
U.P.	2.30 (14)	2.24 (15)	(2.57 (10))	2.38 (13)
West Bengal	2.63 (11)	2.30 (14)	2.23 (14)	2.26 (15)
India	3.24	3.41	3.62	3.50

Note: Figures in parenthesis show rank.

* = Average 1977-80.

† = Average 1976-79.

(b) High Growth : J & K, Assam, Karnataka, (3.25% to 4.0%) Gujarat, Kerala.

(c) Low Growth : Orissa, A.P., Rajasthan, Tamil Nadu (2.50% to 3.25%).

(d) Very Low Growth : U.P., Bihar, West Bengal, M.P.

The above discussion indicates that as far as the total SDP is concerned all States of the Indian Union have recorded clear and sustained increases, although there are significant differences in the rates of growth. Thus it appears that the forces of growth over the planning period are spread over the entire length and breadth of the country, although their impact has been uneven.

Unstability and Variability in Growth of SDP

The question of the unstability and variability in the growth of SDP may be examined now briefly. We may judge the unstability of growth process in terms of the frequency of decline of SDP. In the period of 18 years between 1961-62 and 1979-80, SDP did not register a decline in any state in 4 years only. In another 3 years the decline in SDP was confined to less than four States. In the remaining 6 years, the decline was spread to over 5 States. In particularly bad years like those of 1965-66 and 1979-80 majority of the States are adversely affected.

The variability in SDP may be measured by the spread between the lowest and highest increase in a year among States. Relevant yearwise information has been given in Table 3. The degree of inter-state variability of SDP is quite high and has increased sharply in the Sixties, though it has again somewhat declined in the post 1975-76 period.

Thus it appears that the Indian economy continues to be bedevilled by the increasing unstability and inter-state variability in the growth of SDP inspite of heavy investment in irrigation and the increased diversification of the economy. The degree of unstability appears to be high in the States of Rajasthan, Orissa, Gujarat, Karnataka and Madhya Pradesh. It is moderate in the States of Andhra Pradesh, Bihar, Haryana, U.P. and West Bengal; and low in the States of Assam, J & K, Kerala, Maharashtra, Punjab and Tamil Nadu.

Table 3

Variability in State Domestic Product

Year	Number of States showing Decline	Lowest Increase (%)	Highest Increase (%)	Total Variation (%)
1961-62	4	-1.0	11.3	12.3
62-63	5	-3.1	9.6	12.7
63-64	2	-7.0	9.3	16.3
64-65	—	0.6	19.9	19.3
65-66	10	-15.0	3.3	18.3
66-67	3	-8.2	17.2	25.2
67-68	1	-1.0	20.2	21.2
68-69	5	-19.3	9.0	28.3
69-70	—	2.0	24.4	22.4
70-71	2	-1.7	34.8	35.5
71-72	3	-10.9	5.0	15.9
72-73	9	-20.3	5.8	26.1
73-74	4	-4.5	22.4	26.9
74-75	6	-13.9	9.2	23.1
75-76	—	1.6	28.5	26.9
76-77	9	-12.1	8.3	20.4
77-78	—	2.7	18.1	15.4
78-79	3	-5.1	9.6	14.7
79-80	13	-16.5	3.0	19.5

Growth of Per Capita SDP

Three yearly averages of per capita SDP at constant prices of 1960-61 have been calculated in the same manner as the total SDP. Relevant figures are given in Table 4. Per capita SDP ranged from Rs. 220 to Rs. 403 in 1960-63; from Rs. 239 to Rs. 499 in 1970-73 and, from Rs. 251 to 629 in 1978-81. During the period 1960-63 to 1970-73 per capita income declined by 1.0 percent in West Bengal. During this period marked increase took place in the per capita SDP in Himachal Pradesh, Punjab and Haryana and to a lesser extent in Karnataka and Kerala. In the Seventies increase was noticeable in case of Maharashtra, Punjab, Haryana, J & K, Tamil Nadu and Andhra Pradesh, while it was negative in Kerala and Madhya Pradesh.

Table 4
Per Capita SDP at Constant Prices (1960-61) in Rs.

State	1960-63	1965-68	1970-73	1975-78	1978-81
Andhra Pradesh	284 (100.0)	284 (100.0)	304 (107.0)	319 (112.3)	345 (121.5)
Assam	309 (100.0)	341 (110.4)	343 (111.0)	354 (114.6)	352 (113.9)
Bihar	220 (100.0)	204 (92.7)	239 (108.6)	251 (114.0)	251* (114.0)
Gujarat	376 (100.0)	383 (101.9)	403 (107.2)	412 (109.6)	419 (114.4)
Haryana	329 (100.0)	354 (107.6)	436 (132.5)	479 (145.5)	502* (152.6)*
Himachal Pradesh	259 (100.0)	248 (95.8)	376 (145.2)	400 (154.4)	386 (149.0)
Jammu and Kashmir	268 (100.0)	273 (101.9)	296 (110.4)	316 (117.9)	342 (127.6)
Karnataka	300 (100.0)	310 (103.0)	355 (118.3)	365 (121.7)	368 (122.7)
Kerala	259 (100.0)	270 (104.2)	301 (116.2)	295 (113.9)	298* (115.1)*
Madhya Pradesh	251 (100.0)	232 (92.4)	262 (104.4)	261 (104.0)	245 (97.6)
Maharashtra	403 (100.0)	397 (98.5)	423 (105.0)	506 (125.5)	547 (135.7)
Orissa	226 (100.0)	146 (108.8)	254 (112.4)	261 (115.5)	263* (116.4)*
Punjab	374 (100.0)	424 (113.4)	499 (133.4)	562 (150.3)	629* (168.2)*
Rajasthan	295 (100.0)	282 (95.6)	310 (105.0)	325 (110.2)	318 (107.8)
Tamil Nadu	329 (100.0)	322 (97.9)	356 (108.2)	377 (114.6)	407 (123.7)
Uttar Pradesh	249 (100.0)	241 (96.8)	261 (104.8)	276 (110.8)	277 (111.2)
West Bengal	383 (100.0)	388 (101.3)	379 (99.0)	402 (105.0)	381 (99.5)
India	310	318 (102.6)	349 (112.6)	376 (121.3)	389 (125.5)

Notes : * = Average for 1977-80.

Figures in parenthesis show index with 1960-61 = 100.

For the entire period 1960-63 to 1978-81 sharp increase in per capita SDP took place in Punjab, Haryana, Himachal Pradesh and Maharashtra only. On the other hand, per capita SDP declined slightly in M.P. and West Bengal.

Annual compound growth rates in per capita SDP in different periods have been shown in Table 5. In each period there are quite marked inter-state differentials in the rates of growth of per capita income. Bihar, Madhya Pradesh and Tamil Nadu which had shown relatively more rapid rise of per capita product during the fifties, showed much lower rates of growth in the latter period. As many as 10 States showed a deceleration in the rate of growth of per capita SDP in the Seventies as compared to the Sixties, the notable exceptions being A.P., J & K, Maharashtra, Punjab and Tamil Nadu.

Table 6 presents cross classification of States according to level of per capita SDP in 1960-63 and rates of growth of SDP during 1960-63 to 1978-81. The table shows a clear relationship between the levels and rates of growth of per capita SDP. The relatively poor States of Kerala M.P., U.P., Orissa and Bihar also showed relatively low rates of growth. Tamil Nadu, Karnataka, and A.P. fall in the medium category of both the variables. Among the rich States Punjab shows high growth, but West Bengal and Gujarat showed low growth.

Trends in Regional Disparities

Let us now see what has been the impact of inter-state differentials in rates of growth on regional income inequality. The coefficient of variation in per capita SDP declined from 28.59% in 1950-51 to 23.79% in

Table 5
Annual Compound Growth Rate in Per Capita SDP at
Constant Prices (1960-61)

State	1950-51 to 1960-61	1960-63 to 1970-73	1970-73 to 1978-81	1960-63 to 1978-81
Andhra Pradesh	1.17	0.68	1.56	1.08
Assam	-0.17	1.04	0.31	0.72
Bihar	2.06	0.83	0.70*	0.78*
Gujarat	0.57	0.70	0.49	0.75
Haryana	N.A.	2.84	2.01*	2.51*
Himachal Pradesh	N.A.	3.73	0.34	2.22
Jammu & Kashmir	N.A.	0.99	1.80	1.35
Karnataka	0.88	1.68	0.44	1.12
Kerala	0.70	1.41	-0.15*	0.83*
Madhya Pradesh	2.18	0.44	-0.80*	-0.13
Maharashtra	2.50	0.49	3.20	1.69
Orissa	0.62	1.16	0.50*	0.88*
Rajasthan	0.59	0.49	0.34	0.42
Punjab	0.87	2.88	3.30*	3.04*
Tamil Nadu	3.40	0.78	1.64	1.18
Uttar Pradesh	0.78	0.57	0.73	0.59
West Bengal	-0.20	-0.10	0.07	-0.03
India	1.28	1.18	1.37	1.26

Note: * = upto 1977-80.

1955-56 and further to 21.92% in 1960-61 indicating that the first decade of planning witnessed a narrowing of inter-state income disparities. But this trend has been reversed in the latter period as the data given in Table 6 shows.

The coefficient of variation of per capita SDP at constant process after remaining stable between 1960-61 to 1962-63 shows a clear upward trend since than which was interrupted for a short period during 1972-73 and 1973-74. A clear divergent trend in regional disparities is noticeable during the green revolution phase in the country. The divergence has been even sharper in the Second half of Seventies. The movement of other indicators of inter-regional disparities like standard deviation, range and maximum/minimum

Table 6
Gross Classification of Rates According to Level of Per Capita
SDP (1960-63) and Rates of Growth of SDP
(1960-63 to 1978-81)

Level of Per Capita S.D.P.	Rates of Growth of Per Capita SDP		
	High Over 2%	Medium 1% to 2%	Low Below 1.0%
High (Rs. 350 and Above)	Punjab	Maharashtra	West Bengal Gujarat
Medium (Rs. 275 to Rs. 350)	Haryana	Tamil Nadu Karnataka Andhra Pradesh	Assam Rajasthan
Low (Below Rs. 275)		Jammu and Kashmir	Kerala Madhya Pradesh Uttar Pradesh Orissa Bihar

ratio also support the hypothesis of increasing regional disparities since 1960-61 as presented in Table 7.

Factors in Differential Growth Rates

Although a detailed analysis of the factor underlying differential growth rates cannot be attempted here, it would be worthwhile to identify even if tentatively some of the characteristics of the high and low growth states, which are likely to have an impact on their growth performance. For this purpose we have classified the states under study into three categories according to the rate of growth of SDP at constant prices during the period 1960-63 to 1978-81 :—

- (A) High Growth States : Haryana, Punjab, Maharashtra, Jammu & Kashmir, Assam.
(Growth rate between 3.75% & 5.50%)
- (B) Medium Growth States : Karnataka, Gujarat, Kerala, Orissa, Andhra Pradesh, Rajasthan.
(Growth rate between 2.75% & 3.75%)
- (C) Low Growth States : Tamil Nadu, U.P., Bihar, West Bengal, Madhya Pradesh.
(Growth rate between 2.0% & 2.75%)

Table 7
Trends in Inter-State Disparities: 1960-80

Year	Coefficient of Variation %	Standard Deviation (Rs.)	Range (Rs.)	Maximum/Minimum Ratio
<i>Per Capita Income at 1960-61 Prices (N = 16)</i>				
1960-61	19.46	58.8	194	1.90
1961-62	19.07	58.2	177	1.87
1962-63	19.00	57.6	179	1.81
1963-64	20.90	65.0	185	1.83
1964-65	20.40	65.9	196	1.89
1965-66	21.35	63.6	176	1.80
1966-67	22.63	68.8	229	2.22
1967-68	22.23	71.8	258	2.28
1968-69	23.37	73.6	271	2.32
1969-70	23.99	79.2	291	2.41
1970-71	22.06	75.9	260	2.10
<i>Per Capita Income at 1970-71 Prices (N = 17)</i>				
1970-71	25.75	165	628	2.56
1971-72	27.19	173	640	2.57
1972-73	27.10	166	660	2.66
1973-74	26.91	171	697	2.82
1974-75	28.50	176	689	2.75
1975-76	28.11	187	720	2.74
1976-77	31.79	208	744	2.76
1977-78	31.15	218	802	2.87
1978-79	32.14	229	870	2.99
1979-80	36.15	243	916	3.26

Table 8
Selected Characteristics of States Classified by Rates of Growth of SDP

Characteristics	High Growth Rate (3.75% to 5.50%)	Medium Growth Rate (2.75% to 3.75%)	Low Growth Rate (2.0% to 2.75%)
1. Annual growth rate 1960-63 to 1978-81(%)	4.17	3.21	2.37
2. Per capita SDP 1960-63 (Rs.)	369	292	277
3. Per cent of Rural population below poverty line	40.8	45.0	56.7
4. Share of Primary sector in SDP 1960-60 (%)	47.1	55.7	54.9
5. Average size of area (sq. miles in '000)	53.6	76.7	87.2
6. Average size of population 1961 (million)	14.74	22.47	44.24
7. Population Density per sq. km., 1971	275	293	507
8. Population growth (% increase 1961-81)	60.3	55.9	51.7
9. Net cultivated area per agricultural worker 1971 (hectare)	1.50	1.37	1.05
10. Average size of operational holding 1976-77 (hectare)	2.85	2.63	1.20
11. Indices of infrastructural development* :			
(a) Banking	12.84	10.23	9.24
(b) Power	8.30	5.82	4.41
(c) Transport	7.39	4.59	3.54
(d) Health	8.57	5.73	4.26
(e) Education	17.23	15.43	12.02
12. Composite index of development, mid-1970s*	21.76	15.81	14.09
13. Per capita plan outlay 1956-81 (Rs.)	1568	1344	1244
14. Per capita central assistance for plans 1956-81 (Rs.)	482	426	373
15. Per capita flow of institutional funds 1973-81 (Rs.)	718	405	276

Table 8 gives selected characteristics of the three groups of states which throw some interesting light on the structural and demographic constraints operating in the low growth states. The first striking thing to be observed is the close association between the rates of growth, level of per capita income, extent of poverty and the composite index of development. Such an association suggests that under-development is a multi-dimensional phenomenon which tends to perpetuate itself and further that favourable conditions of growth can be generated only when development takes place all along the line. However, at the present stage of

* Index of development shows the factor score (weighted by population) of individual states obtained from the first principal component (Source ; Hemlata Rao, 'Inter State Disparities in Development in India', mimeo).

development in the country, the economic structure of the States as reflected in the share of primary sector in SDP is not uniquely related to rates of growth.

Interestingly the size of the state—both in terms of area and population—emerges as an important factor affecting the growth performance of the states. With the exception of Maharashtra, all states registering high growth rates are comparatively small, whereas the more populous states have registered relatively lower rates of growth. Thus it looks that the more populous backward states are also proving to be administratively unmanageable, which affects their growth performance.

The table also suggests that the demographic balance in the low growth states has been upset and low resource base acts as a constraint on their development. The population density of low growth states is markedly high and the size of operational holding and cultivated area per agricultural worker is markedly lower. The present demographic disbalance of these states is the result of a long historical process of concentration of population in the once land rich and fertile regions around the major river systems of the country. Interestingly the less densely populated states on the northern and western periphery of the country show a more rapid growth.

Among the man-made factors the availability of infrastructure and the level of investment have been found to be affecting the growth performance of the states. The high growth states have a relatively more developed infrastructure of material and human capital as compared to the medium and low growth states. Moreover, the level of investment under the plans—both in the public and private sectors has been greater in the better off and rapidly growing states. Not only the richer states are in a position to mobilise larger resources themselves they have received a distinctly larger share on per capita basis in central plan assistance as well as in the flow of institutional funds. That this should continue to be so in spite of the repeated policy pronouncements for ensuring a larger flow of resources, towards the poorer states reveals that the

institutional mechanism for directing the flow of resources is still inadequate and weak.

Our analysis suggests that any global policy for development of the backward states as a whole is not likely to be very successful in attaining its goal of balanced regional development. Such a policy should be region specific and must take into account the economic, demographic, administrative and other constraints affecting the growth performance of each region or state.

Conclusion

The main conclusions of the study may now be briefly summed up :

1. All States of the Indian Union have registered steady increase in total SDP, though the differences in the rates of growth were quite sharp.
2. The entire period is marked by high instability in growth rates which has increased over time.
3. The increase in per capita SDP have been generally low except in a few States like Punjab, Haryana, Maharashtra and Himachal Pradesh. In two States, namely, Madhya Pradesh and West Bengal, per capita SDP has actually declined.
4. A positive association is observable in the levels of per capita SDP and rates of growth as a result of which inter-State income disparities have tended to widen.
5. The policy instruments devised to promote a more balanced pattern of regional development are not strong enough to arrest the divergent trend in inter-state disparities. Efforts on a much larger scale than in the past are needed to attain the objective of balanced regional development.
6. A proper strategy of balanced regional development must take into account the economic, demographic, administrative and other constraint affecting the growth performance of each state or region.

Product Mix Optimisation

P. S. KHATTRA
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Milk processing technology offers a multiple choice of routing milk for product Manufacture in milk plants. The product-mix in a milk product factory usually comprise liquid milk, butter, ghee, ice-cream, milk powder, baby food and like. The choice of product manufacturing decision gets multiplied with variations in packaging of products to cater for their varying market demands. It is thus important that elements of product mix entering the optimal production plans should be based on the economic rationale. In order to develop economic rationale a composite milk product factory in North-Western India was selected. The results are discussed in this paper.

The rapid modernisation of milk marketing infrastructure in the Public sector of India had led to the remarkable Product-diversification in the 1970's. This ongoing trend in dairy industry, apart from generating favourable impact on import substitution process, has been deemed fit for retrieving nation's population from the nutritional supply-demand imbalances by making available increased quantity of fresh milk and various milk products. The increment in the degree of product diversification, has however, added to the complexity and difficulty of selecting economically efficient and technically feasible combinations of milk products. The problems of choice between products gets further complicated owing to the differentiation of each product into various packages which are heterogenous with respect to the size and type of packing material employed. These differences of packaging impart variations in the market prices of the same milk product by way of affecting its technical coefficients.

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Though the public sector milk plants are primarily meant for the maximising welfare of the society, yet their economic viability is indispensable for determining the success of this endeavour in the long-run. The implementation of atleast the restrictive optimisation of the product-mix commensurate with social gains, is bound to have favourable and lasting impact on

the economic viability of these milk plants in long run. It has, therefore, become imperative to find out the optimum combinations of milk products for the months representing various seasons of milk production during the year. *Keeping in view the difficulty of practically adhering to the points' solution of optimum product-mix offered by linear programming, sensitivity of the objective function to the changes in the optimum product levels was also portrayed. **Besides this, identification of processes determining upper limits of product activities at constant unit reduction in the value of objective function was also made. Additionally, optimisation of product-mix at full capacity use of the dairy plants, which added an element of foresight into product planning in view of existing under utilization of total installed capacity, was also attempted 1, 2.

Data and Methodology

The results of this study are based on one of the public sector milk plants from a milk-surplus state of North-Western India. The highly diversified product-mix without any dominant bias for a particular product and further differentiation of each product into different packages appeared to be most suitable for this type of study. This characteristic

*A few studies attempted in this direction in dairy industry are :

James C. Snyder and Charless E. French, 'Selection of Product Line for a Fluid Milk Plant by Activity Analysis'. Jour. F. Econ. Vol. XXXIX No. 4 p. 914, 1957.

First author's Economics of Processing constraints for Representative Multi-product Milk Factories in Public Sector of North-Western India'. Approved Ph. D Dissertation, Kurukshetra University, Kurukshetra, 1981.

Jagdeesh C. Kalla et. al., 'Costing and Optimisation of Product-Mix A case study of Milk Products in Factory, Vijayawada (A.P.), N.D.R I. Publication No. 201.

**Sensitivity analysis is an extension of linear Programming. For the exposition of the execution process, see Burrough's Corporation, Tempo Mathematical Programming System Detroit, Michigan, 1976.

1. The installed capacity of the case plant remained under utilised even in the flush seasons of the study period.
2. The utilization of the installed capacity of the dairy plants has recorded to the level of 65.25 percent of the total installed Capacity, D.R. Shah, Dairyman, Vol. XXXIV, No. 35.

coupled with location of the plants in the centre of the state and easy availability of adequate data become the basis of its selection. The selected plant was commissioned in April, 1974 with its installed processing capacity of one and a half lakh litres of milk per day. The handling capacity of this plant remained 75,000 litres of milk per day since its inception till now. The product-wise installed capacity of the plant remained at 5, 4 and 6 tonnes per day for power, butter and ghee respectively. Bottle filling capacity of the bottling plant was 12,000 bottles or sachets per hour.

The product-mix of this composite milk plant constituted *ghee*, white butter (WB), table butter (TB), whole milk powder (WMP) skim milk powder (SMP), ice-cream powder (ICP), standardised milk (SM), double toned milk (DTM), sweetened flavoured Milk (SFM), *lassi*, *paneer* and milk cake.

The Data

The results of the case-study plant are based on the data relating to the year 1978-79. For capturing the impact of conspicuous cyclical behaviour of milk production on the product-mix of the milk plant, the quantitative data relating to product-mix and resources employed during four discrete months representing lean (May), transitory (August), Flush (November) and transitory (February) periods were unknown proportion of their usage posed the serious problem arriving at costs attributable to individual milk products. The procedure for apportionment of costs pertaining to the third category of resource elicited for each relevant resource separately.

Labour

The manufacturing of milk products calls for utilization of services of engineering and supervisory staff which only indirectly determine the production of various milk products. The expenditure of this type accounts for substantial proportion of total wage bill in milk products factory. Total or direct manpower requirements prescribed for manufacture of each product

*The name of the study plant remains undisclosed as it is, so desired by plant administration.

were made the basis of apportionment of actual expenditure on manufacturing and engineering staff. The justification of this apportionment procedure is based on the logic that higher demand for direct labour for a product would require more intensive use of particular machinery which may increase the chances of its breakdown and thus would utilise more services of engineers. Similarly, more the direct labour employed, more would be the requirement of supervisory staff.

Fuel

Furnace oil was the main source of fuel for generation of steam in the boiler section of study plant. In the absence of knowledge regarding product-wise steam requirements, estimates of total steam requirements for various milk products were made utilizing standard formulae. The expenditure on fuel was thus apportioned among various milk products in proportion to their total prescribed steam requirements.

Electricity

Apart from direct electric consumption in respective sections of various milk products, substantial amperage is indirectly consumed by milk products in reception, boiler and refrigeration sections. The direct electricity consumption in kilowatts for each of these sections was estimated through multiplying kilowatts of an electric motor with number of hours it worked during the year. Milk, steam and refrigeration requirement of various milk products were treated as criteria for the appointment of electricity usage of reception, boiler and refrigeration sections respectively. To these electricity estimates for different milk products, were added the direct kilowatts of electricity which were similarly estimated for each period for arriving at total (direct and indirect) estimate of power consumption. The resultant total estimated electricity consumption for each milk product served as apportionment basis of electricity bill among various milk products.

Bottle Breakage

The actual expenditure on bottle breakage in the study plant was allocated to relevant products in

proportion to the breakage rates for different types of bottles having standardised through experience. These rates varied from one per cent for bigger bottles (250 and 500 ml) to 4.5 per cent for small bottles (200 ml). The variation in breakage rate of bottles may be attributable to the structural differences of bottles apart from the varied degree of care with which bottles of different types are handled.

Depreciation

The cost component includes the cost of wear and tear of that part of plant and machinery which exclusively involves in the manufacture of various milk products. Product-specific components of depreciation for machines and equipment are bound to cause difference in the unit cost estimates of different milk products. Depreciation costs were estimated by making due allowances for extra shift in certain machines and was based on net balance method³. This, information maintained in the depreciation schedules of the product specific machinery was utilised to estimate product-wise depreciation cost in the plant under study. In case the single machine or equipment involved in more than one product like bottling plant etc. their depreciation cost was apportioned on the basis of quantity manufactured of final milk products.

Distribution Expenses

The distribution expenses being of influencing the profitability of various milk products were required to be apportioned among products. The revenue earned by various milk products was chosen as apportionment basis.

Model

The unit costs of processing and consequent returns incidental to processes involved were used to optimize

3. Net balance method of depreciation is also called written down value method according to which the depreciation charge is certain percentage of the written down value of the asset. In general terms the depreciation charge for nth year is: $A(1-d)^{n-1}d$ Where A=initial cost, d=rate of depreciation. For details see chandra, P; 'Projects-Preparation Appraisal and Implementation'. Tata MC-graw Hill Publishing Co. Ltd., New Delhi, P. 88.

net returns (returns over prime and product specific fixed costs) in milk products factory under consideration subject to constraints (bi's). The first model used was of the following LP format :

$$\text{Maximize } Z = C_1X_1 + C_2X_2 + \dots + C_j X_j + \dots + C_nX_n$$

Subject to the conditions:

$$a_{11}X_1 + a_{12}X_2 + \dots + a_{1j}X_j + \dots + a_{1n}X_n \leq b_1$$

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

$$a_{i1}X_1 + a_{i2}X_2 + \dots + a_{ij}X_j + \dots + a_{in}X_n \leq b_i$$

$$a_{m1}X_1 + a_{m2}X_2 + \dots + a_{mj}X_j + \dots + a_{mn}X_n \leq b_m$$

Where the C_j for $j=1, 2, \dots, n$; b_i for $i=1, 2, \dots, m$ and a_{ij} are all constants, and the decision variables, $X_j \geq 0$

Activity Bonds

In order to conform the optimum product line to the real world situation, some of the product activities called for imposing of lower and upper bonds. For instance, SFM and Lassi being cold drinks with abysmally low demand during winter months, were constrained with upper bonds at their base levels during November and February. The management of the concerned plant having gone into agreement with the government to supply DTM worth Rs. 4.00 lakhs to the school children in each year necessitated imposition of lower bond or the existing level of DTM.

RESULTS AND DISCUSSION

The normative product lines both at base and relaxed levels of processing resources alongwith existing product-mix are presented in table 1. It may be seen from this table that product optimisation exercise called for summary rejection of white butter (except in May at base resource profiles) and of *Lassi*. Both the products were thus rated as the least favourable activities. SMP appeared to be the better substitute for WMP in view of its relatively less per unit resource absorption and more revenue generation capacity at both base as well as at augmented resource profiles. Among the butter activities, the smallest lot sub-group (TB-20 gms) appeared to be the most promising activity in May, August and February which tended to capture most of the butter production during these months.

However, in the month of November, the largest lot sub-group (TB-500 gms) accounted for the major proportion of butter line. Ghee sub-lot of 500 gms in February and of one kg in May captured the total ghee production. During the month of August and November, ghee 4 kg sub-lot showed an edge over its counterparts by virtue of its higher profitability and resource-use efficiency. Paneer lots of 500 gms were preferred over small sized (200 gms) paneer lots during May, August, and November. Contrarily, paneer 200 gms replaced its counterpart entirely in the optimum plans at existing and relaxed resource positions during the month of February. Leaving aside the lean season represented by the month of May, the production of milk cake appeared profitable subject to the existing resource constraints in the months representing flush and transitory seasons. However, with the relaxation of resources' supply, milk cake activity ceased to be remunerative. SFM is observed to be another promising activity with its unfailing entry into the optimum plans envisaged at base and relaxed resource profiles during all the selected months. DTM (bottled) moving ahead of its lower bound confirmed its profitability for its inclusion in optimum plans during May, August and November. On the other hand, DTM (poly pack) being relatively less profitable did not go beyond the limit imposed by its lower bound.

The most striking is the observation that fluid milk competed favourably with other western products. The production of DTM (Bottle) and SM therefore, remained justified on economic ground which is required for meeting the vast milk requirements of urbanites. This assured maximum welfare of the society which is one of the main objectives of these multi product milk factories in the public sector.

Another important conclusion which emanates from the figures of table 1, is the reduction in the degree of product diversification in optimum product lines obtained with the relaxation of resource constraints. This finding is in consonance with the hypothesis of inverse relationship between profitability and degree of diversification. Besides, lot subgroups for each product experienced reduction in their numbers in product-optimisation process.

TABLE : 1
Existing and Normative Product Lines of the Sample Milk Plant in transitory lean and thrush seasons of Milk Production

Sr. No.	Product	Unit	May		August			November		February				
			Existing		Optimum		Existing	Optimum	Existing	Optimum	Existing		Optimum	
			S-I*	S-II**	S-I	S-II					S-I	S-II		S-I
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	Table Butter (20 gms)	Qtls.	0.48	0.48	1236.75	18.56	18.56	1033.33	—	—	—	6.56	6.56	933.33
2.	Table Butter (100 gms)	Qtls.	47.69	47.69	3.25	48.30	48.30	206.67	105.21	105.21	—	150.61	150.61	—
3.	Table Butter (200 gms)	Qtls.	39.33	39.33	—	36.88	36.88	—	38.08	38.08	200	2.56	2.56	—
4.	Table Butter (500 gms)	Qtls.	—	—	—	44.16	87.36	—	39.73	105.66	1000	37.23	108.50	186.67
5.	Table Butter (500 gms)	Qtls.	32.62	32.62	—	43.20	—	—	65.93	—	—	93.12	—	—
6.	W M P (500 gms)	Qtls.	—	—	—	16.53	16.36	—	—	—	—	4.89	4.84	—
7.	W M P (1 kg.)	Qtls.	—	—	—	36.89	36.53	—	71.50	70.79	—	110.60	109.51	—
8.	W M P (10 kgs.)	Qtls.	—	—	—	48	47.53	—	324.80	321.58	—	468.40	411.81	—
9.	W M P (25 kgs.)	Qtls.	—	—	—	28.83	51.54	—	—	—	—	243.97	871.25	70
10.	Ghee (500 gms)	Qtls.	—	—	—	—	—	—	—	—	—	20	41.85	838.32
11.	Ghee (1 kg.)	Qtls.	126.24	124.99	928.14	67.56	66.89	—	190.13	188.25	—	150.97	149.48	—
12.	Ghee (2 kgs.)	Qtls.	—	—	—	94.32	93.39	18.59	357.14	353.60	—	136.22	134.87	—
13.	Ghee (4 kgs.)	Qtls.	—	—	—	57.96	57.38	775	110.72	109.62	749.92	78.88	78.10	—
14.	Ghee (16.5 kgs.)	Qtls.	—	—	—	101.81	100.82	134.56	34.49	34.15	142.28	49.01	48.53	—
15.	SMP (450 gms)	Qtls.	30.62	30.62	1499.10	25.18	25.18	1550	13.37	13.37	1500	11.50	2.60	1330
16.	SMP (25 kgs)	Qtls.	179.38	179.5	59.90	543.32	520.71	—	993.67	993.77	—	627.25	—	—
17.	Paneer (200 gms)	Qtls.	0.55	—	—	1.14	—	—	3.37	—	—	2.57	4.46	297.06
18.	Paneer (500 gms)	Qtls.	0.01	2.58	0.00009	0.02	1.88	13.80	0.07	—	253.92	0.05	—	—
19.	S F M	'00Lts.	347.69	385.05	385.04	172.38	181.75	181.75	64.48	64.48	64.48	59.72	59.72	59.72
20.	Lassi	'00Lts.	48.56	—	—	14.65	—	—	4.74	—	—	3.52	—	—
21.	S M (Bottled)	'00Lts.	928.64	922.69	15145	1072.30	1065.43	28122	632.43	628.37	145.05	—	—	—
22.	S M (Polypack)	'00Lts.	31.40	31.36	15787.82	19.78	19.74	13666.39	224.70	347.68	15014	757.57	757.55	39356.24
23.	D T M (Bottled)	'00Lts.	177.62	177.62	6676.45	189.68	189.68	1248.63	159.81	159.8	6581	—	—	—
24.	D T M (Polypack)	'00Lts.	—	—	—	—	—	—	88.18	88.18	88.18	321.88	321.88	321.88
25.	Milk Cake (200 gms)	Qtls.	0.48	—	—	1.39	5.01	—	3.05	1.65	—	3.13	6.48	—

*S-I represents product lines at existing availability of processing resources.

**S-II represents product lines at relaxed availability of processing resources.

Post-optimal Adjustment in Levels of Activities

It is natural that any deviation in the optimum levels of products would be impossible without reducing the profit. The magnitude of profit reduction would be equal to the difference between actual profit of activity and the level of profit at which that activity may attain greater than zero level in optimum basic solution. Any deviation in optimum levels of activities which are already in the normative plan at a level greater than zero would also reduce the value of objective function. The extent of loss in the value of objective function would be determined by the difference between the profitability of the concerned product and that of its next best alternative.

At Existing Supply of Resources

The levels to which, activities may be pushed from their zero levels in optimum basic solution at constant per unit reduction in the value of objective function alongwith the processes determining such limits are presented in table 2.

The perusal of this table revealed that lassi during summer (May) appeared to offer the scope of maximum increase (77.71 quintals) in its production at the lowest per unit reduction (Rs. 95.61) in the value of objective function. The same activity during winter (November) was considered as the least desirable which was evinced by the highest reduction in the profit of the factory (Rs. 309.52) by a unit increase in its production. The production of lassi registered the minimum augmentation (1.29 quintals) in its level at the given rate of profit reduction per unit of lassi. The economics of the scale appeared to cause the difference in economic efficiency of lassi during two district seasons. For instance, during summer season higher demand for cold drink like lassi necessitated correspondingly higher production of lassi and enabling it to reap the economics of scale. The advantage of economics of scale during winter season remained denied for lassi because of its abysmally small production owing to slump in its demand.

During two transitory periods, viz., pre-flush (August) and post-flush (February), the unit increase in production of paneer packets of 200 gms and 500 gms

TABLE : 2
Upper Levels of Products which did not enter optimum Product-Mix at Existing Availability of Resources and their constant Unit Reductions in Normative Profit in sample Milk Plant.

Sr. No.	Product	Unit	May			August			November			February		
			Upper Level	Unit reduction	Limiting process	Upper Level	Unit reduction	Limiting process	Upper Level	Unit reduction	Limiting process	Upper Level	Unit reduction	Limiting process
1.	W.B. (500 gms)	Qtls.	—	—	—	87.36	126.40	TB. (500 gms)LL*	105.66	128.31	TB (500 gm) LL	108.50	129.21	TB (:00 gm)
2.	SMP(25 kgs)													
3.	Paneer (200 gms)	Qtls.	1.03	142.07	Paneer LL (500 gms)	1.88	14.11	PaneerLL (500 gms)	2.19	268.61	Milk Cake (200 gms) LL	—	—	—
4.	Paneer (500 gms)	Qtls.	—	—	—	—	—	—	2.19	255.91	Milk Cake (200 gms) LL	4.46	40.58	Paneer (200 gms) LL
5.	Lassi	'00Lts.	77.71	95.61	Sugal UL**	7.10	120.70	Sulphuric Acid UL	1.29	309.52	Milk Cake (200 gms) LL	1.73	98.67	Bottles (200 ml) UL
6.	Milk Cake (200 gms)	Qtls.	1.03	290.10	Paneer LL (500 gms)	—	—	—	—	—	—	—	—	—

*LL stands for product activities which came to zero level in optimum product plan as a result of increment in its next best alternative.

**UL stands for resources which would be exhausted with the increment upto upper level or the concerned product activities.

respectively was identified to forego minimum profit at the factory level.

The stringency of sugar, sulphuric acid and bottles (200mls) during respective months of May, August and February was found to constrain increment in production of Lassi. The increments in optimum levels (greater than zero) of milk products at constant unit reduction in overall profit and processes limiting the magnitude of increments are presented in Table 3. From amongst the product activities entering optimum plan at a level greater than zero, only those witnessing finite reductions in profitability of milk product plan found mention in Table 3. During lean season of milk production (May), SM (Poly pack) was the only milk product which could offer increment (76,93,00 Lts) in its optimum level at finite unit reduction (Rs. 322.46) in the profitability of the plant under study. The scarcity of craft paper bags constrained the production of replaced milk product which was the next best alternative of SM (Poly pack). Thus, availability of craft paper bags was found to indirectly affect the increment in the optimum level of added enterprise (SM Poly pack). During the flush season (November), SM (Polypack) was found to cause the minimum reduction (Rs. 15.01) in the profitability of the plant with unit increase in its optimum level. Besides, this activity warranted the highest increment (504.75000 Lts.) over its normative level with the least per unit reduction in the profitability of the plant under study during the peak period of milk production. The increase over optimum level of DTM (Poly pack) appeared to be a grossly losing proposition in view of highest reduction in profit incidental to a unit increase in its manufacturing during November.

During pre-flush and post-flush periods represented by August and February, the upward unit deviation in optimum levels of SMP (25 kgs) and (450 gms) respectively was realisable with minimum sacrifice of profit. Moreover, SMP (25 kgs) offered the maximum increment (51.54 qtls) over its optimum level during the month of August. The stringency of power during August and of WMP tins (500 gms) during February indirectly constrained the increment in optimum level of SMP (25 kgs) and (450 gms) respectively. During August, the highest loss of profit (Rs. 1499.42) was due

to a unit increase in SM (Poly pack) over its optimum level. During February, the highest loss in profit (Rs. 216.26) was observable due to unit increase in milk cake (200 gms) above its quantity conceived in optimum plan.

Relaxed Supply of Resources

Table 4 represents increments in the levels of activities which failed to enter optimum product plan at non-zero levels and sacrifice in profit due to unit addition of such activities and processes preventing further increase in levels of these activities at constant unit loss of profit. It may be seen from the table that small sized (200 gms) lots Paneer could be substituted for bigger sized (500 gms) Paneer lots with the minimum sacrifice of profit of Rs. 15.05, 14.11 and 12.70 during May, August and November respectively with one unit addition of the former. The inclusion of Paneer (200 gms) in optimum plans or May, August and November at levels greater than zero appeared to cause the least loss to the plant management among all other milk products which are zero level in optimum plans. In the flush month (November), the increment in the production of Paneer (200 gms) was maximum (253.29 quintals).

Introduction of Milk Cake in optimum product plans of May and August at non-zero levels could be made with greatest loss per unit addition of milk cake. During May, Milk Cake would be substituted for Paneer (500 gms). During August, stringency of sugar would determine its upper limit. During the peak period of milk production (November), the highest sacrifice in profit (Rs. 248.73) with one unit addition was observed for WMP (1 kg) which was closely followed by that for SMP (25 kgs). Both the activities were found to replace Ghee (4 kgs) which is evident from the indirect constraining impact of ghee into (4 kgs) on the increment in the levels of both types of powders at constant unit loss to the plant business.

During the post-flush transitory period (February), WMP (1 kg) turned out to be most desirable contrary to the flush season (November) where it was the least desirable. The desirability of this activity emanated from the magnitude of reduction in profit incidental to

TABLE : 3

The increments in the optimum Levels of various products At constant Unit.
Reductions in Normative Profit Alongwith Their Determinants At Existing Availability of Resources in the Sample Milk Plant.

Sr. No.	Product Activity	Unit	May			August			November			February		
			Upper Levels	Unit Reduction	Limiting process	Upper Levels	Unit Reduction	Limiting process	Upper Levels	Unit Reduction	Limiting process	Upper Levels	Unit Reduction	Limiting process
1.	TB (500 gms)	Qtls.	—	—	—	—	—	—	—	—	—	126.08	39.40	Store UL
2.	WMP (10 kgs)	Qtls.	—	—	—	—	—	—	—	—	—	413.90	17.67	WMP Tins (500 gms)(UL)
3.	WMP (25 kgs)	Qtls.	—	—	—	70.44	383.61	WMP Tins (500 gms) UL	—	—	—	—	—	—
4.	Ghee (500 gms)	Qtls.	—	—	—	—	—	—	—	—	—	42.88	35.98	WMP Tins (500 gms)(UL)
5.	SMP (450 gms)	Qtls.	—	—	—	—	—	—	—	—	—	5.34	13.51	WMP Tins (500 gms) UL
6.	SMP (25 kgs.)	Qtls.	—	—	—	572.25	7.89	Power (UL)	—	—	—	—	—	—
7.	Paneer (200 gms)	Qtls.	—	—	—	—	—	—	—	—	—	10.93	183.94	Sugar (UL)
8.	Paneer (500 gms)	Qtls.	—	—	—	6.03	77.59	Sugar (UL)	—	—	—	—	—	—
9.	SM (Polypack)	'00Lts.	108.29	322.46	Craft Paper	25.91	1499.43	Craft Paper Bags (UL)	852.43	1301	Bottles	781.29	188.45	Craft Paper Bags (UL)
10.	DTM (Bottled)	'00Lts.	—	—	—	189.682	21.09	DTM (LL) Bottled	151 802	112.83	DTM (B) (LL)	—	—	—
11.	DTM (Polypack)	'00Lts.	—	—	—	—	—	—	94.01	133.43	DTM (P) LL	328.06	119.51	DTM (P) (LL)
12.	Milk Cake (200 gms)	Qtls.	—	—	—	6.67	590.98	Bottle 200 ml	13.31	25.35	SFM UL*	12.48	216.26	SFM (UL)

*UL in case of upper bonded activities indicated their elimination from optimum product-mix.

unit increase in its level. The inclusion of SMP (25 kgs) in place of WMP (25 kgs) in the optimum plan was the least desirable owing to the largest reduction in profit (507.69) with addition of one unit of the former during the month of February. The increments in optimum levels (greater than zero) of products achievable at finite unit reductions in profit with processes limiting such increments are given in table 5.

A perusal of table 5 would reveal that during lean season (May) of milk production, DTM (bottled) offered the cope of maximum augmentation (1073.67,00 Lts) in its optimum level at the lowest unit reduction (Rs. 70.59) in profitability of the plant as a whole. Polythene liner appeared to indirectly constrain further increment in DTM (bottled) due to its stringent supply. SMP (450 gms) called for highest sacrifice of profit

TABLE : 4

Upper Levels of Products which did not Enter the optimum Product-Mix at Relaxed Availability of Resources and Their Constant Unit Reductions in the Normative Profit at sample Milk Plant.

Sr. No.	Product activities	Unit	May			August			November			February		
			Upper Level	Unit Reduc- tion	Limit- ing pro- cess	Upper Level	Unit Reduc- tion	Limit- ing pro- cess	Upper Level	Unit Reduc- tion	Limit- ing pro- cess	Upper Level	Unit Reduc- tion	Limit- ing pro- cess
1.	T.B. (100 gms)	Qtls.	—	—	—	—	—	—	200.00	35.65	TB (200 gms)(LL)	0.0027	47.32	Al. foil (UL)
2.	T.B. (200 gms)	Qtls.	3.25	52.06	TB (100 gms)(LL)	206.67	21.22	TB (100 gm (LL)	—	—	—	0.0038	5.20	Al. foil (UL)
3.	T.B. (500 gms)	Qtls.	—	—	—	206.67	48.04	TB (100 gms)(LL)	—	—	—	—	—	—
4.	W.B. (500 gms)	Qtls.	3.25	190.48	TB (100 gms)(LL)	206.67	174.89	TB (500 gms)(LL)	1000	128.31	TB (500 gms)(LL)	186.67	129.21	TB (500 gm)(LL)
5.	WMP (500 gms)	Qtls.	—	—	—	—	254.99	Capacity (UL) Powder	—	—	—	0.01	16.42	Capacity (UL) Bot- tling
6.	WMP (1 kg)	Qtls.	—	—	—	—	247.16	Capacity (UL) (Powder)	0.12	248.73	Ghee Tins (4 kgs) (UL)	0.01	2.40	Capacity bottling (UL)
7.	WMP (10 kgs)	Qtls.	—	—	—	—	250.99	Capacity (UL) (Powder)	0.4	202.72	Ghee Tins (4 kgs) (UL)	0.003	71.15	Capacity Bottling (UL)
8.	WMP (25 kgs)	Qtls.	—	—	—	—	179.58	Capacity (UL) (Powder)	—	—	—	—	—	—
9.	Ghee (1 kgs)	Qtls.	—	—	—	18.59	14.75	Ghee (2 kgs) (LL)	445.56	46.34	Ghee 16.5 kgs (LL)	0.019	125.38	Capacity Bottling (UL)
10.	Ghee (2 kgs)	Qtls.	—	—	—	—	—	—	445.56	16.23	Ghee 16.5 kgs. (LL)	0.010	127.31	Capacity Bottling (UL)
11.	Ghee (4 kgs)	Qtls.	—	—	—	—	—	—	—	—	—	700.00	118.85	Ghee tins 4 kgs (UL)
12.	Ghee (16.5 kg)	Qtls.	—	—	—	—	—	—	—	—	—	0.0062	244.61	Capacity Bottling (UL)
13.	SMP (25 kgs)	Qtls.	—	—	—	—	187.47	Capacity (UL) Powder	0.04	242.37	Ghee tins (4 kgs) (UL)	70.00	307.66	WMP 25 kgs (LL)
14.	Paneer (200 gms)	Qtls.	0.00009	15.05	Paneer (LL) (500 gms)	13.80	14.11	Paneer (LL) (500 gms)	253.92	12.70	Paneer (LL) (500 gms)	—	—	—
15.	Paneer (500 gms)	Qtls.	—	—	—	—	—	—	—	—	—	297.06	40.58	Paneer (200gms) (LL)
16.	Lassi	'00Lts.	0.0003	122.07	Paneer (LL) (500 gms)	41.18	95.06	Sugar (UL)	2.78	62.68	Bottles 200 ml	0.032	97.86	Al. Foil (UL)
17.	Milk Cake (200 gms)	Qtls.	0.00005	226.59	Paneer (500 gms) (LL)	5.01	291.35	Sugar (UL)	9.74	148.45	Sugar (UL)	6.48	231.75	Sugar (UL)

TABLE : 5

The Increments in Optimum Levels of various Products at Constant Unit Reductions in Normative Profit Alongwith their Determinants at Released Availability of Resources of the sample Milk Plant.

Sr. No	Product	Unit	May			August			November			February			
			Upper Level	Unit Reduction	Limiting process	Upper Level	Unit Reduction	Limiting process	Upper Level	Unit Reduction	Limiting process	Upper Level	Unit Reduction	Limiting process	
1.	TB (100 gms)	Qtls.	19.11	422.33	Butter Car tons 20 gms (UL)	1033.33	505.03	Butter Cartons 20 gms (UL)	—	—	—	—	—	—	
2.	TB (200 gms)	Qtls.	—	—	—	—	—	—	1000	1.39	Permanent Paper(UL)	—	—	—	
3.	TB (500 gms)	Qtls.	—	—	—	—	—	—	—	—	—	795.01	252.79	Butter (UL) Car tons 20 gms	
4.	TMP (2 kgs)	Qtls.	—	—	—	—	—	—	—	—	—	1400.00	177.58	Corrugated Boxes Ghee(UL)	
5.	Ghee (2 kgs)	Qtls.	—	—	—	422.91	11.86	Ghee tins (4 kgs) (UL)	—	—	—	—	—	—	
6.	Ghee (4 kgs)	Qtls.	—	—	—	—	—	—	750	102.59	WMP (10 kgs) (LL)	—	—	—	
7.	Ghee (16.5 kgs)	Qtls.	—	—	—	153.14	14.59	Corrugated Boxes Ghee(UL)	750	28.08	Corrugated Boxes Ghee (UL)	—	—	—	
8.	SMP (450 gms)	Qtls.	1504.06	2125.59	Capacity Ghee(UL)	—	—	—	—	—	—	1330.00	14	483.35	Ghee 16.5 kgs (LL)
9.	SMP (25 kgs)	Qtls.	70.71	166.52	Corrugated Boxes Ghee(UL)	—	—	—	—	—	—	—	—	—	—
10.	Paneer (200 gms)	Qtls.	—	—	—	—	—	—	—	—	—	315.73	496.78	SFM (UL)	
11.	Paneer (500 gms)	Qtls.	2.58	184.88	Capacity Powder (UL)	60.62	20 25	SMP Car tons (UL) 450 gms	274.07	543.60	SFM (UL)	—	—	—	—
12.	SM (Polypack)	'00Lts.	15789.80	230.79	Capacity powder (UL)	—	—	—	—	—	—	39356 24	17.19	WMP 1 kg (LL)	
13.	DTM (Bottled)	'00Lts.	7550.12	70.59	Polythene Linear (UL)	3971.02	66 60	Polythene Linear (UL)	7500.48	80.40	Polythene Linear (UL)	—	—	—	—
14.	DTM (Polypack)	'00Lts.	—	—	—	—	—	—	7667.56	81.86	DTM (P) LL	381.88	281	73.46	DTM (LL)

(Rs. 2125.59) for each unit increase above its optimum level.

During pre-flush transitory period (August), *Ghee* (2 kgs) could envisage an increase of 404.32 quintals with minimum sacrifice of profit (Rs. 11.86) with each addition of one quintal to its optimum level. The scarcity of ghee tins (4 kgs) may have been indirectly responsible for determining the upper limit for the production of smaller sized lots of ghee (2 kgs). Similarly TB (100 gms) was observed to replace TB (20 gms) with the highest sacrifice of profit (Rs. 505.03) with each unit addition of the former. The increase sought for TB (100 gms) at constant unit reduction in the value of objective function was 826.66 quintals. Butter cartons (20 gms) were identified to indirectly determine the magnitude of increase in TB (100 gms) due to their exhausted supply.

During peak period of milk production (November), TB (200 gms) offered the scope of substantial increment (800 quintals) over its optimum level with the least sacrifice in profit (Rs. 1.39). Parchment paper was identified as a constraint for the increment over optimum level of TB (200 gms). On the other hand, unit increment over the optimum-level of Paneer (500 gms) called for the highest sacrifice (Rs. 543.60) in the overall profitability of the plant.

During the month of February which represented post-flush transitory period, SM (Poly pack) warranted the least sacrifice in profit (Rs. 17.19) incidental to unit enhancement over its optimum level which was followed by DTM (Poly pack) with its unit sacrifice in profit of Rs. 73.46. However, both the activities failed to show any significant increment over their respective optimum levels at the constant rates of loss specified above. WMP (25 kgs) witnessed the highest increment (1330 qtls) over its optimum level with reduction in profit (Rs. 177.58) for every increase of one quintal.

Conclusion

The results of this study reveal that seasonal fluctuations in availability of milk determine the size-lot manufacturing decision for almost all elements of milk product-mix in the case of composite milk plant. Secondly, the stringent supply of crucial processing inputs combine with fluctuating availability of milk to determine optimum milk product-mix. Unless a seasonal inventory planning along with intensified milk procurement efforts are made, the optimal milk product-mix in public sector milk plants in even milk-surplus states may be identified with unfulfilled dreams of dairy farmers in the country.

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Promoting Suitable Technology

GYANENDRA SINGH

The research and development (R/D) organisations in the country have made significant contribution in developing suitable farm machinery and some of which have been commercialised by small scale manufacturers. Large scale adoption by the manufacturers of newly developed machinery, however, has not been possible due to weak linkages between the R/D institutions and the manufacturers. Majority of the R/D institutions have limited industrial liaisoning capabilities and, therefore, the transfer of the technology from these institutions to manufacturers are seldom effective. There are a large number of manufacturing promotional organisations who are rendering assistance to small scale manufacturers and village artisans. Efforts should be made to involve these organisations in the transfer of technology of agricultural machinery.

Introduction

A number of research and development [R & D] organisations are engaged to undertake the improvement in existing design of agricultural machinery and to develop new machines suitable for various farm operations and farming systems. These activities started as early as late Nineteenth Century when horse drawn machinery were imported from European countries. Activities at that time were in the hands of British Officers and their line of thinking was very much influenced by the development in Europe. By 1930 many bullock drawn ploughs were developed. After the independence, Government of India decided to survey the indigenous implements being used by the farmers in the country with a view to improve upon their working efficiency and develop new machines.

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Research and Development activities got momentum after the establishment of Agricultural Universities in 1960's. Initial emphasis was confined to development of tillage equipment but gradually activities expanded to seed drills, seed-cum-fertilizer drills and threshers. Till date more than 380 farm implements and post harvest equipment have been developed by various R. and D institutions numbering about 45. However, the commercial production of these machines has been low

(25 per cent).¹

The efforts of the extension network of ICAR and agricultural universities have helped the researchers in establishing the techno-economic viability of the technologies. For wider adoption of the technologies by the farmers, however, concerted attempt has not been made to involve rural artisans and small scale manufacturers for introduction and popularization of farm machinery. The adoption of the technology, therefore, has been slow. If the improved farm equipment and technical know how associated with it is to be propagated amongst the large community of the farmers, the existing industry promoting and rural development agencies may have to be actively involved in the delivery of the technology (available at R & D centres as well as commercially manufactured) to the rural artisans and farmers with necessary inputs and infrastructure ensuring the quality of the products.²

Research and Development Efforts

Indian Council of Agricultural Research [ICAR] through its research institutes and research centres, agricultural universities and Council for Scientific and Industrial Research [CSIR] are main organizations responsible for R & D activities. In addition, farm machinery manufacturers and few private individuals have also made significant contributions in the development of improved farm equipment. These organizations are trying to transfer the technology to the farmers through their own limited extension network and therefore, the impact is felt in selective locations only. The CSIR has established 10 Poly Technology Transfer Centres in different states to deliver their technology. The National Research and Development Corporation of India [NRDC] are the Sale Agent for the commercial exploitation of technologies developed in India.³

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The technology of improved designs available at the R & D centres are being delivered to only few selected artisans and manufacturers through the limited regional and national extension services. The Agro-Industrial Development Corporations established in 18 states have the major responsibility of production of the improved implements and machines developed at the ICAR Research Institutions/Centres and Agricultural Universities.

Manufacturing Promotion

The small Scale Industries Development Organization [SIDO] and District Industries Centres [DIC] who provide technical and financial support to small scale industries and village industries are the main manufacturing promotional institutions in the country. The small farm machinery manufacturers/village artisans not only require the technology of new machines but also the prototypes for manufacturer. These agencies, however, have hardly been represented by engineers who have experience in farm machinery and, therefore, farm machinery industries do not get due place in their programmes.

In addition to the agencies mentioned above, there are Small Industries Services Institute [SISI], Khadi and Village Industries Commissions [KVIC], Appropriate Technology Groups, Rural Engineering Centres, Rural Development Organizations, Private Industrial House, Voluntary organizations, who assist the small scale manufacturers and village artisans by way of training, providing raw materials and in getting financial credit through the credit institutions.

The Regional Network for Agricultural Machinery [RNAM] a Programme of Economic and Social Commission for Asia and the Pacific [ESCAP] financed by United Nations Development Programme [UNDP] is making effort to promote the production of improved implements and machinery through mutual cooperation amongst the developing countries. There are eight countries namely India, Indonesia, Iran, Pakistan, Philippines, Srilanka, South Korea and Thailand participating in the programme. The Central Institute of Agricultural Engineering [CIAE], Bhopal is coordina-

ting the RNAM activities in India.⁴

Farm Machinery Production

Farm equipment are being produced by the village artisans and small scale manufacturers on custom built method and medium and large scale industries on mass production techniques. The large and medium scale industries numbering about 1474 are manufacturing items like tractors, power tillers, diesel engines, irrigation equipment, plant protection machinery, land development equipment, post harvest machinery, dairy equipment, electric motors etc. Bullock drawn and power operated, machinery requiring simple manufacturing technology such as ploughs, cultivators, disc harrows, levelers, seed drills and planters, sprayers, weeders and dusters, threshers, groundnut digger, shaker, potato digger, groundnut decorticators etc. are produced by the small scale industries numbering more than 6, 981.⁵ These units are scattered over the whole country with a concentration in selected pocket over the northern, western and southern regions. In addition there are large number of unregistered units located in sub-urban and rural areas whose numbers are not known but is estimated to be around 3,000. These units undertake repair, maintenance of farm machinery besides fabrication of threshers, seeding devices, harrows, cultivators, trolley etc.

Village artisans numbering more than a million, although, fabricate simple hand tools and bullock drawn implements, such as spades, pick axe, rakes, weeders, hand hoe, sickles, ploughs, blade harrows, bullock cart etc., they meet about 80 per cent of the farm machinery requirement in the country.

Popularisation and Adaption

The popularisation of the farm equipment is the

effort of the various extension agencies to make the farmers aware of its usefulness through display, demonstration, training and other audio-visual aids. The adaption on the other hand is the utilization of the same in regular use. To achieve accelerated adaption of new technology efforts are required :

- * for demonstration to the farmers with a view to create awareness about its utility and effectiveness,
- * to assess the demand of the technology and to select the suitable mode of commercial production,
- * to transfer the technology to the manufacturers and rural artisans for commercial production,
- * to train the farmers in operation, maintenance and repair.

The above activities are being undertaken by various agencies in the country within their resource constraints.

Indian Council of Agricultural Research [ICAR]

The ICAR although primarily responsible for education, research and development programmes in the country in the field of agriculture, horticulture, fisheries, animal husbandry and forestry, have established Farm Science Centre [Krishi Vigyan Kendra] and Trainers Training Centre to transfer the relevant technologies to the users. These are being executed by the ICAR Research Institutes/Centres and Agricultural Universities. The technology from the research organisations is also being transferred under Lab To Land Programme to few adopted farmers.

The All India Coordinated Scheme on Farm Implements and Machinery with coordinating centre at CIAE, Bhopal has the unique advantage of having research and development: prototype production workshop, feasibility testing under actual field conditions, training of village artisans and establishment of linkages with the small scale manufacturers in one scheme. The Scheme has centres located at Bhopal, Coimbatore, Hyderabad, Ludhiana, Pune, Shillong, Jhansi, Lucknow, Ranchi, Udaipur, Junagadh, Kharag-

4. Singh, G. and Srivastava, N.S.L. Annual Report Subnet Work Activity IV on Improvement of Manufacturing Technology of Seed-cum-Fertilizer Drills and Grain Threshers under Regional Network for Agricultural Machinery [RNAM], Central Institute of Agricultural Engineering, Bhopal, 1980.

5. Development Commissioner, Small Scale Industries Development Organization, New Delhi, 1976.

pur, Hissar, Jabalpur, Pantnagar and Vellanikkara.⁶ (Fig. 1.)

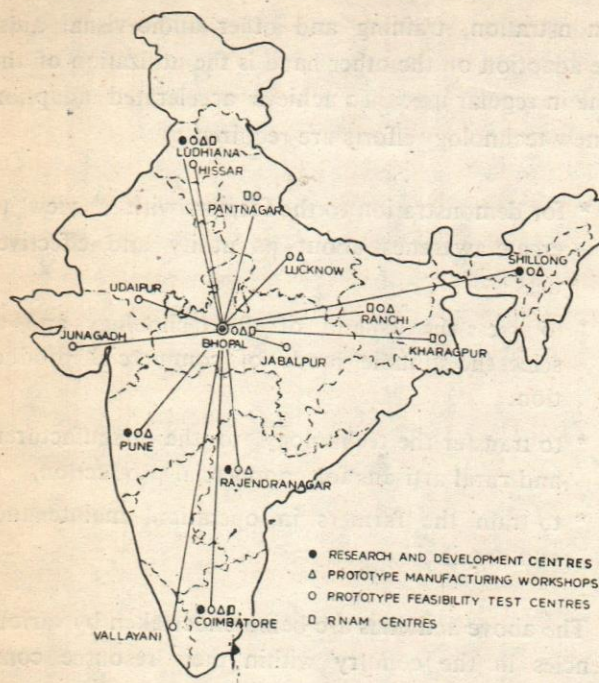


Fig. 1 All India Coordinated Scheme on Farm Implements and Machinery

Ministry of Agriculture and Rural Development

Department of Agriculture and Cooperation, Ministry of Agriculture, coordinates the farm machinery production and popularization programmes of the State Government being undertaken through Agro-Industrial Development Corporations. There are 3 Tractor Testing and Training Stations [TTTS], located at Budni, Hissar and Anantpur. In addition to testing of tractors and agricultural machinery, these stations provide training to the farmers, rural youths, artisans technicians in various trade of farm machinery operation, repair maintenance and manufacturing. The Extension Training Centres [ETC] located at Nilokheri (Haryana), Rajendranagar (Hyderabad) and Anand (Gujrat) also provide training to the farmers and artisans³.

Ministry of Rural Development finances majority of the Development Programmes related to farmers, village artisans and rural youths being undertaken by various governmental, private and voluntary organizations through IRDP and TRYSEM^{7,8}.

Rural Engineering and Rural Technology Centre

A large number of rural engineering and rural technology centres sponsored by the Department of Science and Technology, Ministry of Industries, Ministry of Rural Development have established training centres for upgrading/improving the skills of the rural people. These programmes are also being operated in small measures by Indian Institute of Technology (IITs). Rural Engineering Institutes, Rural Polytechnics and Industrial Training Institutes [ITIs].

State Government

The major responsibility of popularization of improved agricultural implements and machinery rests with the Directorate of Agriculture of the State Governments. The Directorate of Agriculture/Agricultural Engineering executes the programmes of popularization through its extension network. The states who have provided technical functionary upto block level have the advantage of transferring the technology to the farmers in the villages. Agricultural Engineering Cooperative and Marketing Federation [ENCOFED] in Tamil Nadu and Farm Machinery Cooperative Societies at Block Level in states like Gujarat, have helped the farmers, in adopting farm technology. The states having inadequate infrastructure in extension services, contributed very little in popularization of small farm implements and their involvement in encouraging the manufacturers and distribution of agricultural machines has been minimal.

6. Annual Report All India Coordinated ICAR Scheme on Research and Development of Farm Implements and Machinery Prototype Manufacturing Workshop and Implements Testing Units for Testing Improved Implements under Actual Field Conditions, Central Institute of Agricultural Engineering, Bhopal, February, 1983.

7. Manual on Integrated Rural Development Programme, Ministry of Rural Development, Government of India, New Delhi, 1980.

8. TRYSEM Instructions to applicants for Infrastructural Assistance, Ministry of Rural Development, Government of India, Jan. 1982.

Private and Voluntary Organisations

Tractor and farm machinery manufacturers, charitable trusts, industrial houses, youth clubs, religious institutions, private rural engineering institutions have established training and extension service centres for the benefit of rural people to improve their living standard by helping them to increase the agricultural productivity and establishing village industries. Ministry of Rural Development also provides funds for strengthening the training facilities and stipend to the trainees under Integrated Rural Development Programme [IRDP] and Training of Rural Youths for Self Employment [TRYSEM] programmes^{7,8}. The efforts of the various rural development agencies is appreciable, however, they work in isolation and are not fully aware of the improved implements and machinery developed by the R&D Centres. Hence, it is desirable to establish good liaison among the R&D centres and the agencies responsible for transfer of technologies at National and State Levels.

Credit Facilities

The adoption of the new technology depend upon the financial resources available with the farmers/artisans and small scale manufacturers and their priorities to invest that. Initial investment on new improved implements and machinery will definitely cost more than the traditional tools used by the farmers, and, therefore, additional financial resources must be provided for adoption of the new technology. The various means available to increase the financial resources are as follows :

- * Own capital
- * Friends, relations
- * Village money lenders
- * Traders, commission agents
- * Cooperative credit societies
- * Commercial banks
- * Rural banks
- * Land development banks
- * Government development programmes.

NABARD

The Government of India has established National

Bank for Agricultural and Rural Development [NABARD] a new significant statutory financial institution to operate as Rural Reserve Bank. NABARD has taken over the entire undertaking of the Agricultural Refinance and Development Corporation [ARDC] and replaced Reserve Bank of India in the matter of refinancing the State Cooperative Banks [SCBs] and Regional Banks [RRBs]. It provides by way of refinance to banks all kinds of production and investment credit to Agriculture, Small Scale Industries, Artisans Cottage and Village Industries, Handicrafts and other allied economic activities in and integrated manner for short term loan (upto 18 months), medium term loan (18 months to 7 years) and long term credit (upto 20-25 years).

All the 28 Nationalised Banks in the country provide short term (for working capital) and medium term (for capital goods) loan to the farmers, rural artisans and small scale industries through their 19,942 rural branches. This constitutes 51.6 per cent of the total branches. The loans are available for the purchase of tractors and farms machinery against hypothecation to the banks and for the land development and creation of irrigation facilities against the mortgage of land.

The Regional Rural Banks initiated in 1976 are to supplement the efforts of other financial institutions in rural areas. They are like scheduled commercial banks but confined to districts where primary credit societies (which are base line societies) at villages or block levels, do not exist or very weak. The RRBs are sponsored by the commercial banks with central and state governments additional financial contributions. RRBs extend credit facilities to people with meagre resources such as small and medium farmers, labourers, artisans etc. By December, 1980 there were 120 RRBs with a network of 5,000 branches in the country.

State Cooperative Banks are Apex Cooperative Bank in the State. They guide control and finance the District Central Bank and Cooperative Institutions in the state. The SCBs are financed by NABARD. These banks provide short term (crop) loan and medium term loans to the farmers/artisans through Central Cooperative Banks located at the District/

Towns and through the Primary Agricultural Credit Societies [PACSSs], Primary Non-Agricultural Credit Societies [PNACSSs], Farmer Service Societies established at the Village Level by a group of villagers.

The State Land Development Bank are similar to State Cooperative Banks and extend term loans for the purchase of capital goods such as tractors, pumps, engines, threshers etc. The banks have primary Land Development Banks [PLDBs] having membership of individual farmers. The credits not covered under PACSSs are taken care by these banks.

Reasons for Low Adoption of the Technology

It is not the intension to belittle the role played by various agencies involved in R & D, extension, production and popularization of farm machinery amongst the farmers. They may have achieved their objectives within their own institutional frame work. But one can not deny the inescapable fact that majority of small and marginal farmers are still using the traditional hand tools and implements. The improved technology could be made available to only few selected group of farmers. Perhaps, all the agencies engaged in the delivery of the technology could not achieve the desired objectives due to sheer magnitude of the technology, inadequate institutional frame work coupled with poor coordination in the delivery system and scarce input resources with the farmers. It is in this context the low adoption of the technology shall be examined.

A. Inadequate institutional frame work and poor coordination

An examination of the various agencies involved in promotion of the technology revealed that the programmes are being executed primarily by the following Ministries :

- * Research and Development—Ministry of Agriculture and Ministry of Science and Technology.
- * Promotion of small scale industries and village industries—Ministry of Industries.
- * Population of improved farm equipment—Ministry of Agriculture, and Ministry of Rural Development.

The various departments/institutions/organizations

belonging to above ministries work in isolation without proper coordination at apex level which makes monitoring and dissemination of technology difficult and adoption slow.

At the delivery end also there is weak linkages amongst research institutions, small farm machinery manufacturers/village artisans and farmers. The District Industries Centres, who are the functionaries of the Ministry of Industries for the promotion of industries in a district including village industries, have no effective machinery below district level to serve the rural artisans. If adoption of the technology is to be accelerated amongst the farmers the village artisans must be involved in fabrication, repair, maintenance and supply of farm machinery. A centralized unit like Agro Industries Development Corporation howsoever big cannot serve the masses. The State Government whose contribution in popularization of farm machinery has been minimal must create infrastructure at district and block levels, which will coordinate and extend the assistance to manufacturers and village artisans in production and distribution of machinery.

B. Market Research

Due to socio-economic, agro-ecological and technological diversity in India the forecast for demand of agricultural machine is difficult to predict with any accuracy. This responsibility, rest with the State Government to assess the implements and machines requirement of the farmers. However, the information is hardly made available to the manufacturers and, therefore they have their own methods to estimate the demands. The National Council for Applied Economics Research [NCAER] have made some studies with regards to tractors and farm machines but the information is again location specific. The research engineers attempt to assess the demands of the new farm machines developed by their organizations. As the operational area of these centres is limited, their forecasting have a limited accuracy.

C. Raw materials

The Small Scale Industries Development Corporation and District Industries Centres, although, assess raw material requirements to the small scale industries

and village artisans and provide them at reasonable price but due to large demands from non-agricultural industries, these agencies find it difficult to meet all the requirements. The agencies are also not equipped to supply smaller quantity of special steels like carbon steels to small industries and village artisans. Furthermore the procedure to be followed in obtaining the permit for getting the raw materials through the District Industries Centres [DICs] are too complicated for the illiterate/semi-literate village artisans.

D. Demonstration sale and service

The adoption of the new technology is very much influenced by the level of the formal education of the farmers and artisans. A report published in 1971 underlines the attitude of the illiterate farmers... "The rate of adoption of improved implements for those in high literacy ability category was approximately eight times that of illiterates"⁹ ...This calls for the extensive education and training of farmers in new technology. The centres responsible for training of farmers and artisans by and large are located in the cities. Furthermore their numbers are very few as compared to their population. Thus a few privileged class of farmers could only avail the training opportunities. If a meaningful training programme is to be planned for the larger participation of the farmers, these will have to be at the Block Level.

It is not only training and demonstration which are essential preconditions for large scale adoption of the technology but also availability of good quality equipment and reliable service facilities at rural level. Study indicated that even in the best mechanized district like Ludhiana [Punjab], farmers are compelled to travel from 12-23 kms distance for repair and maintenance of tractor and diesel engines. In other states they may have to travel even upto 50 kms or more for service facilities with only bullock cart transport available in the area.¹⁰

E. Financial resource constraints

Major constraint with farmers for adopting improved agriculture machinery is their limited financial resources. In the villages the payments are made to the village artisans in kind for buying hand tools and implements. The implements purchased from the manufacturers is always in cash which puts the farmers in vulnerable financial constraint. The procedure to obtain credit facilities in the villages for the purchase of agricultural inputs including farm machinery through the farmers credit societies, Regional Rural Banks, Land Development Banks and Commercial Banks, is too complicated for the illiterate farmers and artisans to follow. Studies have indicated that it takes from 3-6 months to get the loan from the credit societies and banks. Only few education rich farmers have been able to get the loan from the organized credit institutions.¹¹

Mode of Coordination In Technology Transfer

As mentioned earlier R & D Institutions have made very little effort to involve manufacturing promotional organisations in effective delivery of technology of improved implements and machinery. Manufacturing promotional organization on the other hand lack trained manpower having experience of farm machinery. Without the coordination between these organisations adoption of the new farm equipment technology will be limited and low. We may discuss here the possible mode of coordination amongst the existing agencies : (Fig 2).

1. National Farm Mechanization Committee [NFMC]

This committee was constituted during 70's in the name of National Farm Mechanization Board, but it never become operative. Efforts are now underway to revive this committee. The committee not only should decide the policies regarding the mechanization of Indian Agriculture but also the national strategy of production of agricultural machinery. The committee should have membership from Planning Commission,

11. Desai, D.K. and Prakash Hari. Planning and Implementation of Financing Agriculture Through Area Approach [A case study in Bihar State]. Centre for Management in Agriculture, Indian Institute of Management, Ahmedabad, 1973.

9. Kohli, K.C. Adult Education Must Reach Poor. The Hindustan Times Daily News Paper. September 10, 1982.

10. Gopinath, C. Manufacture, Distribution and Use of Agricultural Machinery in India, Problems and Financial Requirements. CMA Monograph No. 60, Centre for Management in Agriculture, Indian Institute of Management, Ahmedabad, 1976.

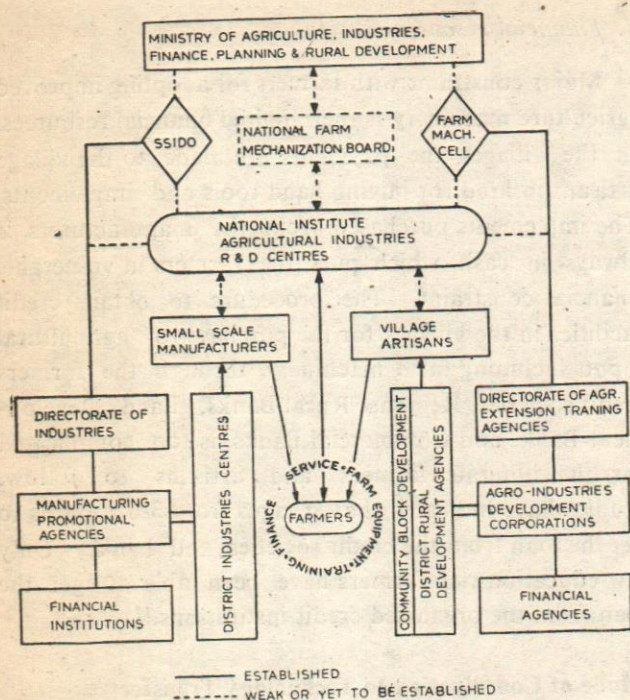


Fig. 2 National State and District level Coordination in Manufacturing and Promotion of Farm Machinery.

Ministry of Agriculture, Ministry of Industries, Small Scale Industries, Development Organization, R & D Institutions, Agricultural Universities, NABARD, Small Scale Manufacturers Associations, Progressive Farmers, Agricultural Economists etc.

2. National R & D Institute

The Central Institute of Agricultural Engineering [CIAE] coordinates the R & D activities of more than 34 centres located at Agricultural Universities and Colleges and with International Organizations engaged in development of agricultural machinery and, therefore, functions as a National Institute in the country. The Institute activities related to manufacturing promotion has been limited to selected regions due to limited infrastructure facilities in this field. However the Institute may coordinate with other agencies to promote the production of quality implements and machinery. Suggested organizations may be :

- * R & D Institutions
- * Farm Machinery Cell, Ministry of Agriculture
- * Indian Standards Institution [ISI]

- * State Agro Industrial Development Corporations [AIDC]
- * Appropriate Technology Cell
- * Directorate of Agriculture/Agricultural Engineering
- * Council for Advancement of Rural Technology [CART]
- * Small Scale Industrial Development Organization [SSIDO]
- * Small Industries Services Institutes [SISI]
- * Poly-Technology Transfer Centre
- * Khadi and Village Industries Commission [KVIC]
- * National Bank for Agriculture and Rural Development [NABARD]
- * Other Extension and Rural Development Agencies
- * Manufacturers Associations

3. Farm Machinery Cell, Ministry of Agriculture

The Farm Machinery Cell under Ministry of Agriculture, Government of India is looked after by a Director Machinery having two technical personnel in the rank of Joint Commissioner [Machinery] and Joint Commissioner [Agro Industries]. The major functions of the cell include the production and popularization of agricultural machinery at National level, decides the Government policy on import of agricultural machinery, testing of agricultural machinery including tractors and organise training of artisans and farmers.

The Cell also coordinates with Directorate of Agriculture, State Governments and State Agro Industrial Development Corporations in production and popularization of agricultural machinery.

Due to limited infrastructure facilities available and limited decision making powers with the technical personnel at the cell it has only partially achieved the success in helping progressive mechanization policy of the Government and strategy of production of agricultural machinery. This may require enhancement of the Farm Machinery Cell under Ministry of Agriculture to a Department of Farm Machinery and also better coordination with other agencies engaged in manufacturing promotional and popularization activities in the field of agricultural machinery. Compared to the People's

Republic of China who have Ministry of Farm Machinery, the suggestion of creating a Department of Farm Machinery under Ministry of Agriculture is very modest. The department should coordinate with :

- * R & D Institutions and Agricultural Universities
- * Indian Standards Institution [ISI]
- * Small Scale Industries Development Organization [SSIDO]
- * Small Industries Service Institutes [SISI]
- * Council for Advancement of Rural Technology [CART], Ministry of Rural Development, Govt. of India
- * National Bank for Agriculture and Rural Development [NABARD]
- * National Research Development Corporation [NRDC]
- * Agro Industrial Development Corporation [AIDC]
- * State Directorate of Agriculture
- * Other Extension Agencies
- * Manufacturers Associations

4. Directorate of Agriculture/Agricultural Engineering

Major responsibility of popularization of agricultural machinery rests with Directorate of Agriculture established in the states under Ministry of Agriculture. Some of the States have established even Directorate of Agricultural Engineering. To accelerate the programmes of progressive mechanization of agriculture by using appropriate tools, implements and machinery it is essential that a separate Directorate of Agricultural Engineering is established in each state. These Directorates should decide the major issues related to :

- * Mechanization policy of the state
- * Strategy of production of agricultural machinery
- * Development of rural industries for production of agricultural machinery

- * Infrastructure for popularization of agricultural machinery
- * Distribution and sale of agricultural machinery under National Rural Development Programmes
- * Training of rural artisans, farmers and rural youths
- * Agro service facilities for farmers.

To achieve the above objectives the Directorate should coordinate with :

- * Farm Machinery Cell, Ministry of Agriculture
- * State Agro Industrial Development Corporation
- * R & D Institutions
- * Directorate of Industries
- * Small Industries Service Institutes [SISI]
- * ITIs and Polytechnics
- * Poly Technology Transfer Centres
- * Rural Development Agencies [DRDA]
- * Financial Institutions
- * Small Scale Industrial Development Corporations
- * Small Scale Manufacturers Associations
- * Other Extension Agencies

5. District Industries Centres [DIC]

The DICs have been established to provide technical, financial raw materials and marketing assistance to Small Scale Manufacturers and Village Artisans [Village Industries Project]. In the field of Farm Machinery however, they have provided limited assistance due to lack of trained manpower in this field at the centres. It is suggested that these centres be represented by people having experience in the trade of farm machinery industries. The centre should also coordinate with :

- * District Agricultural Engineer
- * R & D Institutions
- * District Rural Development Agencies
- * Association of Small Scale Manufacturers of Farm Machinery
- * Lead Banks and other Credit Financing Bodies.

INDEPENDENCE

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37 years ago, we threw off our chains of slavery and joined the comity of Independent Nations.

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Let us usher in the 38th year of Independence by pledging ourselves to hard work and united effort which alone can take us to our cherished goal.



The Resource Concentration—Dispersal Debate for Rural Development

DR. P. J. CLOKE

Rural planning in the United Kingdom has a long history, stretching back to the initial statutory legislation in 1932 and 1947. From these beginnings policies of resource concentration have been adopted for rural areas, and although they have become more sophisticated and better coordinated through time, they have been subject to strong criticism by commentators who favour policies of resource dispersal. The recent structure plans have not heralded an adoption of dispersal policies. Indeed there appear to be strong institutional constraints preventing their adoption. It is argued that a change of focus towards matters of policy-making and policy-implementation would greatly benefit the understanding of what does happen, and what might happen in rural planning and resource allocation.

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Introduction

The recent Indo-British seminar on the subject of rapid social and economic change within a regional framework¹ has highlighted the significant and interesting parallels which exist within the study and planning of the two rural socio-economic environments concerned. Despite the cross-cultural gulf, the huge disparities in prevailing levels of deprivation and disadvantage, and the different nature of indigenous rural economies, a strong sentiment of overlapping theoretical and practical interests emerged from speakers of both nationalities at the seminar. For example, Pathak (1983) described the concept of rural development in India in terms of both desired positive social and economic change, and structural changes in order to secure human welfare. Deshpande (1983) developed the spatial aspects of this theme, arguing that economists and geographers have been preoccupied in their search for levels of socio-economic development through the identification of settlement hierarchies in a region so as to establish 'growth points' or 'service centres'. His conclusion is critical:

"the exercises in 'levels' at their best serve to present a picture of spatial imbalance, but they hardly reach the geographical reality underlying" (p. 2).

1. Held at the University of Birmingham and Saint David's University College, Lampeter, September 15-28, 1983.

Other participants at the seminar sought to contribute positive suggestions as to how this somewhat stale approach to environmental management in rural areas might be improved given different foci. Ramachandran (1983), for example, used a critique of central place theory as a platform for the proposal of village cluster frame works in rural planning to replace single settlement growth centres.

These themes are strikingly familiar in the United Kingdom context. Since the initial enabling legislation in 1947, the world-renowned planning system has incorporated a classical rural strategy of resource concentration into growth centres. In doing so there has been a rather vague hope that opportunities established in these selected centres would somehow be transmitted to the residents of surrounding hinterland villages. This strategy of resource concentration, despite regular updating and sophistication, has been widely criticised on the grounds of its failure to accommodate the required socio-economic changes which might achieve welfare-oriented goals in planning. As a result, there has been a parallel search for alternative socio-spatial frameworks which might better serve the interests of deprived and disadvantaged groups in the countryside. The remainder of this paper gives detailed analysis to this debate between 'concentration' and 'dispersal' in British rural planning.

The Theoretical Environment

The explanation as to why planning authorities in Britain came to adopt resource concentration policies in the initial era of planning is difficult to pin down with any confidence or exactitude. For the sake of convenience, explanatory evidence may be reviewed under the headings of 'theory' and 'practical expediency' although these categories are neither mutually exclusive nor intrinsically separate.

A series of neo-classical and locational theories have been recognised as important inputs favouring the concentration of rural resources such as service, employment and housing opportunities into selected growth centres. Central place theory was viewed with academic favour in the 1940's and 1950's during which time initial rural policies were devised. The inherent assumption that rural settlements occur as part of an

hierarchical pattern was apparently adopted by planners who thus assumed that this hierarchy should be upheld by supporting nodal points within it. The commonly held view was that there is a 'proper relationship' between service centres and their hinterlands, and this in turn led to the planned promotion of service centres in post-war rural Britain. The work of Howard Bracey (1952; 1962) typifies the bond between theory and planning in this respect. He identified 'central villages' which have disproportionately high levels of services for their population size, and was instrumental in securing these central villages as the foci for investment within the Wiltshire development plan (1953). There is no doubt that planners of this era did think in terms of central places, and this tendency has lingered despite the subsequent empirical investigations which falsify the universality of central place theory in real life, and the rejection of the neo-classical underpinning on which the theory is based (Beavon, 1977).

Closely linked to central place theory was the early use of thresholds by planners to assess the viability of rural services. By indicating the minimum population required to support a particular service or facility, planners again tended to favour the 'safety' of captured clientele in larger population centres rather than risking an over-dispersal of service provision in more marginal (at least according to threshold theory) locations. Again, there have been subsequent criticisms of the threshold concept. Shaw (1976) has shown that no magic figure can in reality indicate the point at which a facility will appear or disappear in any particular location. These 'birth' and 'death' procedures rely far more upon the characteristics of the entrepreneur or public sector decision-makers concerned. Moreover, thresholds have been viewed solely in an economic light, ignoring the opposite and equally valid notion of social thresholds, that is the number of services and facilities needed to support the rural population in a fixed location. The predominance of economic threshold thinking has been a formative influence in the rise in favour of resource concentration policies, although its direct application has been somewhat reduced by the introduction of more flexible strategic policies during the 1970's.

Perhaps the most explicit formative influence on

rural policy in the United Kingdom has been that of a search for economies of scale. Most professional planners committee members would regard their decisions as being based on the realism and pragmatism of the economics of resource allocation during periods of financial restriction, rather than on the tenets of seemingly esoteric theory. Accordingly the presumption that resource concentration strategies will achieve economies of scale because "bigger will be cheaper" has proved immensely attractive in policy-making terms. Ayton (1980) has laid down four tenets of economic reasoning which follow the assumption of economies of scale:

- (i) small villages cannot independently support education, health and commercial services which require support populations of thousands.
- (ii) public sector service options are constrained by limited and diminishing resources.
- (iii) private sector service and some public sector services (for example, gas) will not be provided where they are unprofitable, and rural areas often fall within this category.
- (iv) mobile services incur high running costs and offer a low quality of service.

These four principles lead directly to the practice of fixed-point service provision in sizeable centres.

The work of Gilder (1979) has cast some doubt on the apparently invulnerable position of scale economies. He has argued that rural areas where existing settlement have spare capacity in basic services such as schools and sewerage systems can achieve greatest economies by utilizing that capacity through growth allocation whatever the size and the status of the settlement concerned. Although this work has been the subject of considerable debate (see Cloke and Woodward, 1981), it appears that a reappraisal of scale economies is both warranted and desirable in the rural planning context.

Another set of theories which have had a formative influence in the concentration-dispersal debate are those connected with growth poles and growth centres. These theories have often been ill-defined, but the two

processes of *backwash*, where central nodes attract factors of production from surrounding areas and *spread*, where economic prosperity is transmitted from the centre to the periphery, have been adopted as ideal models for planning in pressured rural areas and remote rural areas respectively. Superficially, then, growth centre theory justifies the concentration of development into selected service centres in both pressured and remote rural areas. There are again, however, problems in the practical application of this theory, as the selected centres are depicted as both *providers for* and *retarders of* growth in smaller hinterland settlements. Obviously, then, there are difficulties in the exact implementation of backwash and spread mechanisms to suit local circumstances. In addition, there is theoretical and empirical evidence (Moseley, 1974) to suggest that rural growth centres in Britain are not of sufficient scale to provide a full range of growth centre attributes. The benefits of resource concentration, then, may again be more apparent than real.

A final obsession on the part of rural planners which has influenced their selection of resource concentration policies is conservationism, whereby the need to preserve and conserve the heritage of the rural built environment has led to anti-growth sentiments in many rural areas, manifest in the perceived need to concentrate growth into selected centres.

Paradoxically, these various theoretical notions have been used *both* as an explanation of why resource concentration policies were initially favoured *and* in retrospective justification of those policies in subsequent analyses (Cloke, 1980). Thus, although various theories offer trappings of respectability to resource concentration, there is more than a suspicion that conceptualisation has provided a cosmetic justification for policies which were created merely out of economic and administrative expediency. Certainly, there have been implicit ideological and political stances adopted by rural policy-makers which tend to support this contention. A review of the political economy context of rural planning (Cloke, 1983) suggests that policy-makers have been consistently conservative and pragmatic in their evaluation of available policy options. Moreover such intervention as has been achieved by planners in rural areas for welfare objectives has itself been constrained

by ideology and economic factors which place high priority on a minimisation of local taxes and public sector spending. Within these constraints, planners were originally searching for high-profile policy with which to demonstrate that rural problems were being tackled, and the key settlement policy of resource concentration presented itself as a convenient blueprint which was both visible and seemingly cost-effective.

It is against this background that the performance of rural resource concentration policies in the United Kingdom should be judged. Failure should be viewed as a gap between rural need and rural opportunity provision, but it should also be measured against the fact that commentators have repeatedly expected too much from a pragmatic and broad framework policy.

The Development Plan Era

Given this range of theoretical and pragmatic promptings, it is hardly surprising that rural policies within the 1947-68 development plan era differed only according to the degree of resource concentration sought, rather than according to whether concentration was a more equitable or beneficial strategic option than resource dispersal. On the face of it, the 1947 Town and Country Planning Act presented rural planners with a clean sheet—any of the spectrum of policy options could have been entertained. In practice the constraining influences mentioned above, plus specific central government guidance created fairly rigid boundaries for rural action. Planning authorities were advised to concentrate on service provision in larger rural settlements and were given centralised instructions that economic service provision could only be brought about by the selection of certain villages for expansion.

The details of rural development plan policies have been given detailed analysis elsewhere (Cloke, 1983; Martin and Voorhees Associates, 1981; Woodruffe, 1976). In summary, three main categories of policy may be identified:

- (i) *Key Settlement Policies* where comprehensive concentration of housing services and employment into selected centres is sought not only to build up the centres themselves, but also to provide opportunities for hinterland villages.

- (ii) *Planned Decline Policies* in which direct attempts are made to rationalize the rural settlement pattern by refusing to locate public investment in outmoded small villages and by prompting a population shift into larger growth centres.

- (iii) *Village Classification Policies* where villages are categorized according to existing service functions and environmental quality, so that growth can be allocated to suitable (usually larger) receptor settlements.

Several important questions should be raised about the underlying aims of rural policy during this period. Was the settlement pattern being supported? Was it being deliberately rationalized? Was the objective a more simple one of establishing a convenient basis for the service-provision obligations of local authorities? Finally, was the fundamental objective *urban-based* one, namely to secure protection against undue urbanisation of the countryside? These questions may be addressed by study of the various perceived successes and failures of rural planning in the development plan era.

Many analysts have been extremely critical of policies and planning during this time-period. Darley (1978, 299) concludes:

“Blind acceptance of policy dogma, such as key settlements or short-term economy measures bringing with them long term deprivation, without the background research into the effects of such policies has landed the rural areas in a mess.”

In a more down-to-earth analysis, MacGregor (1976, 526) is first understanding, then damning:

“The idea of putting all the services into one village to serve several surrounding ones offers a financially viable solution to this problem, and is therefore very attractive to administrators and planners. Unfortunately when one puts all the council houses and old people’s bungalow allocation for the area into one village, leaving the other villages to ‘die naturally’ (i.e. be taken over by the better off...) this destroys the natural balance of social groups.”

In fact, the negative assessments of the performance of key settlement policies have reached almost bandwagon proportions, such that it is difficult to break through this institutionalized criticism in order to discover any acknowledged achievements of the key settlement type of policy. Nevertheless some positive achievements should be recorded.

First, in terms of land use, it is clear that policies of resource concentration have usually been effective in preventing sporadic development in the countryside (Working Party of Rural Settlement Policies, 1979). By channelling growth into selected centres, key settlement policies have also to some extent aided the increased provision of infrastructural services such as sewerage networks, electricity and telephones (see, for example, Gilder and McLaughlin, 1978). These successes should not be underrated as it is clear that in many areas the concentration/conservation ethic has limited undue urbanization in the countryside, environmental quality in many small villages and achieved pragmatism in the provision of statutory services.

The weakness of resource concentration policies is to be found in their preoccupation with physical planning to the detriment of social conditions in rural communities. It should be remembered that two basic objectives were sought via these policies—the build-up of centres of opportunity (the 'key settlements'); and the use of these opportunities to improve conditions for residents in hinterland villages.

Some success has been gained in the build-up of key settlements. Case studies in two English countries (Cloke, 1979) suggest that concentrated housing and employment provision (the latter often using industrial estates and advance factories to attract entrepreneurs) has occurred in some places and has ensured that rural people do receive opportunities to live and work in the countryside rather than being forced to migrate to higher order urban centres. These broad trends, however, mask a considerable diversity of achievement in establishing thriving rural growth centres. In cases where growth trends existed prior to the policy, there has often been a continuation of growth, but where no such prior impetus was available there are few examples of a key settlement policy being able to

reverse the downward spiral of lost opportunities and depopulation.

The second key settlement objective of maintaining villages in the rural hinterland has been less successful than the first. There is clear evidence that the use of resource concentration policies has coincided with a general deterioration of service, housing and employment opportunities in small villages. Although it is difficult to assess the degree to which planning policies are responsible for these trends, the planners' reluctance to permit housing and employment development in non-selected villages has exacerbated rural housing problems in small settlements. Many young families have been forced to leave their home villages not only because of competition in the housing market from the gentry, the retired and second homers (Dunn et al., 1981) but also because of the lack of local authority dwellings (Phillips and Williams, 1982). Moreover, there are small but significant numbers of deprived households who have become trapped in these unsupported settlements, as *in situ* services disappear and public transport links to the nearest service centres are not maintained (Shaw, 1979; Walker, 1978).

Two broad criticisms of the social role of key settlement policies appear valid. First, the county-level plans have assumed that there is a standard type of rural community and ignore the local scale variations which demand flexible planning solutions. Second, these plans have not proved easy to adopt in the light of changing circumstances in rural areas. In particular rural policies have ignored the scope for the dispersed provision of small scale housing, service and employment schemes in hinterland villages.

More importantly, a series of problems with resource concentration, policies occur outside the remit of current planning powers. Direct provision of rural employment, suitable housing for local rural needs, service opportunities for non-mobile groups, and adequate public transport links between key settlements and hinterland villages are beyond the direct control of planning authorities, yet it is the lack of these various opportunities which has prevented the framework policy of resource concentration from fulfilling its full potential. Isolated cases of positive planning have occurred, but generally there have been insurmountable

financial and administrative barriers preventing a co-ordinated approach to rural planning during the development plan era—a situation which Green (1971) has described as twenty years of wasted opportunity for positive rural planning.

The stream of criticism revelled at resource concentration policies for exacerbating the social problems experienced by many rural residents has led to the suggestion of a number of alternative framework policies based on the notion of greater resource dispersal. Venner (1976) has argued that people who live and work in the countryside have a right to the continuation of their *village units*. This would entail small-scale and balanced housing developments, low-cost accessibility schemes and the return of lost services and jobs to every village. Obviously such a pattern would require heavy subsidy and a change in political opinions as to the extent to which these factors should be supplied as a social service rather than as economically viable projects. Another set of ideas has centred on the *new village/rural settlement* theme whereby rural opportunities may be further dispersed by the establishment of new villages or by the refurbishment of previously settled locations (Darley, 1978). A further group of commentators has investigated the idea of *village clusters* in which a group of adjacent small villages can, in various manners, collectively assume the role and functions currently held by single-settlement growth centres. Hancock's (1976) 'village constellation', Parry Lewis' 'cluster-dispersal' and McLaughlin's 'functional interdependence' concepts all offer various degrees of village clustering which would, at least in theory, mean that the benefits of establishing rural growth points could be spread amongst a greater number of smaller and previously ignored rural communities. This climate of opinion in favour of resource dispersal represented the academic environment within which the new structure plan system was introduced in the United Kingdom in 1968. As a consequence, many expectations were raised that rural policies under the new legislation would adopt some aspects of these alternative resource dispersal policies.

The Structure Plan Era

The 1968 Town and Country Planning Act required county councils to present *structure plans*, and district

councils to present *local plans*—the former as a broad-based and flexible programme of strategy for the wide area, and the latter as detailed schedules for small-scale development control. Structure plans were to consist of very detailed surveys of country-wide social and economic trends, followed by a written statement of policy intent, and the information available from both the reports of survey and the written statements produced by councils provide a fascinating insight into the direction to be taken by rural policies over the structure plan period.

Essentially, there has been no apparent policy re-direction away from resource concentration and towards resource dispersal during the presentation and implementation of structure plans in Britain (Cloke and Shaw, 1983; Derounian, 1980). The previous criticism of key settlement policies has been ignored by decision makers in favour of a continuing allegiance to the perceived qualities of channelling growth into rationalised centres, rather than dispersing opportunities into the small, more needy, settlements.

A survey designed to test planners' attitudes towards the concentration/dispersal debate during their preparation of structure plan policies for rural areas (Cloke, 1983A) provides an interesting insight into why the expected policy shift towards resource dispersal did not take place. When asked whether greater levels of dispersal of resources and opportunities to smaller villages was recognised as a desirable planning goal, a clear majority of planning authorities rejected any support of resource dispersal, even in this hypothetically-phrased situation. The reasons for continuing to support resource concentration may be summarised in three main categories:

- (i) Opposition to resource dispersal on the basis of experience from previous rural settlement policies. Many respondents concurred with the author of the following comment:

"It still appears to us that if we had allowed a greater dispersal of development it would have done little to boost or maintain services in the smaller settlements...the end result of dispersal would simply be more people living further from a good range of services."

- (ii) opposition to resource dispersal on theoretical grounds. One respondent struck a chord echoed by many others :

“Dispersal policies do little to maximise opportunities in the form of providing access to the ‘outside world’. They seem to be pointing us back in the direction of the ‘self-sufficient’ villages of the past which were of arguable merit then and are of doubtful value to the modern world.”

- (iii) opposition to further resource dispersal because sufficient dispersal had already taken place. Many countries had nominated up to 70 key settlements during the development plan era, and this spread of opportunities was considered as sufficient (some would say excessive) to meet the needs of equitable dispersal investment.

The survey did highlight the view expressed by a minority of planning authorities that resource dispersal was a desirable planning goal. This view espouses a rejection of past policies and the criteria on which they are based, as summarised by one respondent :

“economic criteria will nearly always point to concentration for greatest economic efficiency; unfortunately the service consumers in rural areas are generally not so conveniently concentrated. Their needs should be balanced in the equation, and the means of ensuring a greater dispersal of development sought.”

These underlying attitudes expressed by rural policy-makers give a strong hint as to why structure plan policies continued to seek a concentration of rural resources. Other, more pragmatic, factors are also explanatory, however, in this context. The reality of the situation for most countries was that they were faced with insurmountable previous commitments to the development plan framework of key settlements. Planning permissions had been granted for major housing developments, and such permissions are extremely expensive to rescind. Long term investment strategies based on a centralization of resources had been entered into by agencies dealing, for example, with water, health and education services. These, too,

would be extremely difficult to halt and redirect into more dispersal-oriented rural locations. Perhaps most important of all, central government showed no sign of wavering from its tacit support of the economics of resource concentration. Thus when structure plans were presented to the Secretary of State for Environment for his approval, such approval was not forthcoming unless certain “standards” of financial house-keeping were maintained. These standards were such that resource concentration was an inevitable conclusion :

The details of structure plan policies for rural areas have been analysed by Clock and Shaw (1983). In summary, six types of policy were identified :

- (i) *market town policies*, where resources are to be concentrated into focal market towns and restraint will be exercised over resource allocation in smaller rural settlements.
- (ii) *key settlement policies*, where certain settlements (sometimes smaller than market towns) are selected to receive comprehensive growth of housing, services and employment so that they may in turn act as centres of opportunity for the surrounding rural hinterland.
- (iii) *tiered policies*, where growth is allocated to different tiers of selected growth centres, ranging from comprehensive investment in the largest, to the provision of small levels of housing opportunities in the smallest selected settlements.
- (iv) *Severe restraint policies*, where rural areas immediately adjacent to metropolitan centres are subjected to severe restrictions on any resource growth in order to conserve the rurality of the area in the face of rampant urbanisation pressures.
- (v) *hierarchical restraint policies*, where in similarly pressured areas, small levels of growth are permitted in a strict hierarchy of rural centres. Growth is nevertheless restrained in most settlements especially the smaller villages.
- (vi) *area policies*, where some attempt is being made to divert from strict policies of concentration either through permitting housing growth in

son with another whose policy has not been so strong. Inevitably, then, the likely costs and benefits of alternative resource dispersal strategies are even more shrouded in the inadequacies of our analytical techniques, since such strategies are still only on the drawing board and have never been implemented even experimentally.

Secondly, it has become generally recognised that the strategic level considerations of key settlements and other types of policy cannot *of themselves* solve rural problems. Policies of resource concentration and resource dispersal merely act as spatial umbrella policies *within which* the essential acts of resource allocation are performed. Thus the provision of housing for local needs, employment, services and access opportunities are specific tasks which require lower-level and specific decision-making within the umbrella planning framework. In one sense, then, to focus rural planning debate on the framework policies is to miss the very important point that most impacts of rural planning occur at the local level as a result of specific decision-making. This decision-making may not be local, however, as many such local impacts are caused by regional, national and international policy-makers.

A recognition of these previous deficiencies in the study of management of the rural socio-economic environment has led to a shift in the focus of rural planning research. Only recently have rural researchers fully acknowledged that study of written policy statements for rural areas has been over-emphasised and misleading, both because these statements do not accurately reflect the likely outcomes of the rural planning process, and because they also fail to account for the non-statutory activities of decision-making agencies and individuals in the public and private sectors which largely fall outside of the remit of conventional planning. Instead of studying written policy statements, researchers have turned their attention to the questions of policy-making and implementation, with particular emphasis being given to the perceived shortfall between policy intention and what actually happens—the so-called ‘policy implementation gap’.

The failure of planning to respond to pressing social difficulties in rural communities may be explained with reference to two symbiotic elements of the planning process. On the one hand it is clear that the efficiency

of existing rural planning policies has been drastically reduced by difficulties of policy implementation. Insufficient resources, especially financial and manpower resources, and problems of a lack of co-ordination between various decision-makers capable of achieving impacts in rural communities, have certainly been at least partially to blame for the inefficiencies of rural planning. These factors might be viewed as an *implementation problem*, and inherent in this view is the notion that implementation difficulties can be solved by means of logical and rational planning procedures.

On the other hand, a *policy problem* might be recognised within which suitable policies are somehow being prevented from reaching the surface of policy-making processes. In other words, the policy-implementation dichotomy falsely represents the complex procedures of rural planning which are currently structured in such a way as to preclude positive attempts to redress rural social disadvantage. Inherent in this view is that planning tends to act as an internal survival mechanism which tends to repel socially progressive policies (Knox and Cullen, 1981).

Policy and implementation research in urban environments (admirably summarised by Barrett and Fudge, 1981) suggests that the second of these two perspectives is likely to be more fruitful for those seeking to understand the deficiencies of rural planning. Urban research also provides a shopping list of those areas requiring further attention in the rural environment. In general, we need both to understand the decision-making machinery involved, and to understand (and perhaps seek to influence) the motives of these decision-makers. More specially, four areas of further investigation are required (Hanrahan and Cloke, 1983):

- (i) the role of the state, as either an independent arbitrator or as a preserver of existing social structures.
- (ii) the role of decision-making agencies, especially the relationships between central and local government, between different resource allocation agencies, and between the public and the private sectors.
- (iii) the role of individual decision-makers, particu-

larly with respect to their corporate or ideological motives.

- (iv) the distinctiveness of rural areas, which impose a spatial facade on a spatial structural phenomena.

It is these matters, far more than questions of framework policies of resource concentration and resource dispersal, which hold the key to a better understanding of socio-economic planning in rural areas. Little progress will be made until the mechanisms of policy-making and policy-implementation are more clearly understood. Effectively then, we need to replace the notions of rationality and a political processes in rural planning with other foci which will hoist it into the wider context of the 'real world' political economy.

This article began by tracing some rather simple parallels between the study of rural planning in India and the United Kingdom. It becomes clear in the conclusion to the article, that researchers in both nations are following similar paths in search of an explanation to the deficiencies of their current planning mechanisms. It is equally clear that much may be learnt from the readiness of Indian researchers to accept the inevitability of an ideological perspective within the study of rural planning and resource allocation. United Kingdom researchers, having been slow to catch on, are now speedily catching up.

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Export Prospects for India

DR. K.S. DHINDSA
IQBAL WALIA

The paper examines India's exports prospects for different commodities. The study shows that India's share in the exports of agricultural products in the world is below one per cent. There is tremendous scope for increasing exports of non-tradition agricultural products (like fresh fruits & vegetables, processed food, dairy and livestock products) and the engineering goods. The engineering exports alone could be the mainstay and the forerunner of India's exports and a growth rate of minimum 15 per cent per annum at constant prices. India also has bright export prospects for many of its non-traditional commodities.

At a time when the world economy is passing through serious crisis, trade prospects for India during the coming years have to be viewed in the context of the cumulative effect that is likely to be exercised by wide range of economic and commercial forces both in national and international areas. Indeed, from the point of view of economic policy a study of past trends is of interest only in so far as it may provide an insight into the likely developments in future. "All projections are, by their very nature, a reflection of a small manageable set of assumptions about economic behaviour drawn from the contemporary experience."¹

The assumptions, on which projections are supposed to be based, should be made both about factors affecting world trade in those commodities of which India is a major exporter in the world, and also about Indian economic policies.

First of all, we assume that India will take all necessary steps to ensure the competitiveness of India's export products in the world markets. As regards quality improvement, keeping to delivery schedule, product development, and publicity and propaganda, there will be more vigorous efforts than hitherto.

Secondly, we assume that exports of India's traditional products will not be allowed to suffer for want of adequate export surpluses.

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1. Manmohan Singh, *India's Export Trends and Prospects for self-sustained growth*. Clarendon Press: Oxford 1964, P. 179.

Thirdly, we assume that India's trading relations with other countries will continue to be conducted on a non-discriminatory and multilateral basis.

Fourthly, it has been assumed that export prices will not fall and also that the relative price relations between commodities exported from India and their foreign substitutes will remain stable.

It is clear that the Government have a vital role to play. "Export can only succeed if there is all round appreciation that export is a national commitment. Basic inputs are no doubt in short supply, but the requirement for export production is so small that it should not be difficult to meet them if all the government departments are motivated with the national commitment of fulfilling the export contracts at any cost."² Thus the "Export strategy should ensure rapid increase in exports without affecting domestic supply and to ensure that the growth of export production leads to an improvement in quality, access to modern technology and increased employment through greater participation by large number of manufacturers especially from the small and medium sectors."³

Commodity projection

India's exports of major groups of products are likely to show increase during the decade of 1980-1990. Projections of exports from India by major commodity groups, are given in Table 1. At current prices, exports are expected to increase at 21 per cent per annum and at 1979-80 prices at 11 per cent per annum.

The prospect of world tea trade depends on the development in tea consumption in the non-producing countries. Of this, more important is the consumption in the developed countries as they account for about 75 per cent of the total consumption in the non-producing area.

The World Coffee market is faced with an oversupply situation. To regulate supply to demand the Inter-

Table 1
Export Projections At 1979-80 Prices

Commodity	1979-80	1989-90	GR Per Cent Per Annum
<i>(a) Agriculture</i>			
1. Plantations	579	1040	6.0
2. Cereal & Prep.	131	445	13.0
3. Processed foods	120	425	13.5
4. Commercial crops	331	800	9.2
5. Marine Products	253	810	12.3
6. Fruits, Veg. & Flowers	118	320	10.5
7. Others	209	400	6.7
Total Agriculture	1741	4240	9.3
<i>(b) Manufactures</i>			
1. Engineering goods	650	2632	15.0
2. Leather & Leather goods	390	1324	13.0
3. Gem & Jewellery	590	3088	18.0
4. Textile (Incl. cotton, silk, woollen etc.)	880	1970	8.4
5. Basic chemicals, pharmaceuticals & cosmetics	180	468	10.0
6. Chemical & allied products	156	487	12.0
7. Plastics & Linoleum	35	100	—
8. Handicrafts	225	765	13.0
9. Sports goods	25	95	12.0
10. Other manufactures	450	1167	10.0
Total Manuf.	3581	12096	12.9
Total A+B	5322	16336	11.9
Total including others	6421	18231	11.0

Source: Tandon Committee Report on Export Strategy 1980—Report of Sub-Committee.

2. M. L. Verma—India's foreign trade: Prospect & Retrospect, P. 23.

3. Suresh Mehta—Export-Perspectives for the 1980s'. Export-Import Times, 20 Jan., 1980, P. 33.

national Coffee Agreement came into existence in 1962 followed by another agreement in 1968, specifying individual quotas for different exporting countries including India.⁴

In 1979-80, exports of plantations were Rs. 579 crores. The target for 1989-90 has been fixed at Rs. 1040 crores. Thus, the growth rate would be 6.0 per cent.

Exports of processed food has emerged as a potential area. Important items having good scope include canned meat, walnut kernels, fresh onions, preserved and dry vegetables, pickles, jams, jellies, chutnies etc. Exports for 1979-80 were Rs. 120 crores. The target for 1989-90 fixed at Rs. 425 crores though ambitious, can be achieved if attention is paid to some of the pressing problems of the industry and remedial actions taken.

The exports for the marine products are projected at Rs. 810 crores and thus, the growth rate per cent comes out to be 12.3 per cent.

The exports of fruits and vegetables offers a good prospect provided we can meet the quality requirements of foreign markets and have adequate production of the required varieties. The total exports of fruit, vegetables and flowers in 1989-90 is likely to be in the range of Rs. 320 crores the growth rate percentage to be 10.5 per cent.

Thus, the exports from the agricultural sector, such as, of tea, coffee, spices, walnut kernels, oilcakes, sugar, rice etc. account for nearly one-third of total exports. "The Tandon Committee observed that, of late, we have been losing ground in this sphere, and the relative share of agricultural exports in our total exports has been declining slowly. Some of the causes identified by the committee includes stagnation of output, low yields, rising domestic demand, protectionism among development market economies, slow growth in world trade etc."⁵

India's share in the exports of agricultural products in the world is below one per cent. But there is tremendous potential of exporting agricultural and agro-based products to the Middle East and the other parts of the world. We can easily increase the share of agricultural products from one third at present to 50 per cent in our total exports, provided requisite steps are taken to diversify agricultural production and create exportable surpluses. Over the years, due to low importance attached to agricultural exports and especially owing to growing domestic demand, India's share in world exports of some of the items has declined considerably. "In respect of vegetables it has declined from 1.2 per cent in 1970 to 0.3 per cent in 1979; in tea from 33.4 per cent to 23.8 per cent, and tobacco from 4.0 per cent to 3.6 per cent. Some of the items where India has either maintained its share or increased it to some extent include rice, coffee, animal feedstuffs etc."⁶

It has been rightly emphasized in the Sixth Five Year Plan that the agricultural growth pattern has to take into account the immediate as well as the long term needs of agricultural commodities, both for domestic consumption and for exports. Thus the total agricultural exports are expected to rise at the growth rate percentage of 9.3 per cent i.e. Rs. 4240 crores during 1989-90, as compared to Rs. 1741 crores during 1979-80.

Engineering goods are India's most potential exportable products. Their exports have expanded at about 25 per cent per annum during the decade ending 1978-79. However, there has been some slackening in the rate of growth in 1979-80. The year 1980-81 had, of course, recorded significant improvement based on which export target of Rs. 1150 crores was fixed for 1981-82. There is no doubt, looking ahead and talking about the export marketing strategy not only for the 80s but also for the 90s that engineering exports alone could be the mainstay and the forerunner of India's exports and a growth rate of minimum 15 per cent per annum at constant prices should not be beyond the reach, provided of course, the infrastructure does not fail us and we keep pace with applied research and

4. P. L. Tandon Committee Report on Export Strategy 1980s. Ministry of Commerce, Govt. of India, New Delhi, P. 223.

5. P. L. Tandon—Op. Cit., PP. 94-95.

6. FICCI—Export Plan for 1981-82, New Delhi, P. 53.

development or infusion of imported technologies in product designs and process technologies. With the creation of adequate capacity in terms of quantity and quality well ahead of time, it should not be difficult for us even to exceed this projected level.

Export prospects for leather and leather manufactures are not good. The consumption of natural leather in the importing countries has suffered as a result of a growing use of rubber and synthetic leather. The most important reason why India's exports of leather and leather manufacture are not likely to rise significantly is to be found in an inelastic supply of raw hides and skins depend largely on the natural death rate among the animals. Given a relatively inelastic supply and a growing domestic demand for leather products, exports are unlikely to increase significantly. During 1979-80 the exports of leather and leather goods was Rs. 390 crores. Though a target of Rs. 1324 crores has been fixed for 1989-90, it is doubtful whether the target would be achieved in view of the present environment and the recessionary trend prevailing in the international market.

Exports of gems and jewellery now occupy the second position in India's total exports after the exports of engineering goods. Diamonds form the major part of the exports followed by precious and semi-precious stones. The target figure of exports of gems and jewellery items for the years 1989-90 is Rs. 3088 crores which is about 6 times more than it was in 1979-80. It is expected that exports of cut and polished diamonds will increase.

Cotton textiles is India's oldest industry. Yet, its contribution to export earnings is relatively small viewed in terms of the capacity and the potential existing in the country and the promising market abroad. Wool and Woollens are an old industry. It has emerged as a good foreign exchange earner. The future prospect of export of woollen manufactures from India is dependent on the supply of better quality wool and modernisation of the industry. The most important item in India's export of woollen manufacture is carpets and druggets. In spite of promising potential existing in the world market, our exports of man-made fibre textiles have remained either stagnant or have recorded only a marginal rise.

The target of Rs. 1970 crores set for the textiles for the year 1989-90 is meagre. It shows only 8.4 per cent growth rate.

Basic chemicals, pharmaceuticals and cosmetics include drugs, dyes, alcohol, agro-chemicals, soaps, detergents, dhoop, essential oils etc. India's share in the total world trade in these items is less than one per cent. The target of Rs. 468 crores is rather meagre. Given the necessary support, the industry feels, the target would not only be achieved but exports can be more than doubled. The emergence of Iran and other Middle East countries as important markets is yet another factor for stepping up our exports.

Handicrafts constitute an important segment of decentralised sector of our economy and provide employment to over 2 million artisans scattered all over the country. Handicrafts comprise a wide range of products, such as, carpets, hand-printed textiles, art metal-wares, cane and bamboo articles, wood work, dolls and toys etc. Exports of handicrafts was Rs. 225 crores during 1979-80 and it is projected at Rs. 765 crores during 1989-90 i.e. 13 per cent growth rate per annum. There is a rapidly growing market for our handicrafts in the Western Europe and North American Countries.

The Indian sports industry is highly export-oriented, with nearly 70 per cent of the production being exported. Football is the major item exported, accounting for more than 50 per cent of the exports, followed by cricket equipments. The target for 1989-90 has been fixed at Rs. 95 crores, primarily because India has a large production capacity and can be made to participate effectively in export trade. The world demand for various sports goods is fast increasing. In view of these products being largely labour-intensive items, India has a comparative cost advantage. What is required is to explore the International market fully and gear our production and marketing machinery accordingly.

Total manufactures are projected at Rs. 12,096 crores i.e. 12.9 per cent growth rate per annum during 1989-90. Thus, the total manufactures and agriculture including others are projected at Rs. 18,231 crores i.e. 11 per cent growth rate per annum.

It is extremely difficult to fix a target for the exports in the changing requirements of the economy. In any case, the level of exports should reach atleast Rs. 18,231 crores in the middle of 1990's. To generate this export surplus, careful planning is called for to generate a surplus in the economy. In other words, the productive base has to be considerably strengthened and enlarged, we will have to keep pace with the latest technologies to cater to the international market which is becoming more and more quality and design conscious.

It should be noted that fresh penetration into the existing markets is rather difficult. So, new markets should be cultivated. The steep rise in the oil prices have phenomenally increased the revenue of gulf countries. As a result, large scale development is underway. These opportunities should at best be used for devising appropriate export planning and strategy. The promotion of trade with the developing countries of Asia, Africa and Latin America also need special consideration. A careful identification of export products and their relevance to particular geographical areas can certainly open up new avenues of trade.

Initially, considerable cost has to be incurred, involving the use of foreign exchange. For this purpose, the present restrictions on foreign exchange needs further liberalisation. This would also call for build-up of export entrepreneurship, transport, credit systems, information agencies and other export services. Investment in these services are likely to be rewarding in the long period.

Conclusion

Though there is less scope for the expansion of export of traditional agricultural products, there is tremendous scope for increasing exports of non-traditional agricultural products (like fresh fruits and vegetables, processed food, dairy and livestock products)

because of rapidly expanding world demand for these commodities. The study shows that engineering goods are India's most potential exportable products. Their exports expanded at about 25 per cent per annum during the decade ending 1978-79. There is no doubt, looking ahead and talking about the export marketing strategy not only for 80's but also for the 90's that engineering exports alone could be the mainstay and the forerunner of India's exports and a growth rate of minimum 15 per cent per annum at constant prices should not be beyond our reach, provided we create adequate production capacity in terms of quantity, quality and design etc. As regards exports of handicrafts and sports goods, these being labour intensive items have also good export prospects.

Thus if efforts are made to avoid all the constraints which do not allow the export share to rise and if markets are cultivated in an imaginative manner on a long term basis, and if we can assure the foreign buyers of our quality, specification and adherence to delivery schedule, there is hardly any reason why our exports should not rise.

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Impact of Training on Personnel Managers

PREMILA SETH

Personnel Manager's job performance is influenced by his beliefs/attitudes. The belief patterns act as cues during the process of training. Cluster analysis of responses obtained from 119 Personnel Managers resulted in three and six clusters for responses before and after training respectively. The clusters obtained for after training revealed greater consistency and integration. The cluster pattern summarises the Personnel Manager as an employee oriented, objective individual able to recognize the utility of group processes and having faith in the capacity of worker to take initiative and handle responsibility. Training for Personnel Managers, to be effective, should therefore be directed towards the entire complex of attitudes/beliefs underlying managerial philosophy and their inter-relatedness in terms of clustering patterns.

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Introduction

Human relations forms a major component of the Personnel Managers' job. Their style and method of performance is an outcome of their attitudinal/belief patterns towards various policies and practices, which is itself subject to change in response to environmental influences.

Given the significance of managerial beliefs/attitudes, the question that comes to mind is—'Is it possible to promote organisational effectiveness and managerial efficiency by inculcating the 'desired' attitudes through the process of training?' If the answer is in the affirmative, which of course, is the basic premise of this research, then trainers need to have a synoptic view of attitudinal patterns and about the inter-relatedness of different attitudes before trying to import training. Basic to expectation of any change in managerial behaviour through training is, to understand how employees grow at work and how managers learn to accept new ideas. Imparting knowledge about benefits of some particular forms of behaviour is not sufficient to change it. For e.g., a manager will not begin practicing participative management because he has been told the benefits it can bring, unless he holds beliefs which are consistent with or supportive of them, no matter how useful they may seem to be. The belief patterns, therefore, act as cues, during training and look for deviations from or conformities with their expectations. Bearing this in mind this research

studies the clustering patterns of attitudes of personnel managers towards various managerial practices before and subsequent to training intervention. The study would thus arrive at attitudes that are mutually dependent on each other and require different focus through training.

Review of Literature

A couple of cross-cultural studies is what one could come across in the research survey.

Haire, Ghiselli and Porter (1966) studies 3646 managers drawn from 14 countries covering their beliefs towards: (i) the capacity of subordinates for initiative and responsibility; (ii) efficacy of participation; (iii) Sharing of the information with employees; and (iv) providing opportunity for his control on the job. This study reported Indian Managers showing more autocratic orientation to various management practices as compared to most of the managers of Western and European countries.

Professor Bernard Smith and John Thomas (1972) in 1966-67, in a comparative study of 164 senior and middle level Indian and American Managers reported Indian Managers' belief in group-based, participative decision-making, but with little faith in the capacity of workers for taking initiative and responsibility. Indian manager they found is basically a cold, calculating person. This research showed no significant difference from their American counterparts in their conservative approach. Interestingly, the middle level Indian managers espoused greater belief in change and are less conservative than their American counterparts.

Research Methodology

Included in this research study are the beliefs/attitudes towards management practices which need focus during managerial training. For e.g., practices like leadership and supervisory behaviour, approach to participation, role of unions in promoting employee welfare, to mention a few. The same were studied before and again after the training intervention, to study the training impact on its clustering patterns. Relationship of belief patterns with some of the background variables of the manager, such as his total

work experience, his educational background (professional/non-professional) his earlier exposure to similar training, and nature of the industry (public/private, manufacturing/service) he represents, were studied for this research.

Measurement of beliefs/attitudes

A questionnaire consisting of 72 statements was formulated specifically for this study. The acceptance or rejection of the statements indicated the respondents' attitude about the issue in question.

The common problem of distortion of responses arising out of social desirability were minimized by: (a) ensuring strict confidentiality; (b) assuring that there are no right/wrong answers and their responses are only indicative of their individual opinion; and (c) indicating that their responses are only a training aid meant for future improvement of training and not for assessing the respondent.

The question items were validated by obtaining the judgement of 3 groups of professional trainers :

- those in the training field directly related to the particular training which comprise the study sample, for e.g., faculty directly involved in the present training programmes;
- those in the field of training indirectly related, for e.g., the trainer of any training institute external to the institute from where the sample is actually drawn;
- professionals in the academic field for e.g., University Professors who are involved in teaching but are not directly themselves involved in training.

For more practical reasons of requirements of the study, the researcher deemed it right to limit it to logical and qualitative validation thus ensuring 'faculty input validity', 'participant validity' and 'objective validity'. Neither was reliability measured except that it had good validity because (i) each variable was measured by just two or three question items and therefore no split-half reliability was possible. Similarly

test-retest reliability was not possible because pre-test and post-test questionnaire were administered to the same sample as a part of research design.

Sample

The personnel managers under study were post-experience, executives sponsored for a 10-day training programme on personnel management conducted by Administrative Staff College of India. There were 119 personnel managers representing private/public/government sectors; manufacturing/service organisation, with age ranging from 26-55 years. The breakup of the sample is as shown in table 1. The final questionnaire of 72 items was administered to the participants (119 personnel managers) before the

to reduce the number of variables and, via this reduction, to gain greater control over the assembled data. Cluster analysis constructs groups of variables (comparable attitudes) having greater similarity between each other and distinguish them from attitudes showing little similarity with variables outside the cluster thus, each variable in cluster analysis being represented only in one cluster. The analysis was begun with a cut off point of 0.45 as the minimum factor loading for inclusion in the cluster.

Results and Discussion

Through the process of cluster analysis three clusters were obtained for the before training responses and six clusters were obtained for responses after the training intervention.

Table 1
Sample Distribution

Total N=119

Age	Educational background		Earlier Training & Seminar Experience			Total work experience (in years)				Nature of Industry			
	Profes- sional	Non- Profes- sional	Nil	1-5 Courses	6-10 Courses	1-10	11-20	21-31	31-40	Public sector	Private sector	Manu- factur- ing	Service sector
26-35 years	5	8	1	12	—	10	3	—	—	4	7	8	5
36-45 years	38	32	14	52	4	9	52	9	—	23	47	41	28
46-55 years	9	27	9	25	2	1	15	14	6	5	33	21	16

commencement of the training programme and again after the completion of the programme.

Method of Statistical Analysis

Inter-relatedness of cluster patterns of different attitudes was obtained through the method of cluster analysis.

Cluster Analysis

Cluster analysis is rather a simpler form of factor-analysis used in forming homogenous groups of research variables (for e.g., beliefs/attitudes in this study) to check those that are strongly related, in order

Before Training Response Clusters

As seen in table 2 six variables comprising this cluster are attitudes relating to: work group behaviour, leadership behaviour, employee welfare, management theory towards business, and joint decision making for wage fixation. Table 2 shows that 60-62% of personnel managers believe that employers in large organisations suppress individual creativity and for them profit motive takes precedence over employee welfare. 72 per cent from the same group who agreed on the former two issues also agreed that most of the large organisations lack objectives which guide executive decisions. They also believe that the work group behaviour explains most of the employee

Table 2—Cluster 1

N=119

S. No.	Variables	Response percent- age	Correlation (r) with total cluster
1.	Resistance to change at work place is the result of work group behaviour	45	.51
2.	Leadership behaviour is dependent on group behaviour and not merely on leader traits	52	.42
3.	Employers profit motive takes precedence over employee welfare	60	.49
4.	Large Corporation suppress individual employee's creativity	62	.39
5.	Management Theory—Most Organisations lack corporate objectives which guide managerial decisions	72	.40
6.	Wage fixation could be a matter of joint determination	93	.46

resistance to change. 52 per cent are also of the belief that leadership/supervisory behaviour is more dependent on the group members and on the nature of the task than mere presence or absence of leadership traits. These beliefs seem to convince 90 per cent of them that wage fixation is a matter to be decided jointly between the management and union representatives. The high percentage (90) could be explained by the prevailing practice of collective bargaining in deciding the issue of wages. It can be seen, how a substantial segment of personnel managers, in this sample, held a critical attitude towards the employer/management in the context of employee welfare and how it is linked up with group processes of collective bargaining, leadership, behaviour and employees' resistance to change.

Table 3 Cluster II comprises of three variables. 67 per cent of the personnel managers have expressed their faith in the capacity of worker to behave responsibly and exercise self-control. 46 per cent of the same group of personnel managers held progressive attitude towards management practices. To keep pace with the

Table 3—Cluster II

N=119

S. No.	Variables	Response percent- age	Correlation (r) with total cluster
1.	Faith in capacity of worker—that the worker is capable of responsibility and self-control	67	.29
2.	Progressive management practice should change with changing economic and technological conditions	46	.29
3.	Amount to be decided for awards, bonus etc. through joint determination	77	.26

changing requirements of the time, they believe that their policies and practices should change with changing economic and technological conditions. It would be interesting to further study whether these managers belong to a particular sector of industry (public/private). 77 per cent of the respondents accepting joint consultation for deciding awards/bonus agree that participative management basically requires a progressive managerial mind.

On closer observation of this cluster, two things emerge—one, the principles of management which apply to the general environment also affect their individual organisation practices and hence the need to change their own practices with changing techno-economic environment. Second, a positive attitude towards the worker is the prerequisite for participative management and this can be only prevalent in a managerial class having progressive outlook.

The correlation value of .75/.76 cluster III (table 4) of each of the two variables with the total cluster is indicative of their strong linkage. 45 per cent of the respondents opine that transfer decisions should be a matter of joint decision-making. 46 per cent of the managers believe job analysis to be a facilitator for employee placement. If the job content/requirement is known fully well then transfer/placement decisions can be easily taken through joint consultation of management and union.

Table 4—Cluster III

N=119

S. No.	Variable	Response percent-age	Correlation (r) with total cluster
1.	Transfer decisions through joints determination	45	.75
2.	Job-Analysis for proper placement	46	.76

After Training Response Clusters

In contrast to three clusters for before training responses, six clusters obtained for responses after training are discussed below :

Cluster I Table 5 falls into three distinct categories: (a) policy orientation of the personnel manager

Table 5—Cluster I

N=119

S. No.	Variable	Response percent-age	Correlation (r) with total cluster
1.	Welcome government intervention in business policy of private enterprises	86	.43
2.	Progressive management practices should change with changing economic and technological changes	63	.42
3.	Management Theory-Most organisations lack corporate objectives which guide managerial decisions	73	.48
4.	Employee welfare should be the concern of the employer	58	.32
5.	Large corporations suppress individual employee creativity	55	.37
6.	Faith in capacity of worker that the worker is capable of responsibility and self-control	63	.49
7.	Process and techniques of manufacture/business orientation etc. through joint determination	63	.43
8.	Wage fixation through joint determination	72	.37

(serial No. 1, 2, 3) (b) attitude of the manager towards employees welfare (serial No. 4, 5, 6); (c) issues that could be covered through joint determination (7 and 8). The first category—the policy orientation describes the respondents acceptance of government intervention in business and policy decisions of private enterprises. They also believe that large corporations lack objectives which help them in taking decisions. As against 40 per cent in the before training responses 63 per cent are convinced as a result of training, that their own policy and practices should be in accordance with changing socio-economic conditions. This category of the cluster reflects their attitude towards the existing management philosophy which by and large is, according to them, lacking in clear corporate objectives. The second category relating to the attitude of the managers towards employee welfare reposes faith in the capacity and sense of responsibility of the employee. The are critical of the management's impersonal approach towards employee welfare and a feeling is expressed by 58% of the managers that employee welfare is essentially the concern of the employer. This positive attitude towards the worker probably contributes to their accepting not only wage fixation but processes, and methods of manufacture of products, and scheduling of shifts etc. could be decided in consultation with the worker representatives, which is the 3rd category of this cluster. This cluster gives evidence that the attitudes have a direct bearing on the policy orientation and management practices.

This cluster aggregates attitudes inter-relating productivity with job satisfaction, group incentive schemes and supervisory effectiveness.

According to them, the employee attitude and morale is the best indicator to gauge the effectiveness of the supervisory style. As against 45 per cent before the training intervention (table 2) 64 per cent after the training believe that worker frustration could be explained in terms of group pressures. Therefore, knowledge of group dynamics could be constructively used by the manager while planning for incentives and for other methods of promoting higher productivity. Being convinced about the group effectiveness and group incentives, 79 per cent agree that reward system, if introduced in the organisation, their nature and

quantum could be jointly determined between management and worker representatives. Bonus also could be a matter of joint determination. This again could be explained in terms of the existing practice of collective bargaining prevalent in most organisations. Cluster II of Table 6 gives an integrated picture of the managers approach to various practices in the organisation and highlights factors contributing to efficiency and productivity.

Table 6—Cluster II

N=119			
S. No.	Variable	Response percent-age	Correlation (r) with total cluster
1.	Profit sharing incentives result in cooperative work attitudes	65	.39
2.	Group incentives better than individual incentives	65	.50
3.	Resistance to change at work place is the result of work group behaviour	45	.40
4.	Group pressures are the sources of frustration at work place	64	.47
5.	Job satisfaction need not necessarily result in productivity increase	49	.48
6.	Indicators of effective supervision are morale and employee attitudes	37	.36
7.	Amount to be decided for rewards, bonus etc. through joint determination	79	.34

It is interesting to note that all the variables included in this cluster relate to personnel managers' approach to leadership and supervision in industry. It tries to give a unified picture of the factors contributing to conflicting supervisory style. 72 per cent believe that authoritarian supervisory methods have no practical value and hinder two-way communication. This essentially speaks of the democratic orientation of the Personnel Manager, with its concomitant effect on their belief that, when an individual is subjected to conflicting authority and when responsibility exceeds authority the individual cannot be held responsible and accountable. Therefore, it would be very unsound

management approach to expect responsibility and accountability from an employee without giving him enough authority, which in fact is the situation prevalent in most organisations. Based on their experience 73 per cent of the respondents reported that it is not only the personality of the leader but some of the above mentioned factors that are equally important for effective leadership and supervision. Normally, training programmes tend to emphasise on the leadership styles and approaches without focussing on the environmental conditions which are equally important for effective leadership and therefore need to be reinforced during training.

Table 7—Cluster III

N=119			
S. No.	Variables	Response percent-age	Correlation (r) with total cluster
1.	Successful leadership behaviour is dependent on other factors than merely leadership traits	73	.49
2.	Authoritarian leadership hinders two-way communication	72	.66
3.	Without Unity of Command and authority there can be no accountability	95	.60
4.	Responsibility without authority is an unsound management practice	87	.56

Cluster IV (Table 8) highlights the personnel managers' attitude towards rewards/punishments. Managers who do not believe in having rewards as a common practice, do not frequently use punishment in their repertoire of managerial behaviour. According to 47 per cent of them, punishment as a method for disciplining the worker, should be used infrequently. 60 per cent believe that rewards should be minimally used to avoid frustration amongst other in the organisation who are not rewarded. Managers who do not believe in the effectiveness of rewards for the development of the employee are also convinced that punishment as a method of disciplining them is unwarranted.

Table 8—Cluster IV

N=119			
S. No.	Variable	Response percent- age	Correlation (r) with total cluster
1.	Rewards should be scarce	60	.70
2.	Minimum use of punishment for shaping human behaviour	47	.69

Cluster V (Table 9) recognises the role of the unions, and how joint determination could extend to different areas. 89 per cent recognise the positive role of unions in promoting employee welfare and hence believe that decisions on issues like incentive schemes and transfer of workers could be jointly determined between management and union. It also indicates acceptance of the role of trade union institutions today. It could be argued that since trade unions have become the reality of today's industrial life, this response pattern could be out of social desirability.

Table 9—Cluster V

N=119			
S. No.	Variable	Response percent- age	Correlation (r) with total cluster
1.	Positive role of unions in promoting employee welfare	89	.69
2.	Transfer of worker within plants	50	.62
3.	Incentive schemes		
		57	.71

Cluster VI (Table 10) relates to the promotion and appraisal policy in the organisation. It reflects the perceived need of 69 per cent of the respondents for an objective approach towards appraisal practices for avoiding frustration amongst workers arising out of promotion policy if the latter is not based on objective appraisals. Discussions with the personnel managers have highlighted the problems of achieving optimal objectivity of appraisal system. However systematic the process of appraisal may be, there is a possibility

Table 10—Cluster VI

N=119			
S. No.	Variable	Response percent- age	Correlation (r) with total cluster
1.	Promotions policy in the organisation mostly leads to employee frustration	70	.65
2.	Sound appraisal system should measure performance against target	69	.70

of bias and subjectivity creeping into any appraisal due to reasons of immediate work requirements, interpersonal relationships between appraisee and appraiser and sometimes political interference in most assessment decisions. This cluster reminds us of the need for an objective appraisal system, if at all an organisation has to have a promotion policy which minimizes employee frustration.

Conclusions and Suggestions

The research findings contribute to discussions on a number of issues that are conclusive as well as suggestive in terms of future research action.

1. A closer look at the three clusters obtained before training (Table 2, 3, 4) and six clusters obtained subsequent to training (5, 6, 7, 8, 9 and 10) reveal that there is much more consistency and integration in the variables forming the clusters after the training than they were in the before training group. While before training, the managerial mind, recognizes the importance of group-behaviour (table 2), they were not clear as to how it could be work-related for utilising this knowledge and increasing their effectiveness as Personnel Managers. No doubt, based on their work experience they are aware of the group pressures resisting changes, but at the same time they are not able to utilise the same group processes for constructive purpose such as promoting job satisfaction and increasing productivity.

2. In the after training cluster II (Table 6) relating to group behaviour, personnel managers accept that groups should be tolerated and used for the organisa-

tion. They are convinced that group based incentives are superior for increasing productivity and believe in using the group for effecting changes in the organisation. They do agree that leadership style could be best judged through group attitude and morale and group pressures should be contained to decrease frustration at work place.

3. Another finding, through a closer observation of the before-and-after clusters, is managerial belief towards employee welfare. Management, it is confessed, pay greater attention to profit motive than to employee welfare and development. They are critical of most large organisations lacking in direction for achieving their objectives. The response percentage shows that subsequent to training managers developed a more sympathetic attitude towards workers. Their belief in organisation's responsibility to care for the personal needs and requirements of the workers juxtaposed with a critical attitude towards the employers self-centered approach gives an impression that training has resulted in greater employee orientation of the personnel manager. This also suggests that basically the manager has empathy with the worker, but in the work situation, when he is bogged down with innumerable day-to-day problems of policies, procedures, production results and maintenance of smooth industrial relations any deviant behaviour on the part of the worker is more than irksome to the manager, whereas on his reflection at a training situation, away from the work place, probably he still feels that the worker deserves all the sympathy from the personnel manager. Discussions with the personnel managers revealed that the blame for negative worker behaviour squarely rests with the trade unions, who according to them, exploit the innocent workers.

4. Before and after clusters further highlight that an openminded progressive group of personnel managers favour modification of management practices in keeping with the pace of changing environmental conditions. They welcome government intervention and control in the economic policies of private enterprises. Probably, according to this managerial group; the private enterprises enjoy more than normal freedom in its functioning.

5. Another major finding that emerges out of the

before and after training clusters is the democratic orientation of the Personnel Manager. While accounting for the factors which contribute to successful leadership style, they do recognise the role of other factors such as the span-of-control, the degree of authority enjoyed by the leader. Another aspect related to this factor is the number of areas, which the personnel managers agree, should be covered under joint determination which has significantly increased after their exposure to the training programme. One of the reasons would be their recognition of the contribution made by trade unions in improving employee welfare.

6. The study also highlights the desire of the personnel manager to be objective in his handling all personnel in the organisation by avoiding getting into oft entangling problems of frustration by having too many rewards, by using various techniques of punishment so as to prevent increase in the number of grievances around the work environment.

7. The critical attitudes of the personnel manager towards the employers is a pointer towards the Personnel Managers low degree of identification with the management group. One of the reasons that could account for this is their position in the Organisation structure and the conflicting roles and responsibilities handled by them during times of peace vs. situations of crisis, which they often seem to voice through their individual and group discussions.

An analysis of the above before and after clusters summarises the Personnel Manager as an employee-oriented, group-oriented, objective individual. They have faith in the capacity of workers, recognize the potential utility of group behaviour and believe that certain management decisions which directly concern the worker could be jointly determined between management and union.

8. The present findings are more or less in confirmation with some of the findings of Haire (1966) and Thomas and Smith (1972) studies both reporting group orientation for Indian Managers. The latter study reported the observed paradox between Indian manager's indicating low faith in workers' capacity to assume responsibility but still indicating belief in parti-

cipative management. Explanation offered for those findings was that, belief in participative management could be the result of its widespread exhortation in management education programmes. According to them low level of need satisfaction with low faith in workers, nothing more than lip service could be paid to theme of participative management. These studies, it must be remembered date back to the years 1966-70. As per the present study the personnel managers have come to accept the worker as a responsible person capable of self-control, handling responsibility and taking initiative. The personnel managers of the eighties do not merely believe in group orientation but also recognise how group behaviour could be positively utilised for promoting organisational effectiveness. The present study is therefore, a pointer towards manager's shift in attitude regarding employees' work behaviour. It also explains that the managers concept of the worker during the eighties has shifted from its traditional limited role and the worker today, is more responsible. There is no denying the fact that the general social and economic development for the past decade has created increased awareness of their rights and duties. In contrast, the impersonal rigid hierarchy of the past would evidently reinforce, amongst subordinates, the tendency to avoid taking initiative and responsibility.

9. Coming to the attitude towards participative management (Haire (1966)) (Thomas Smith (1972)) to identify Indian managers with beliefs towards participative management applied to all decision making and it would be but natural for the manager to succumb to the socially desirable phenomenon of participation.

In the present study this limitation has been overcome by trying to assess respondent attitudes towards specific issues which the personnel manager would accept or reject for joint decision-making process. Another important factor of the then study was the time frame. With the then traditional autocratic system of Indian managers (reported as a finding in Haire study) it was immature to introduce participative management as a one shot developmental process. In fact, the present findings of the clustering patterns have revealed that positive attitudes towards participation pre-suppose: (i) belief in the capacity of worker to

handle responsibility; (ii) recognition in the role of trade unions for promoting the standard of employee welfare; (iii) belief in democratic and group processes as a positive method of promoting job functions and increase productivity and, (iv) managerial orientation towards the employee—that the worker welfare is as much a responsibility of the employer as to seek profit from business.

Obviously, the trade union today have to come to stay as a stable institution and the personnel manager recognises its strength much more than it was a decade ago. The growing trade unionism on one hand and increasing worker awareness of his expectations on the other have resulted in the autocratic style of functioning becoming a socially unacceptable phenomenon in industry. Coupled with these developments is the increased recognition of the worker as an important factor and satisfaction of his needs being equally important for promoting industrial growth and development. In spite of these developments, managers still feel that certain areas of decision-making is a unilateral managerial prerogative; and as long as the worker does not reach a stage of sharing both profits and losses, there cannot be complete participation.

The present trend is an indicator of the turning point in the personnel managers' attitudes towards participation. Starting with a completely negative attitude towards participation and towards faith in workers' capacity in the 1960's we are now in the transition stage when the manager has developed faith in the workers' capacity to contribute to, and its representatives joining the management in the decision-making for a few limited areas. Gradually with increasing education, training and efficiency of the worker and improving rapport between the management and the worker the trend is expected towards more and more of participation till a stage is reached when both the parties i.e., management and worker—are mutually and mentally well equipped to accept participative management.

Findings of the present clustering pattern therefore emphasize that management training and development programmes need to confront the entire complex of attitudes enveloping the managerial philosophy. It

needs to realise that management practices desired to be inculcated through training can be effective only if the training process is attentive to the accompanying important beliefs/attitudes that cluster together, recognize factors that help promote certain management principles and render certain other management practices inoperative. As in the present study, the efficacy of the belief in participation, in democratic process, and in joint determination practices presupposes a managerial mind that is less conservative, positively inclined to worker welfare, critical of the existing unilateral decision-making in situations which concern both the employer and the employee, is sufficiently convinced that the worker's representative is able to effectively participate in the joint decision-making and the like. Training programmes, should thus incorporate, a 'wholistic inter-related multidimensional' theme approach to promote attitudinal change (i.e., it should first build up on their attitudes towards workers, their capacity to contribute positively towards participation and similar related themes than merely talk about participation), or else the end results of training programmes aimed at promoting certain desired attitudes, can be, at the most, minimum.

10. Another important finding of this study which needs elaboration is employee-orientation. In the Thomas and Smith (1972) study, there was evidence that Indian organisations place more stress on corporate loyalty than on growth of individual talent. Interestingly, by and large, the personnel managers today still confess that Indian employer is more profit motivated, and managers from manufacturing organisations believe that large corporations suppress individual creativity.

While managers from the public sector are critical of the management and feel that corporations lack objectives for guiding them in their decision-making process, the private sector managers oppose this view.

In spite of this fact it is encouraging to note that the manager today, unlike that of the 1960's possesses a positive approach towards employees. While stressing on the need towards corporate loyalty by the worker they also recognise the importance of the worker's needs in the total process of organisational growth and development. One of the reasons, as already discussed, could be the realisation of the growing trade union strength, the increasing awareness by the worker of his rights and expectations, the overall growth and industrialisation, and the increased flow of knowledge of social and human sciences in our country.

11. The personnel manager's desire to move with the fast pace of industrialisation is also reflected in their progressive attitude to change. The study reveals that managers from the public sector are comparatively conservative and oppose frequent changes in management principles and practices. This could be partly explained by the plethora of rules and regulations that mostly bind the functioning of the Public Sector industry.

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Environmental Scanning for Corporate Planning

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This paper attempts an indepth analysis of the process of development of an environmental scanning and reporting system in a large multi-product, multi-unit company. It also discusses the implications of one of the inferences of the analysis for studies in environmental scanning for corporate planning.

* Year long textile strike in Bombay put many dyes and chemical companies in a bad shape.

* Recent reduction in the excise duties on refrigerators enabled their manufacturers to reduce the price and increase the sales by 58% in four months.

* Applications of electronic technology to computing and the consequent development of calculators threw the mechanical computing machine manufacturers out of business.

* Launching of an industrial project like Kudremukh Iron Ore project generated investment opportunities for many construction companies.

Such examples illustrate the impact of environmental factors on the performance and prospects of companies and point to the need for developing capabilities to identify, monitor, anticipate and interpret such developments in the environment. Practically every operation of the company be it production, marketing, purchase or financing is affected by these changes.

Once it is recognised that corporations need to scan these developments systematically and initiate required action to avoid undesirable consequences, then the question is: how can a company acquire this capability and develop a system for scanning and reporting the developments for corporate planning? What are the underlying processes and factors influencing this development?

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This paper attempts to answer these questions through an indepth analysis of the process of development of an environmental scanning and reporting system in a large multi product multi unit company. It also discusses the implications of one of the inferences of the analysis for studies in environmental scanning for corporate planning. It is divided into three parts. In the first part we describe how this company developed a system for scanning and reporting the developments in the environment and linked it with corporate planning. In the second part we analyse the process by identifying the key tasks in developing an environmental scanning and reporting system and the factors that influenced the motivation, speed of development and scope of scanning and reporting. In the third part we discuss the implications of the inferences for studies on the relevance and future of environmental scanning for corporate planning.

The sources of information for this study are the published reports of the company, articles by the Chairman and Managing Director of the company and the personal association of the author with the design and implementation of formal planning and scanning system in this organisation. The author had opportunities to interact with all the senior executives of this company.

Part I Description

About the Company

With a turnover exceeding Rs. 3000 million and manufacturing units spread all over the country, Diversified Manufacturing Company Ltd. (DMCL) (a disguised name) is one of the largest manufacturing corporations in India. The company produces a wide range of industrial goods and consumer durables in its portfolio of business. Its exports constitutes nearly 15% of the total sales. It has an independent subsidiary to manage its international operations.

Learning from Early Growth Experience

Encouraging profit performance in the first decade of its operation enabled the company to double its capacity for producing industrial goods and diversify

into a consumer durable. The company formulated an ambitious plan of setting one factory a year and financing alternate factory from internal resources. This plan was based on the demand estimates for industrial goods published by the Planning Commission of India. Accordingly, factories were set up in 1964 and 1965 in two different locations. Further implementation of the plan was halted by the onset of recession in the country during 1966-67 to 1968-69. The demand for industrial goods declined and the company suffered a loss for the first time in 1967-68. Such an adverse unexpected economic performance forced the company to review its growth strategy.

Review of the Strategy by Chief Executive

Reviewing the growth strategy, the Chairman and Managing Director of the company bemoaned the absence of commercial intelligence and statistics in the company and stressed the need for taking a disaggregated view of the estimates published by the Planning Commission. According to him, the company should have attempted to break down the total demand estimates into those that were relevant for the products produced by it. The company should not have conceived its plan of one factory a year without this exercise. It could have enabled the company to phase the setting up of new units suitably depending on the market and economic conditions.

Early Attempts in Formal Scanning

In 1970-71 the demand for industrial goods picked up and the company recovered from the shock of recession and initiated two activities towards developing a data base for environmental scanning. The Central Industrial Engineering Department of the company was entrusted with the task of collecting and analysing statistical information on the Macro-Economic environment. This department had designed and implemented a Management Information System for collecting and reporting internal information. A Market Planning and Research Department was set up in 1973-74 to develop marketing plans for the company's products, based on demand forecasts, and to conduct market surveys for new products. Three market planning and research officers were recruited in the middle management cadre

from the Institutes of Management for this purpose. They were fresh from the Institute and did not have any working experience before joining the company. Two senior executives from the field were also inducted into this department, one of them was made the Chief of the department. There was no addition to the staff of the Central Industrial Engineering Department. The Chief Industrial Engineer of the company was asked to shoulder the burden. He was sent for a short term management development programme in England.

Creating the Data Base

The Chief Industrial Engineer of the company collected limited macro-economic data on Gross National Product, outlays on various sectors under the Five Year Plans of the country, output of major industries and the revenue and expenditure of the Government of India from the publications of Central Statistical Organisation of India, Planning Commission of India and Ministry of Finance. The help of an external agency was sought to compile and interpret data on the performance of the corporate sector. The external agency was running an economic monitoring service. It supplied environmental information through its weekly, monthly and annual publications to the subscribers of this service. In addition, it also supplied specific information on request. The performance profiles of different companies producing similar products were developed for making interfirm comparisons. The economic journals that published data on the performance of the Indian economy were identified and subscribed to. Subscriptions were sent to few international magazines also.

The services of a consultant were hired in 1974 to help the company identify the quantitative relationship between the economic and technological developments in the external environment and the indicators of company's performance.

The market planning cell on the other hand was creating a data base for gauging the environment affecting the future of industrial products. It was recognised by them that the demand for the industrial products produced by the company was a derived demand and the prospects of this industry depended on

the user industries like automobiles, two wheelers, railways, defence, industrial machinery and metal working industries. The data bank set up under the supervision of Marketing Information officer collected data on the performance and prospects of these industries. It made an attempt to collect comprehensive information on the letters of intent and licences issued to various companies, project launched by the state and central government and the progress of these projects.

The senior executives of the company visited national and international exhibitions of industrial products and kept the top management informed of the latest design and technological developments through tour reports.

To disseminate the information so collected, the data bank started publishing inhouse fortnightly called 'Marketing News' in 1975. It attempted a limited analysis of the information collected by it.

Thus the initial efforts were limited largely to identification of the information requirements and collecting the information. The analysis of the information was preliminary. The reporting was informal. Some newspaper cuttings and abstracts of the resources allocated for this activity were meagre. To know the reasons for this, we need to know how the formal planning system developed in the company.

Efforts in Introducing Formal Planning System

Before 1974-75, the company had a system of annual budgeting and production planning. While the former was a financial exercise, the latter an engineering one. Between 1970-71 and 1974-75, the company diversified into agricultural machinery and another consumer durable. These diversification moves were contemplated on the basis of the feel of the market rather than on a systematic exploration and evaluation of alternatives. The main objective of these moves was to utilise the excess capacity existing in various units of the company. With every diversification move, a kind of discomfort developed with the present way of formulating growth strategies. The company's management faced questions like which way the company was moving? What new strengths were intended to be

came to centre around the launching of the Five Year Plans of the Central and State Governments and the announcements of the Central budget and key economic policies of the Government of India.

Indian Economy and Corporate Planner. The *Monthly Review* recorded events and policy developments in the Indian economy during the previous month. Its objective was to draw the attention of the planners to significant developments in the economy and their impact on the performance of the Company.

Corporate Planner, a quarterly, reported in detail the developments in the economic and technological

A separate cell was set up in the international subsidiary of the Company to monitor and report the development in the global environment. Similar reports were published by other departments that mentioned the environmental developments. The title, content

acquired? What was their contribution to exploiting the strengths of the company and overcoming its weaknesses. Answers to these questions pointed to the need for introducing a formal corporate planning system that enabled the company to define its business objectives, goals and future direction of growth. The help of an outside consultant was taken to determine the skills and knowledge required. The stress was on analytical and communication skills. They expected the staff to possess knowledge of the company's strengths and weaknesses.

Based on this experience the three year plan was extended to cover a period of five years.

Strengthening the Formal Scanning and Reporting System

Setting the stage for a systematic scanning and planning exercise, the Chairman wrote "We are living in an age of exponential

objectives and target audience of these reports are given in Annexure I.

These reports are primarily descriptive in nature. Very limited use of statistical tools and techniques is made in analysing the data. The corporate planning cell has contemplated to develop an econometric model to explain the causal linkages between the operations of the company and the environmental factors.

Developments in the Planning System

Changes in the planning system took place along with the increasing systematization of the environmental scanning and reporting system. Planning Cells in each of the manufacturing units were fully constituted in 1978. These cells were advised by the Corporate Office to initiate studies to evaluate their respective units environment, strengths and weaknesses, and identify the gap that needed to be bridged. Interaction between the planners at the Corporate Office and units was facilitated through mutual consultation and joint studies. The Corporate Office published a Corporate Planning Guidelines series to explain to the unit planners the concepts, tools and techniques of Corporate Planning and the role of individual functions like Finance, Marketing and Production in Corporate Planning. Data formats were developed to facilitate consolidation and comparison across units. The formats required the units to mention the growth from old and new products separately.

Linking the Planning and Scanning Systems—The Corporate Plan 1981-82 to 1985-86

The first attempt towards linking the planning and scanning systems effectively was made when it was decided by the Corporate Planning Cell in 1980-81 to project the environmental developments in the next five years from 1981-82 to 1985-86. This study was sent to the unit planning cells for analysis and appreciation. To enable them to analyse the implications of the forecasts, product-industry matrices, giving information on which product of the unit was demanded by which industry and what was the importance of each industry to the unit in terms of order inflow were developed jointly by the corporate and unit planning cells. A chapter on the analysis of the environment was to be a part of the plan document to be prepared by the unit.

It attempted to project the trends in the environment by studying the past performance and programmes and projects that could be taken up during 1981-82 to 1985-86. Use was made of a macro-econometric model and data contained in the draft Five Year Plan 1978-83, published by the Planning Commission, Government of India. The scenario emerging from this exercise was divided into two parts. The first part presented the forecast of general macro-economic factors such as the availability of key inputs, prices and costs, industrial relations, public sector performance and international trade. The sectors were devoted to socio-cultural, political, and technological environment focussed on the growth of electronic technology, and the inroads it was expected to make in the business lines of the Company. The need for acquiring capabilities in applied electronics and systems was stressed.

The guidelines for formulating the Corporate Plan 1981-82 to 1985-86 and the study of the environment were discussed in a conference of the general managers of all the units and an approach to the plan was finalised. In the context of this approach, the units formulated their objectives, set up goals, forecasted their sales and costs to check whether the goals could be achieved, identified new products looking at the opportunities discussed in the study of the environment, if the present products could not achieve the goals. The assistance of the Marketing Planning Department was taken by them to conduct a survey and obtain more information on the likely acceptable price, likely demand, type of technology and the existing and potential manufacturers of these products in India and abroad. Only those products that enabled the units to achieve their goals were included in the final plan of the unit. The unit plans were consolidated into a corporate plan after checking for the achievement of the corporate goals and introduction of new business lines to bridge the gap. Thus, in this exercise the environmental input was well integrated into the planning process.

Looking Beyond 1985—A Brainstorming Session

While formulating the corporate plan for the period for 1981-82 to 1985-86, it was realised by the management that the products and projects included in the plan would keep the resources of the Company

utilised optimally till 1985-86 and that thinking on products after 1985 should start in 1981 if the Company did not want to be caught in a vacuum. With this in mind, the Corporate Planning Department organised a brainstorming session for generating new product ideas. The session was participated by the young executives of the Company who were expected to have a stake into future. A document on the future of the Indian economy by 2000 A.D. was prepared as a basic for analysing the future environment and generating new ideas. This was another way of integrating environmental scanning exercise into long range perspective planning.

Thus by 1981-82 the company had developed a formal environmental scanning and reporting with the following features.

* Scanning and reporting activities manned by trained specialists.

* Formal reporting of development in the environment and their implications for the company's performance and prospects through periodicals and special studies brought out by both the corporate planning and other functional cells in the company.

* Organised collection of selectively identified information through own effort and an external agency.

* Intention to develop an econometric model to explain the casual relationship between the developments in the environment and the performance of the company.

* Environmental scanning system linked effectively with the planning system.

Part II—An Analysis of Processes and Influencing Factors

It can be noted that it took nearly a decade for this company to develop a comprehensive environmental scanning and reporting system, and integrate it closely with corporate planning. The process was slow and the time taken was long. This could be attributed to the cautious and incremental mode of developing the system opted for by the company. To start with, the resources allocated were limited. They

were gradually increased as the company acquired familiarity with the task.

The company did not open all the fronts simultaneously. It started with scanning primarily for one activity, namely, marketing planning for industrial products and extended it to other products and company wide planning as it gained experience.

Key Phases

Based on the description, it is possible to conceptualise the process of developing the scanning and reporting system as consisting of three key tasks, namely, acquisition of skills and knowledge, creation of data base for analysis, and development of reporting system. This is shown in figure 1.

Identification and Acquisition of Skills and Knowledge

This could be considered to be an overriding task which would determine the efficiency and effectiveness of the execution of other two tasks. What skills and knowledge to acquire and how to acquire are the questions faced by a company in this phase. The means for answering these questions could be :

for identification

- (a) company's own knowledge
- (b) consultant's help

for acquisition

- (a) training of internal people
- (b) recruitment
- (c) outside help.

We can note from the experience narrated above that the company opted for a mix of all the options.

Company's own knowledge, though very limited and consultant's advice were the means of deciding what skills and knowledge to acquire.

Having decided this, the company chose the midpath approach of ensuring a mix of internal people and newcomers. Internal people were sent for training outside. An inhouse training programme was also organised. The choice of the new recruits was also balanced. A qualified economist supplemented the skills and knowledge of an industrial engineer in the

Figure 1

Development of Environmental Scanning and Reporting System

Key Phases	Means of Accomplishment
<p>1. Identification and Acquisition of Skills and Knowledge</p> <p>2. Creation and Updating of Data Base for Analysis</p> <p>2.1 Identification { Factors Sources of Data { Published Unpublished</p> <p>2.2 Collection { Formats Frequency</p> <p>3. Development of Reporting System</p> <p>Form Content Frequency Target Audience</p>	<p>1.A For Identification { Company's Own Knowledge Outside help</p> <p>1 B For Acquisition { Training Internal People { Inhouse Recruitment of Trained Specialists { Outside Consultants</p> <p>2.A Inhouse Search — Interviews with Senior People</p> <p>2.B Literature Study</p> <p>2.C Outside Help { An Economic Monitoring Service A Consultant</p> <p>3.A Regular Publication</p> <p>3.B Event Based Studies</p> <p>3.C Meetings</p>
<p>Influencing Factors</p>	
<p>Economic Performance</p> <p>Company's Strengths and Weaknesses</p> <p>Management Support</p>	<p>Trained Specialists</p> <p>Involvement of Company Executives</p> <p>Stage of Development of Planning System</p>

Corporate Office. Similarly, the new recruits from the business schools supplemented the experience of the executives from the field in the Marketing Planning Department.

The mid path chosen by the company avoided the tensions likely to be created by the team of new recruits only, and also the absence of new thinking, likely to result from a team of old executives. The tensions were also avoided by placing the old executives hierarchically above the new recruits.

Creation of a Data Base

Having acquired the skills and knowledge, the next

phase is the creation of data base for the analysis. The two associated tasks are (1) identification of factors to be scanned and sources of data on these factors and (2) collection of data.

These tasks could be accomplished through interviews with senior executives, literature study and outside help. Here also the company opted for a mix. Starting with an informal exploration the company identified the factors and sources with formal inhouse search, outside help and literature. The data were collected from both inside and outside sources and from published and unpublished sources.

The approach adopted by the company can be

recommended to other companies as well. The staff did not depend on theoretical knowledge alone. They had discussions with senior executives who narrated their past experience and helped them to identify the environmental factors to be scanned. This approach not only developed an awareness among the senior executives of this activity but also contributed to the use of the information made available to them subsequently.

The recognition that environmental scanning is a companywide activity and all those who came in contact with the environment in their activities should participate in the scanning and reporting activity was a significant step in developing the scanning system. By identifying these internal sources the team not only ensured effective scanning but also avoided duplication of efforts. The members did not assume an all powerful role and do everything themselves.

The decision regarding the continued use of an external agency for supplying data on routine and as and when requested basis was like the make or buy decision guided by the economics of the choice. The choice of the company was in favour of exploiting the start up synergy provided by this agency and supplementing their efforts. There by they could spend their energies on analysis and interpretation of the information.

Development of Reporting System

This task could be the most significant one in influencing the ultimate use of the information collected and analysed by the scanning staff: How do we report the developments and their implications? What should be the frequency of reporting? Who should receive it and in what form? These are the questions that would arise in this context.

Starting with the circulation of newspaper cuttings for keeping the management informed, the company developed regular system of information through weekly, fortnightly, monthly and quarterly publications. The audience varied from strictly top management to senior executives of the company.

These publications were in response to the need to disseminate the information systematically. The decisions regarding the form, content, frequency and perio-

dicity of reporting was based on the timing of availability of information and the concern for avoiding crowding of information disseminated. Like, if all were made monthly publications, they would not have been read by the target audience.

Another factor to be noted in this process is the concern for keeping the reading matter in any publication within readable limits, like when more and more information on science and technological developments became available, a decision was taken to start a bimonthly called Science and Technology Review instead of increasing the reading matter in Corporate Planner.

As different subsystems in the company were bringing out their own publications *co-ordination* of this activity to avoid overlapping and dissonance was a paramount need. This was achieved through discussion with these executives and agreeing on the content and periodicity of the publication.

Special studies could be considered to be an effective way of reporting the implications of significant events in the environment. This provided flexibility to the system of reporting.

These phases were not strictly sequential, there was a considerable degree of overlapping and mutual feedback in the process.

Influencing factors

Adverse *economic performance* of the company was the principal factor in drawing the attention of the management to the need for scanning the developments in the environment and formulating plans accordingly. The management was prompt in recognising this and initiating efforts towards developing inhouse expertise in this activity. It also recognised that it should be a continuous and not one shot activity. This *realisation* ensured the *continued support* of the top management which was necessary for nurturing an activity of this kind which could get side tracked in the hub and bud of routine operations. The speech of the chairman laid a sound foundation for this activity.

The choice of options in various phases of the development was determined by the strengths and weaknesses acquired through past operations. It may be noted

that the company started the activity in the middle of its career and therefore had already acquired certain strengths and weaknesses.

Outside consultants played an important role in the initial phase of development. The activity picked up momentum with the recruitment of *trained specialists* in both Corporate Office and Marketing Planning Department. They broadened the scope of the activity developed reporting systems and helped to link it with the planning system.

Involvement of executives already working in the company in both scanning and reporting of environmental developments provided start up synergy to the activity.

The other factor which could be identified to have influenced the development and scope of this activity is the *stage of development of the planning system* itself. The planning system passed from an irregular mode to a comprehensive mode as the company gained experience and finalised the process of planning. In the initial analysis the company tended to focus more on internal analysis and setting the planning system in order. The planning cells had to be constituted at the various units, the company executives had to be trained and formats had to be designed. During this period the company made an adhoc or less formal use of the information on environmental developments. Environmental information was gathered more for keeping the management informed and for performance review is to answer what went wrong kind of questions. A detailed analysis of the environment for identifying opportunities and threats gained importance only when the planning system was fully established. In other words, the demand for systematic and comprehensive information on the developments in the environment increased as the planning progressed from one phase to the other.

It may also be noted that the analysis of the environmental information also became more refined as the planning system was well established.

Thus, economic performance of the company, strengths and weaknesses acquired from past operations, continued support of the management, trained

specialists, involvement of the company executives and the stage of development of the planning system could be considered to be the key influencing factors determining the speed of development and scope of environmental scanning for corporate planning.

Part III: Implications of the Inference

The inference, that the stage of development of planning is an influencing factor, has a significant implication for studies on environmental scanning for corporate planning. Based on the data collected from indepth interviews with vice-presidents of planning, managers of corporate planning and individuals who possessed specific responsibility for environmental scanning or analysis in 12 large companies belonging to eight different industries, Fahey and King (2, 1977) contend that there is no evidence to warrant a conclusion that environmental scanning would become a regular element of Corporate Planning. They reiterate their stand in a subsequent article with Narayanan (3, 1981). This time they collected data not only from indepth interviews but also from questionnaires mailed to the members of World Future Society. Their data showed that despite its perceived utility, environmental scanning/forecasting was not regarded so important as to necessitate a major deployment of resources.

As a kind of rejoinder Thomas (6, 1980) presents a composite picture of environmental scanning practices of nine largest corporations of the World. Based on his data, collected from published information, he contends that there is every reason to believe that systematic and omnidirectional scanning for planning is on the threshold of rapid growth and development. Charles Stubbort (4, 1982), revisited the 12 corporations studied by Fahey and King after three years to find out whether the sample of companies had tended towards greater use of resources in scanning and more continuous scanning methods. His data based on indepth interviews with the planning executives, who in seven out of twelve cases were the same persons interviewed by King and Fahey, reinforced their contention. Five out of the twelve corporations had not changed their mode of scanning from irregular to continuous. Movement towards continuous scanning had occurred in three others. In the remaining four corporations there was a movement in the reverse direction from regular

scanning to an irregular one. According to him, the factors that favoured regular scanning were favourable attitudes of academic and business media, demonstrated success and selection of right people. While changes in top management, decentralised organisations, budget cuts, troublesome information from external agencies pushed the firms away from continuous scanning.

What is missing in these studies is a discussion of the stage of development of the planning system in the various organisations studied by the authors. The studies of King and Fahey, King, Fahey and Narayan, and Charlest Stubbort do not provide any information on the practice of planning in the sample organisations. Thomas' study provides very limited data on the state of planning in the organisations studied by him. Only in the case of IBM and General Electric, we have information on both the planning and scanning systems. Both are of continuous and comprehensive type. The relation between the two is explicitly stated as being "an integral part of the planning process in IBM and" the first step in planning process in General Electric.

We have noted from the case presented here that the development of the scanning system is dependent on that of the planning system. In view of this dependence, any judgment on the future of environmental scanning based on an analysis of data on the practice of environmental scanning without relating it with the practice of planning prevalent in the sample organisations is questionable. There is a need for viewing the two in totality.

Concluding Comment

In the absence of comparative data on how other companies acquired capabilities to scan and report the developments in the environment and developed a system to support it, we refrain from developing a prescriptive model for developing an environmental scanning and reporting system. However this study has helped us to identify a certain set of key tasks, approaches and influencing factors in developing an environmental scanning and reporting system. This knowledge can guide other companies to plan the development of an environmental scanning and reporting system and continue to link it effectively with corporate planning.

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Annexure 1

Inhouse Publications Reporting Developments in the Environment

Reports	Circulated By	Contents	Periodcity	Objective	Circulated Among
1	2	3	4	5	6
1. Abstract of Important Article published in professional journals, in Economic, Management Science & Technology	Corporate Planning Department, Centre for Manpower Development and Research	Important Conclusions of the Articles	As and when deemed Appropriate	To keep the top management informed of the various articles appearing in the professional journals.	Top Management

(Contd.)

Annexure—1 (Contd.)

1	2	3	4	5	6
2. Corporate Planner	Corporate Planning Department	Topics relating to all the aspects of the environment	Quarterly	To keep the Planners abstract of the development in the environment and provide a forum for the exchange of views among the Planners	Top Management and executives attached the various planning cells of the company.
3. Executive Brief	Technical information Centre	National International Developments in industrial products.	Fortnightly	To disseminate information on the national and international developments in industrial products.	Senior Executives of the Company
4. Industrial Engineer* (Disguised Name)	Technical Information Centre	Developments in Quarterly technology (This is a priced technical journal, the contributions of authors other than the company executives are also included)	Quarterly	To provide a forum for discussing the developments in the industries producing industrial products.	Engineers and Engineering Students
5. Marketing News	Marketing Planning Department	Issue of Licence, letters of intent, launching of major projects and key developments in the corporate sector.	Monthly	To keep the Marketing executives abreast of the developments in the economy.	Top Management and marketing executives.
6. Monthly Review of Indian Economy	Corporate Planning Department	Major Developments in the Indian Economy during the previous year.	Monthly	To report the developments in the Indian economy during the previous month and analyse the implications of the same for the performance of the company.	Top Management and Executives attached to the various planning cells of the company.
7. Reports of visits to exhibition and participation in conferences, delegations and seminars.	The visiting teams or individuals	Relevant observations	As and when visited	To share the experiences and developments with company executives.	Company Executives

(Contd.)

Annexure—I (Contd.)

1	2	3	4	5	6
8. Science and Technology and Review.	Corporate Planning Department	Major products and processes developed in the world.	Bimonthly	To report the major products developed in the world and identify the opportunities open to DMC Limited.	Top management and executives attached to the various planning cells of the company.
9. Special Studies	Corporate Planning Department	A detailed analysis of the impact of major developments in the environment on the performance and future of the company.	As and when deemed appropriate	To study the impact of major developments in the environment in the performance and future of the company and suggest alternative course of action.	Top Management and executives attached to the various planning cells of the company.
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Environmental Factors and Strategic Planning

SATISH C. SETH

The day to day work of the present/today is keeping most organisations too preoccupied whereby future oriented thinking is being given very little importance in our country. The scanning of the national and international environment for at least a period of 15 years and beyond is essential, says the author.

Satish C. Seth is Deputy Secretary, Department of Science & Technology, Government of India

A corporate entity is primarily a product of history. It is the response of the present to serve the future. Future as everyone knows, is a state of 'uncertainty'. The strength of a corporate entity, therefore, lies predominantly in the maturity, accuracy and resilience of its response to "uncertainty".

Today, all corporate judgements have to be made in a highly turbulent and shifting and uncertain national and international environment.

Future oriented thinking/inputs are thus of the highest importance for the growth and survival and general economic and managerial health of a corporate sector.

Such an input necessitates the presence of those who can make available to the top management or the Board-room benefits of futures research and analysis and a scientific management system. Corporate decisions and judgements have to base on such information and data, where several alternative approaches have been made to predict or scan the emerging environments. Such is thus the bed-rock on which sound corporate strategic planning can be based. The basic point here is not how accurate the scanning of the state of uncertainty is. The key point is can the management of an undertaking can say that given this future uncertainty how well our organisation shall perform in

the future? And what it shall be doing then? And to what effect?

Ad-hocism is one way to manage or mis-manage things. Management based on long-range thinking, future oriented scanning and intelligent response to societal considerations is another. Futurism in management thus provide those building-blocks which can ensure corporate survival. The economic stakes of every corporate entity are enormous and they have several long-range implications. No company or an undertaking is set up just for a few year's life. It goes into the lift of a nation or can operate beyond the national boundaries for several years to come. The astonishing speed of technological change in the international environment is today affecting every nation social and industrial scene and choices both in the private and the public sectors. Thus the manager of today has to be one who can command information both national and international information of the concerned systems and by systems in his field of operation. He also need easy access, internal or an external, to such information which is drawn by the application of tools and techniques of anticipatory management and technology forecasting. The strength of a manager or a corporate entity in the world of today and tomorrow is directly related to the strength of his future oriented information base.

A manager, perhaps, cannot afford to be blind to the historic facts. He has also to make assumptions about future based on robust commonsense or intuitive judgement. But he can vastly help himself, qualitatively, if he uses the fruits of futures analysis. Since futures analysis and technology forecasting can make his assumptions more explicit. It can further help him in balancing his view, outlook and judgements on the historical facts and the visible and invisible trends. We now turn to examine the concept, anticipatory techniques and importance of technology forecasting, for corporate strategic planning.

Future : *The Concept, Anticipatory Techniques and Importance of Technology Forecasting for Corporate Strategic Planning*

Future : The Concept

Future is a stage in the flow of time. Future is where

things shall happen. Future can be glimpsed through two kinds of events :

- Events which we would like to see happen—
A Fulfilment (opportunity).
- Events which we would not like to see happen—
A crisis (threat).

Past is gone. We can do nothing about it. We can act in the present. Take decisions—Make judgements on or about things which may take place over a time—in future. We can perhaps, influence future; even shape it; at least, we can prefer a future : (a) for our society (social futures), (b) for ourselves (Private futures).

In a sense "Future is Today". Whatever we do today has an impact on the Future. The study of future is thus a powerful tool of management. Do all Managers and Developmental Administrators know how to anticipate future?—Futurology enables them to do so. Futurology is the inter-disciplinary body of knowledge and analytical tool which can help scan and mop out Future. It is thus an important input to planning since it generates ideas and alternatives for decision makers by studying long-range future—as against short range—the long range possibilities.

Other Characteristics of Future

Future is change. (Do we know our direction of change?). Tomorrow does not necessarily repeat today. We cannot in a linear fashion walk up to future. It is full of breaks and discontinuities. It is a state of uncertainty. There are no a priori socio-economic future facts. Individuals can colonize future with their individualistic and private thoughts about future. (What we need to evolve is societal thinking?) Future oriented thinking can be of two types : (a) Deterministic, and (b) Normative. In social terms concern of future is with the needs (as distinct with desire) of people of today and the needs of coming generation. Future is anticipatory imagineering and its management and realisation.

Future Scanning Needs an Early Warning System

Future oriented studies and anticipatory activities

require sound information and data base. Anticipatory function is a highly skilled and analytical exercise. Early warning system records signals of future events. It needs both data and research besides detailed interpretation of facts in terms of—(i) future threats, and (ii) future opportunities. Early warning system helps decision makers by providing anticipatory knowledge. (A decision maker should anticipate and not react. A decision/an investment should be based on anticipation and not reaction). Early warning system makes Managers to work in terms of consequence (Future) and not precedence (Past) thus preparing the base for new policy, and safeguarding Organisational/Corporation interests.

Threat & Opportunity Inventory

A futurist has to catalogue likely future threats and likely future opportunities. This requires, amongst other things, rigorous Trend Analysis. They study of a trend calls for systems analysis both of the internal and external sub-sects and socio-economic environment as well as of their interrelationships. E.W.S. combined with systems analysis can help prepare threat/opportunity inventories. A policy maker can use such inventories to capitalise on—(i) opportunities and to prepare the organisation/system to cope with or eliminate the (ii) Crisis. (Futurology is thus an exercise in preparedness and not an escape function).

Extrapolative & Normative Futures

Extrapolative Futures are deterministic in character. Here we assume that all the variables in a given development system will continue to change at the same rate and in the same direction over the year. In Normative approach it is emphasized that the future is not fixed: many things may occur and administrators and managers and policy makers should explore the various possibilities and then set a norm/goal—choose and prefer a future—and try to realize it. The essence of Futurism lies in generating alternatives in preferring futures—even inventing them, if possible. The emphasis is not on Forecasting but on fulfilling and achieving future goals (anticipated and preferred).

Methodologies for Future Scanning

(Note 1: No single technique of anticipation by

itself is fool proof. It should be judiciously combined with others.)

(Note 2: There are more than 100 forecasting Methodologies in use. Only a few illustrative anticipatory techniques are mentioned here.)

Brain Storming

It is an elementary approach wherein groups can be inspired to conjure images for future or any topic followed by discussion how to realize the same.

Trend-Extrapolation

It involves plotting of historical values of a factor and extrapolation of past phenomena into the future.

Delphi

Assessment of future based on intuitive knowledge and judgement of a matter in hand through a confidential group field feed-back process of experts geographically distantly located to determine consensus, if any. It is an improvement on the Committee system.

Simulation Modelling

It is based on the interaction between three concepts: Systems, mathematical modelling and simulation. It helps provide judgement on the validity of alternative course of action/policies.

Cross-Impact Analysis

Here one assesses the expected impacts and probabilities of occurrence of individual events upon each other. One develops a matrix of possibilities. This technique helps in policy analysis/strategic planning, where alternative courses of action may be evaluated in the context of a complex, interacting environment.

Scenario Building

A scenario is a sequence of events. Scenarios are narrative and/or mathematical manifestations of a

future state of affairs. It helps to grasp the vision of the future. There can be four kinds of scenarios :

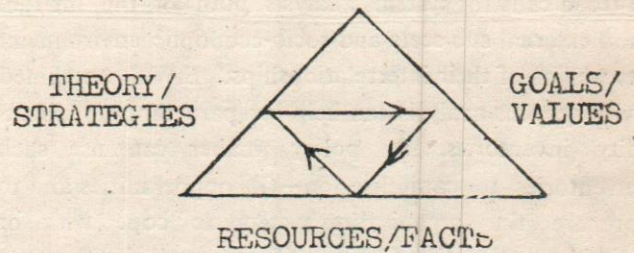
- (i) Macro level (Societal & Global)
- (ii) Micro level (Organisational/Corporate)
- (iii) Forecasting Scenario (Description of probable future)
- (iv) Design Scenario (Creative/normative image).

There are several other techniques drawn from the disciplines of mathematics, statistics, operations research which should be used selectively according to the area under scrutiny. These are: Regression analysis, Time-series smoothing, Sales-force composite, Use of Index numbers, Box-leaking approach, Econometric models, Input output models, Simulation model, Life cycle analysis. There has been a further spurt in the development of a wide-range of other forecasting methods by the late 1970s which have been used by many scholars world over. These are: Mean forecasts, Moving averages, Exponential smoothing, Naive forecasts, Linear smoothing, Adaptive filtering, Autoregressive moving averages, Simple regression, Life-cycle curves, Multiple regression, Multivariate autoregressive moving averages, Decomposition, Census II, Foran, Delphi, Historical analogies, Morphological research, Relevance trees, Systems analysis, etc. Different organisation have to define for themselves the place and scope of forecasting function for their organisations. The important point is that forecasting ought to be fitted into an organisation and integrated with other activities. Since forecasting is not yet a career in the Indian private and public sectors, it lies on a periphery and is used very little if at all. It should also be realised that forecasting which provides quantitative data based on environmental scanning, both within and outside of the organisation, is not an end in itself. Spyros Makridakis and Steven C. Wheelwright in their paper on "Forecasting on Organisation's Futures" rightly observe : "the application of a specific method and the obtaining of a numerical output in only one step, albeit an important one, in the process of forecasting: It is like trying to melt an iceberg by heating the tip: when forecasting accuracy is slightly improved, other managerial problems of implementation rise to the

surface to prevent the full realization of forecasting's promise. To achieve systematic and substantial performance improvement, decision makers who rely on forecasts should have a broader understanding of forecasting and the factors essential to its execution."

7. How to Choose a Future

1. Choosing a Future is the most difficult thing.
2. Whose perception of future should one take into account.
3. The answer lies in clear understanding of the following:
 - (i) National °Resources/Facts;
 - (ii) National °Goals/Values, °OR, Organizational
 - (iii) National °Development Theory/strategies.



Explanatory Note

Futurology encompasses applications of technology forecasting, social forecasting and technology assessment.

(1) *Technology Forecasting*: Its simple definition is elusive. Various researchers see different meanings at different levels of planning. For example; E. Jantsch sees three planning levels and defines technological forecasting at each of these levels :

At policy planning level: technological forecasting is the clarification of scientific-technological elements determining the future boundary conditions for corporate (or generally, institutional) development.

At strategic planning level: technological forecasting is the recognition and comparative evaluation of

alternative technological options, or in other words, the preparation of the technological decision-agenda.

At operational or tactical planning level: technological forecasting is the probabilistic assessment of future technology transfer.

(2) *Social Forecasting* realises on techniques of social science research and use of social indicators.

(3) *Technology Assessment* is a thorough and balanced analysis of all significant primary, secondary, indirect and delayed consequences or impacts, present and foreseen, of a technological innovation on society, the environment or the economy. (See E.B. Sheldon & W.B. Moore, Ed., *Indicators of Social Change*, Russel Sage Foundation, NY, 1968).

Importance of Technological Forecasting

What is the importance of technological forecasting? What can it do? Research has covered well what technological forecasting can do, and Bright, lists ten useful purposes. (See J. R. Bright, "Can We Forecast Technology?" *Industrial Research*, March 1968, p. 56).

1. Assisting in the planning of research programs, the amount, direction, scientific skills needed, and so forth.

2. Guiding engineering programs toward the use of new technology and the adjustment to new technical demands.
3. Identifying areas where product improvement will be needed and revealing the need for new products.
4. Setting quantitative performance standards for new products, processes, and materials.
5. Helping to establish the timing of new technology.
6. Assisting and identifying the economic potentials and impact of technological progress.
7. Guiding technological planning and its contribution to long-range planning.
8. Helping to identify major opportunities and threats in the technological environment.
9. Identifying the social impact of technological progress on employment, skills, educational needs, etc.
10. Identifying possible political developments arising out of technological advances.

Societal Considerations and Implications of Future for Corporate Strategic Planning

This can be studied for (1) Indian Scene and (2) the Global setting.

The Indian Societal Considerations

Indian Societal Features (Co-existence and continuation into future of Agraria, Industria & Post-Industria).	Early Warning Signals & Corporate Sector. Likely future threats and future opportunities/possibilities. (It is only an illustrative and not an exhaustive list)	
1	(Future Threats)	(Future Opportunities)
1	2	3
1. Large Human System (1981 AD: 700 m+ : 2000 AD : 1 Billion).	1. Resources Depletion: Demand-Supply Imbalance. 2. System Overload and Sectoral Breakdown in commodity supply in services, etc. 3. Erosion & Malfunctioning in the system/s for both justice and the distributive justice. 4. Others : Not identified here.	Large India population is an asset provided we succeed to turn it into a resource : (1) Ample Manpower. (2) Adequate internal market.

- ment of crisis management sectoral squads.
6. Need for future oriented decision making. (Introduce: Anticipatory Management).
 7. Innovation in administering justice for the vulnerable sections of society. (In the context of present system 90% of Indian population has defacto no legal personality; nor is he a consumer of sophisticated goods.
 8. Involvement of community/citizenary with the governmental programmes: Need to develop new modes (Note: It should be noted that a single approach is not relevant for a large country like India: Each region should develop its own culture and region specific administrative response).
 9. Need to relate R & D and S & T and Engineering applications to social problems. (Both basic and applied research have their place. We need to identify national priorities)

16. Search of new organisational forms which can generate new linkages in centralised and decentralised not-works involving people's and worker's participation.

The key questions of administrative response to prepare ourselves to cope with the challenges of 21st century, (it is only 6,500 days away) lie in five areas where major overhaul, innovation and radical change is necessary. These are :—

- (i) The system of accountability. (Present system needs drastic change).
- (ii) Introducing urgency hence delegation (and whatever else does with it) and inbuilt systems of work disposal). (We have no time for too many consultations).
- (iii) Need for enrichment for increased job stisfaction (Let's give a hardlook to our placement an

1	2	3
2. Acute Poverty conditions.	1. Ethic decay due to malnutrition. From 1985 onward beginning of slow and lingering death of 500m people due to malnutrition in South East Asia-Messorovich & Pestel. 2. Urban overload (1981 AD: 130m+ (2000 AD: 330m+) due to mass migration from rural to urban area. (Water, Housing, traffic breakdowns and sharp decline in the quality of life in urban areas). 3. Others	Increased S & T applications coupled with new management and delivery systems can avert future crisis and can raise physical quality of life. (I) Augmentation of Internal R & D Base. Quantum-Jump (II) Modernisation by taking to Tomorrow's Technology in
3. Uneven state of development.	1. Accentuation of Rural Urban divide leading to social-rift-& tensions. 2. Environmental degradation (Forest depletion: Likelihood of the occurrence of Fuel famine and fuel riots in some parts of India: Acute paper crisis). 3. Others.	(1) Food & Water (2) Health (3) Agriculture (4) Industry (5) Communications.
4. Value Plurality.	1. Crisis	

scanning in all organisations. (It would be a continuous on-going programme).

The Global Setting

The above mentioned illustrative but not comprehensive new policy indicators deserve attention firstly for tactical and strategic managerial stance and organizational reform. Secondly, they suggest that the corporate sector should recognize several new facets of corporate responsibility that emerge directly from the socio-economic environment and the new social obligations, aspirations and values attached with them. For these shall play as much role in the shaping of the future corporate strategies as the familiar conventional economic indicators pertaining to questions of manufacturing, productivity, GNP or quick profit making etc. have done so far.

Since the World War II the economic growth has today acquired an important global dimension and thus India or for that matter no nation—irrespective of its ideology can ignore its implications for tactical or strategic planning.

In the global environmental context of the many aspects that one could examine the key factors shall continue to be the questions of resource, technology, their transfer, the questions of foreign exchange constraints and of foreign investments, etc. However, all these have to be examined in the context of the pulls and pressures to which the International Monetary system, subjects them through the World Bank, IMF, the GATT, etc. The questions of trade, aid, foreign policy and the need for ever increasing international exchange and negotiations are all now part of an international folklore or hymn encapsuled in the term, "North-South dialogue" which essentially is an international endeavour to establish a New International Economic Order. Most corporate entities thus have seek their global context, which Herman Kahn, in his paper entitled, "The world of 1990" presented at the White House Conference on the Industrial World Ahead—

2. A Western Europe/North and Central Africa/Middle East Trading/Investment Area;
3. Comecon;
4. Communist Asia (about 1/4 of humanity);
5. Southern Asia (another 1/4 of humanity), and
6. Miscellaneous.

Such an operational context can be used to develop corporate scenarios both in terms of "trends" and preferred "futures". One such global scenario presented by Herman Kahn on "The World of 1990", in the light of a basic surprise-free (and largely "Business-As-Usual") projection looks at the global settings in the context of politically increasingly multi-polar world with the following features :

- A. Rise of Japan as an economic financial, and technological super-state (and possibly political and/or military superpower).
- B. Rise of France to the largest national economy (at least nominally in terms of GNP) in Western Europe.
- C. Almost full reemergence of both Germanies (but some political disabilities are likely to remain).
- D. An emergence (or increased independence and assertiveness) or new regional and large powers.
- E. U.S.—Soviet strategic equality—or possibly even Soviet superiority—accompanied by a relative decline of both superpowers in power, prestige and influence.
- F. An enlarged EEC, with perhaps a new role for France as the "leading nation" of the community—also possibility of a breakup of the current enlarged EEC.
- G. Possible creation of an Eastern European EEC.
- H. At least ad-hoc creation and perhaps self-conscious advancement of a very dynamic (economically) Pacific Hemisphere Trading/Investment Area. (PAHTIA).

information, data, research and analysis and ability to scan the fast shifting scene on the international horizon where developments in the field of science and technology, in transportations and communications on the frontiers of ocean, space, Bio-technology and international super-power rivalry are at an astonishing fast pace making future's uncertainly even more complex. In fact, globally we seem to stand on a strange threshold where the future of our globe rests precariously perched atop a "cross-road" where from commences one path towards total human destruction and the second path, if the collective of human wisdom can be on our side, can unleash a golden era of prosperity for the entire mankind.

The corporate world, against such an intangible and unpredictable global context, shall have to draw both the threat and opportunity inventory. The concern and study of the global future is, however, now a worldwide effort; on a continuing basis the world of managers and administrators need to keep themselves informed fully. The scanning of the emerging trends point out to several major global dangers. These are :

- (i) Food shortage in several parts of the world;
- (ii) High cost of energy and depletion of both non-renewable & renewal sources of energy;
- (iii) Mineral resources (their exploitation, depletion & transfer);
- (iv) The degradation of environment;
- (v) Nuclear war (the probability of nuclear war is one; it is not zero);
- (vi) Likely accentuation of International Terrorism and the piracy at sea and in the space, and
- (vii) Increased social fragmentation, youth unrest and value crisis and universally people being subjected to the cultural and technological shocks; and unpredictable industrial relations scene.

(For detailed technological crisis projected for the year 1985 by Herman Kahn see Appendix 'A').

In so far as future "opportunities" go, the corporate sector will have to seek them both in the national as well in the global setting. Undoubtedly, the realisation or non-realisation of such opportunities will be the con-

sequences of a certain kind of policy or prevailing political judgement. For instance, take the question of food. For an Indian population of one billion by the turn of century we must produce 250 to 300 million tonnes of food. Presently even though we have done well, excepting in the case of pulses and oil-seeds, our net progress comes to 30 per cent of our potential. Now this sector, in the Indian context, has several implications for the future both for the private and the public sectors. But it is vitally linked with our policy not merely pertaining to Agriculture, but to Irrigation, choice of technology, water management and so on. Besides, we need to have a long-range clarity whether we want to run agriculture as an industry or not? Or what percentage of our labour force should over the years be retained in the agricultural sector? What is our policy to utilise optimally our land resources? It is interesting to observe that even though the U.S.A. and China are nearly 2-1/2 times as large as our country but the arable land in U.S. is only slightly higher than in India and it is much less in China and yet both U.S. and China are able to produce more. Do we then go to the use of higher technologies, more mechanisation of let the present system continue? Or, can we decide a right-mix and pursue it for at least a period of 15-20 years? The point being made here is simply this: If we do not go on creating artificial sectoral barriers and instead make certain national judgements as to the respective sectoral long-range role, we can develop a sectoral growth strategy generating such alternatives in which future needs have been accommodated in the current day decisions and programmes. This way we can avert "crisis" of the future and can even turn some of them into an "opportunity". The same holds for energy, for mineral resources, for safeguarding of environment, forests, for industrial and agricultural resources, etc.

Having formed a long range oriented national policy, it becomes easier to explore and make meaningful negotiations for the global and regional arrangements. All this calls for data collection, its analysis combined with technical competence to develop for long-range visions for various sectors and the society.

The first important lesson is that we need to have a good management information system—our national

and international data sources. This is partly a national responsibility and partly that of the corporate sector who can be served by its apex organisations like FICCI, ACC, Chambers of Commerce etc.

The second important step before one could evolve a sound corporate strategy, would lie in having a long-range future scanning capability. Each organisation should have its internal scanning and early warning group so that the Board-room is provided with several scenarios and detailed information.

The day to day work of the present/today is keeping most organisations too preoccupied whereby future oriented thinking is being given very little importance in our country. The scanning of the national and international environment for at least a period of 15 years and beyond is essential says the author does.

Conclusion

Amongst the top 300 companies of the country even the long-range planning is confined only to a few of them. In the private sector this kind of thinking comes to the Indian counterparts of the multi-national companies only from their principles. (In fact in the private sector even though many top companies do have a Planning Manager, he is, perhaps, the least used man in the organisation). In so far as the public sector goes there are only a few undertaking such as, BHEL, HMT, Air India, who for reasons beyond their control in some sectors are obliged to think in terms of next 15 or 20 years.

Similarly, not enough emphasis is being laid on resources and raw materials that industry needs in terms of their life (How long will they last?) and their consumption rate. Because of the highly troubled international environment, our national operations are getting daily affected. We have to thus ask ourselves: if we run out of some of our indigenous resources from which country are we going to get them. Even if we know the countries with surplus export potential in scarce resources, will that country be interested to give it to us? In such an impasse and uncertainty of the future, what our options are : (a) in terms of foreign

policy, (b) in terms of import substitution, (c) in terms of indigenous R&D, (d) in terms of choice of technology, and (e) in terms of diversification. For all this a healthy, on-going Industry-Government dialogue is a must. Can it be said here that at some point of time in the growth of private sector in India it has lost its initiative to advise the Government. Is it not a fact that most of its dealings with the Government are today based on individual effort primarily directed to safeguard a given company's interests? Do we have an adequate machinery to ensure healthy Industry-Government dialogue to protect mutually recognised long-range national interests.

It has been time and again pointed out by Indian industrialists, and perhaps rightly, that if the Government changes its policy frequently how then can they plan for a 20 years period? The question is that this is true for all countries. Even centrally planned economies do change their policies now and then.

Likewise, no corporate strategy can ever become meaningful if it is not based on mature judgements on technology. Three to five years planning and searching safe foreign technology collaborations does not contribute much to evolve a corporate strategy. India may have touched many post-industrial technologies but we do not yet have a technological culture. Even the emphasis on in house R & D in the private and the public sectors (barring the Government led research laboratory network) is a very recent and half-hearted development. An economist's short-range plan does not take into account "tomorrow's technologies". Tomorrow's technologies need to be accommodated in the current day planning. We do not have today any scanning of technology. Our people do go abroad, do read journals, But which system or apex body is providing our organisations on sectoral or unit level ideas of Tomorrow's Technologies in their particular sector. Is our in-house R & D geared to it? In terms of tomorrow's technology, we should identify which country is going ahead in research and development and then see whether it will be profitable for us because any R & D work will take 8 to 9 years before it can be applied or put into operation. Of course, it varies from industry to industry. All technologies travel. The question how soon can we get it?

Finally, today's manager should understand the society in which he is working. The Indian social scene is shifting. India is characterised by extreme poverty and some islands of prosperity. We have to notice how two basic stabilising factors namely social dependency and charity are gradually disintegrating. Today an average Indian is more conscious about his rights and needs. The organised sector has to create conditions to meet the basic needs of its employees in particular and of the average citizen in general. With this is linked the emerging change and shifts in the field of industrial relations. If we get futuristic signals that industrial relations over a time seem to constitute a threat, then we should take innovative steps, today, to safeguard future interests. The question is: Do we have a long range policy or we are going like in other areas, here too, in an adhoc manner moving from one crisis to another.

The only meaningful lesson one can draw is that the corporate sector in India needs increased exposure to and use of Anticipatory Management and its tools and techniques. This alone will give the corporate world a betterfore-knowledge of tomorrow's technologies, tomorrow's markets, tomorrow's markets, tomorrow's patterns of industrial relations. Such an exposure is vital both to the managers in the Government as well as in the industry. Such knowledge gathering & environmental scanning can operationally help : a corporate entity to evolve realistic strategic plans.

Understanding future and reinforcing the Management in its tactical and strategic outlook is a long, patent and technical business, It is not just "Mr. X's Hobby". It is time the Indian corporate sector took seriously the first few steps.

APPENDIX 'A'

1985 Technological Crisis

By 1985 the following areas are likely to give rise to Special Technological Dangers

- (i) Intrinsically dangerous technology.
- (ii) Gradual worldwide and/or national contamination or degradation of the environment.

- (iii) Spectacular and/or multinational contamination or degradation of the environment.
- (iv) Dangerous internal political issues.
- (v) Upsetting international consequences.
- (vi) Dangerous personal choices.
- (vii) Bizarre issues.

1. Intrinsically Dangerous Technology

- A. Modern means of mass destruction.
- B. Nuclear reactors—fission or fusion.
- C. Nuclear explosives, high-speed gas centrifuges, etc.
- D. Research missiles, satellite launchers, commercial aircraft, etc.
- E. Biological and chemical "progress".
- F. Molecular biology and genetics.
- G. "Mind Control".
- H. New techniques for insurgency, crime, terror or ordinary violence.
- I. New techniques for counterinsurgency or imposition of order.
- J. New "serendipities" and synergisms.

2. Gradual World wide and/or National Contamination or Degradation of the Environment

- A. Radioactive debris from various peaceful nuclear uses.
- B. Possible greenhouse or other effects from increased CO₂ in the atmosphere, or new ice age because of dust in stratosphere, etc.
- C. Other special dangerous wastes—methyl mercury, DDT, etc.
- D. Waste heat.
- F. Noise, ugliness and other annoying byproducts of many modern activities.
- G. Excessive urbanization.
- H. Excessive tourism.
- I. Excessive overcrowding.
- J. Insecticides, fertilizers, growth "chemicals", food additives, plastic containers, etc.

3. Spectacular and/or Multinational Contamination or Degradation of the Environment

- A. Nuclear war.
- B. Nuclear testing.
- C. Bacteriological and chemical war or accident.
- D. Artificial moons.
- E. Projects West Ford, Storm Fury, etc.
- F. Supersonic transportation (shock waves).
- G. Weather control.
- H. Big "geomorphological" projects.
- I. Million-ton tankers (Torry Canyon was only 11,825 tons) and million-pound planes.
- J. Other enterprises or mechanisms of "excessive" size.

4. Dangerous Internal Political Issues

- A. Computerized records.
- B. Other computerized surveillance.
- C. Other advanced techniques for surveillance.
- D. Excessively degradable (or unreliably reassuring) centralized capabilities.
- E. Improved knowledge of (and techniques for) agit-prop and other methods of creating disturbances & disruption.
- F. Improved knowledge of and techniques for preventing disturbances.
- G. Complex or critical governmental issues leading to either "technocracy" or "caesarism".
- H. Nuclear weapons affecting internal politics.
- I. Excessively illusioned attitudes.
- J. Other dangerous attitudes.

5. Upsetting International Consequences

- A. Both new and "traditional" demonstration effects.
- B. Technological obsolescence of "unskilled" labour.
- C. New synthetics or processes—e.g. coffee, oil from shale, etc.
- D. Forced modernization.

- E. Growing guilt feelings by many in wealthy nations—particularly among the alienated or young.
- F. Inexpensive and widely available "realistic" communications and physical travel.
- G. Accelerated "brain drains".
- H. Cheap (synthetic ?) food.
- I. Cheap education.
- J. Control and exploitation of the oceans, space, moon.

6. Dangerous Personal Choices

- A. Sex determination.
- B. Other genetic engineering.
- C. Psychedelic and mood-affecting drugs.
- D. Electronic stimulation of pleasure centres.
- E. Other method of sensual satisfaction.
- F. Excessive permissiveness and indulgence.
- G. Dropping out and other alienation.
- H. Excessive narcissism or other self-regard.
- I. Super-cosmetology.
- J. Lengthy hibernation.

7. Bizarre Issues

- A. Generational changes; e.g. extended longevity.
- B. Mechanically dependent humans; e.g. pace-makers.
- C. Life and death for an individual; e.g. artificial kidneys, etc.
- D. New forms of humanity; e.g. "live" computers.
- E. "Compulsory" birth control for "impossible" groups.
- F. Other external controls or influence on what should be personal or even institutionally private choices.
- G. Life and death sanctions or other control of "outlaw" societies which have not yet committed any traditional crime.
- H. Even the continuation of the nation-state system.
- I. Controlling and limiting change and innovation.
- J. Radical ecological changes on a planetary scale.
- K. Interplanetary contamination.

System Dynamics Model of Material Flow—Case of a Steel Plant

OLAF KLEINE
RAKESH KUMAR

The System Dynamics Method has been applied to simulate the flow of production in a steel plant. This model has been designed to be an aid in long term planning. The model is driven by a time variant input i.e. incoming orders of nine different types of finished steel products. The internal dynamics is generated by six negative feed back loops of a production shop. The material flow takes place through 16 such shops each having its own dynamics which gets induced to other shops as material flows from coke ovens to finishing mills. The model makes explicit the environmental influences, policy parameters and their relationships with production. Together these explain the dynamic behaviour of monthly production. It can now be used to experiment with all that can be thought of to influence the parameters and improve upon the production performance of the steel plant. The extended version of this model which includes the financial aspects is a top management laboratory for experimentation with different scenarios of environmental influence and counter-acting strategies.

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Rakesh Kumar is with National Productivity Council, Chandigarh, India.

Introduction

A system dynamics model has been designed to simulate behaviour of production and inventory in response to changes in exogenous variables such as

- Demand
- raw material & power availability
- technical parameters

as well as changes in policy such as

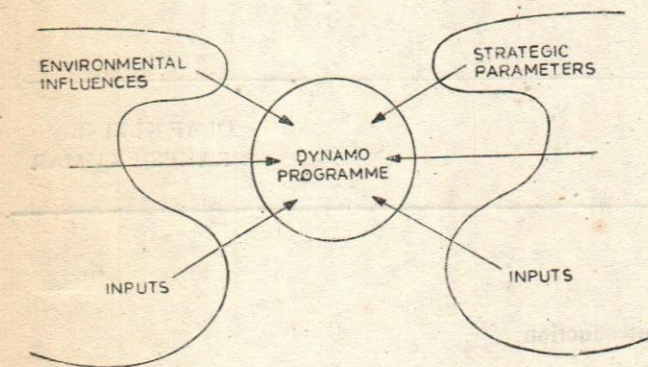
- standards
- reaction co-efficients

The steel plant material flow model is presented here using a deductive approach. First of all the model and the system boundary are described giving the reader a glimpse of the exogenous variables of the model and their treatment for the purpose of simulation experiments. Next an overall view of the model is given, outlining the approach adopted in assembling the submodels of various production shops constituting the whole steel plant. Subsequently, feed back concepts underlying the model of a shop are presented. Some of the built-in company policies which can be tested using the model are briefly discussed. How the model simulates production is then taken up and substantiated with an example. Some insight is given into validation of the model. Finally, some of the various possible applications are presented.

Model and system Boundary

The three components of the material flow model are shown in Exhibit—1. These are

- Environmental Scenario Inputs
- Strategic Parameters
- Dynamo programme.



Exhibit—1

Environmental Scenario Inputs are the exogenous variables of the model e.g. share of demand, supply constraints of critical inputs like cooking coal, power etc. The variables grouped under this head are exogenous based on the system boundary decided by the model designer. Consequently the user of the model has to make assumptions about their behaviour. To carry out the task of making such assumptions in a qualified manner, the model user is required to unearth the various forces of change influencing the exogenous variables and explicitly state his basis for arriving at a scenario. One scenario consists of a set of exogenous variables and their assumed behaviour over the simulation period. Each scenario results in a defined behaviour of production using the feedback structure underlying the material flow model.

Strategic parameters are also exogenous as a result of the system boundary. When compared with environmental scenario inputs, these are considered to be within the control of the management. In other words, the values attained by these variables at any point of time are a result of managerial decision process regarding the choice of technology and organisation. These parameters also have an impact on dynamic behaviour of production.

DYNAMO programme consists of nearly 1300 statements and 96 negative feedback loops. These feedbacks are the third source of explanation of the dynamic behavior of production. Feedback structure, environmental scenario and strategic parameters together result in a behaviour of production.

In all cases when the simulated production does not match the expectations of the management, the programme provides the opportunity to simulate changes in strategic parameters till the simulated production is identical with the desired production. This exercise provides the management an insight into the extent of changes necessary in strategic parameters. Now the question arises whether these can be accomplished with the existing technology or not. In case the answer is 'No' the need for change over to new technology becomes obvious. This programme can also be used for appraisal of projects which could be contemplated for improving the production in the steel plant. Heuristic simulations and project appraisal carried out using the package are exhaustive, reliable, impartial, quick and cheap.

Model of Steel Plant

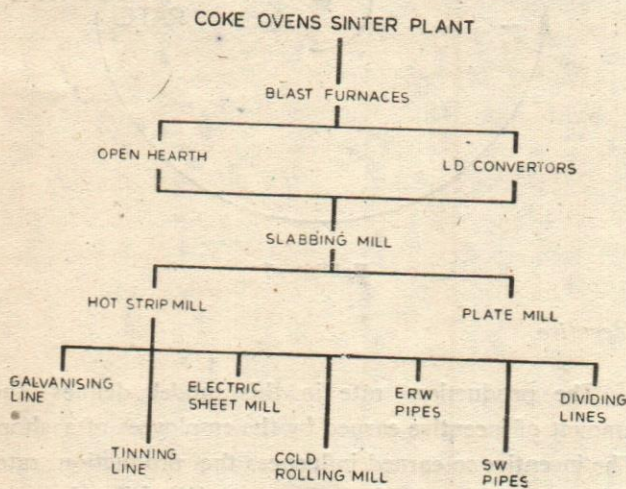
The dynamo package simulates flow of production of 9 varieties of finished steel products. These products are:

- Cold Rolled Sheets
- Hot Rolled Sheets
- Spiral Welded Pipes
- Electric Welded Pipes
- Heavy Plates
- Dividing Plates
- Galvanised Sheets
- Tinned Plates

The monthly incoming orders of finished steel products are the prime movers of material from one shop to the other. Using suitable conversion factors the incoming orders are converted into requirements of various in-process materials like coke, hot metal, ingots etc. This computation results in definition of monthly

inflow of work orders for each production shop. In case this inflow of orders drops down to zero, production also comes to a halt and as order inflow picks up production responds, subject to the constraints of capacity and material availability.

The model distinguishes 25 levels of different inventories, including major raw materials like ore, coal, limestone etc. and semi-finished products like coke, hot-metal etc. and the nine varieties of finished goods. The material flow beginning with raw material, passes through sixteen shops which are arranged in six stages of production before it becomes finished steel as shown in Exhibit 2. A stage comprises of one or a group of production shops. During a simulation period the quantum of flow from one stage to another depends upon availability of capacity, workload and material. Model also takes into account the process loss (yields), handling loss, wastage & scrap. When the production of a stage is further processed in more than one shop in the next stage the distribution key is the ratio of the workload of various shops comprising the next stage.



Exhibit—2

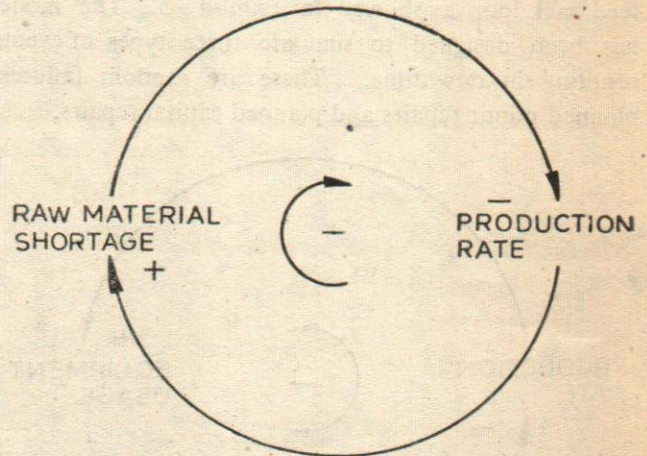
Model of a Production Shop

The feed back structure of any shop of the steel plant has been designed based on six different phenomenon acting simultaneously on production.

Shortage of Inventory (Input of a Shop)

The production rate during any simulation period

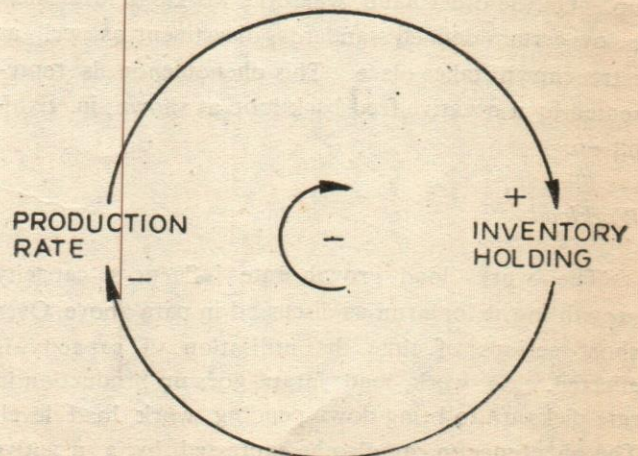
will be throttled in case the raw material inventory sinks beyond an alarming level. The alarming level of inventory and the extent of throttling are the policy parameters built in this model. This phenomenon can also be represented by a feed back loop as shown in Exhibit—3.



Exhibit—3

Excess Inventory (Output of a shop)

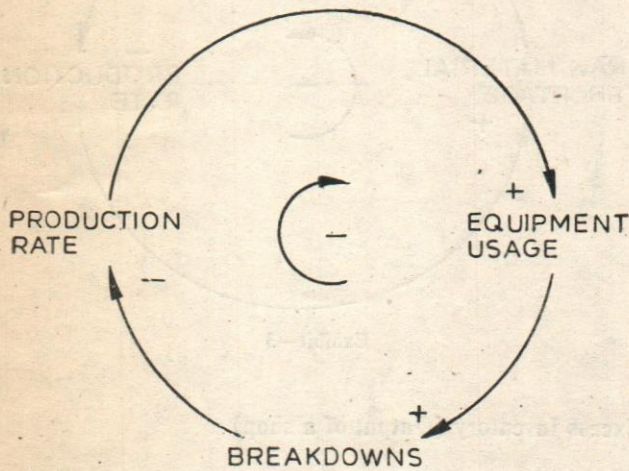
The production rate during any simulation period will be throttled in case the level of inventory holding approaches the alarming level. The alarming level for throttling and the extent of throttling constitute the policy parameters in this model. This phenomenon can also be represented by a feed back loop shown in Exhibit—4.



Exhibit—4

Downtime

The production rate during any simulation period is limited by the installed capacity computed after giving due allowance for downtime. The downtime phenomenon has been modelled as function of usage of equipment. This can also be represented by a negative feedback loop as showed in Exhibit—5. The model has been designed to simulate three types of events resulting in downtime. These are random failures, planned minor repairs and planned capital repairs.



Exhibit—5

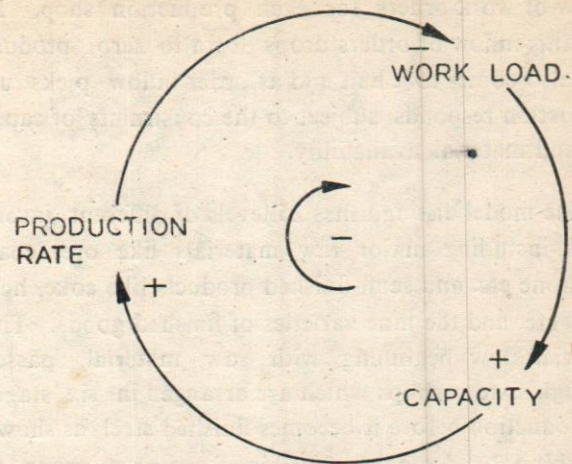
Capacity Shortage

The production rate is also effected by the level of capacity. When workload level exceeds certain defined standards (policy parameter) capacity expansion as well as recruitment takes place to push the production rate up. On the other hand, when the workload level sinks below certain defined standards, divestment as well as retrenchment takes place. This phenomenon is represented by a negative feedback loop as shown in Exhibit—6.

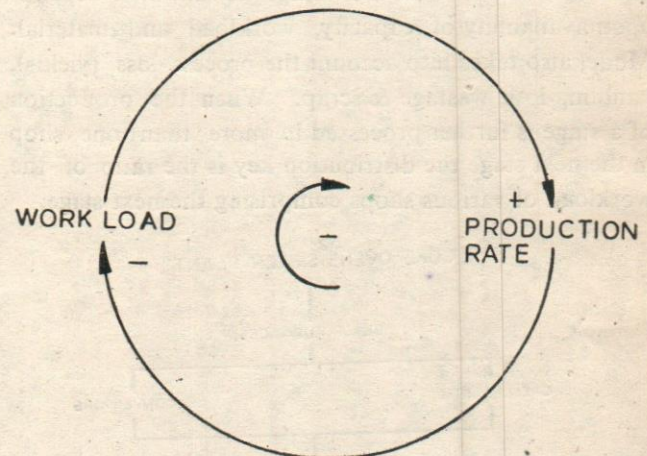
Workload

The work load growth rate influences capacity growth in the long run as discussed in para above. Over short periods of time the utilisation of capacity is effected. As work load inrate goes up production in rate picks up to bring down pending work load level. The phenomenon can also be expressed by a negative feedback loop as shown in Exhibit—7.

PRODUCTIVITY



Exhibit—6



Exhibit—7

Incentive

The production rate in this model defines the amount of incentive earned by the employees of a shop. The incentive so earned influences the production rate. When incentive earned during a period falls short of the expected incentive level, the labour productivity is understood to push the production rate. This phenomenon can also be expressed by a negative feedback loop as shown in Exhibit—8.

Built in Policies

Some of the feed back phenomenon discussed in para 4 have built in policies of the management. These policies are expressed by parameters which represent the conditions when action should be taken i.e.

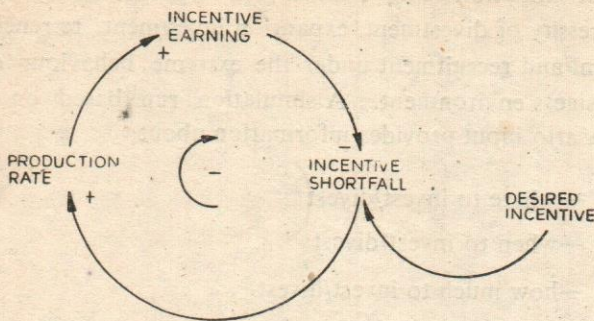


Exhibit-8

inrates or outrates have to be moderated either upward or downwards, so that levels are back to their acceptable limits. The choice of parameters represents management's philosophy/attitude and reflects the degree of risk the management is prepared to accept during decision making. For example, consider raw material inventory level, the policy parameter when compare with the simulated inventory level gives a ratio, which indicates whether control action is desired or not. When this ratio lies between 0 and 1 it implies that the inventory level is below the limit set by the policy parameter and therefore action needs to be initiated by reducing the consumption rate. This is shown in Exhibit-9. Value of ratio greater than 1 does not warrant any

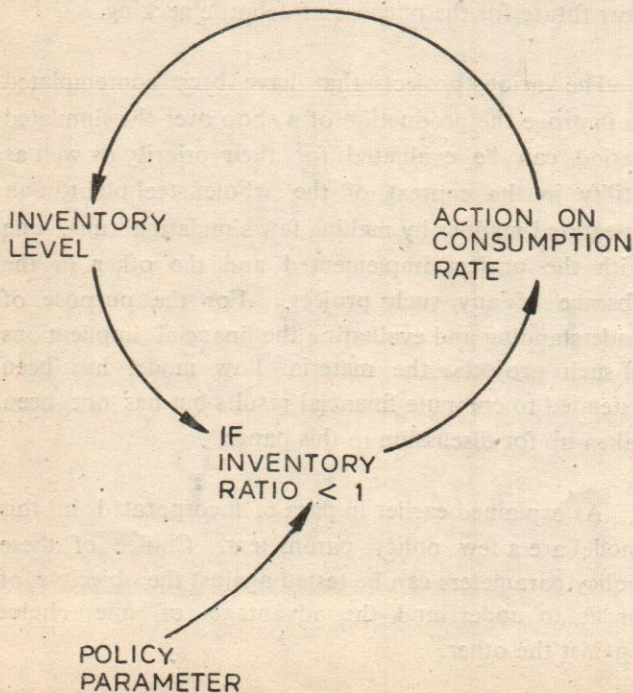


Exhibit-9

action. The degree of action is identified in a coordination system as shown in Exhibit-10.

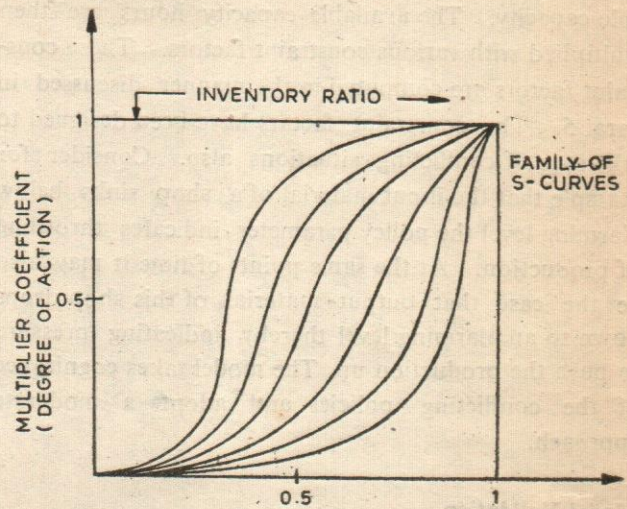


Exhibit-10

On the x-axis is the inventory ratio ranging from 0 to 1 and on the Y-axis the degree of action read as multiplier co-efficient. In case ratio is 1 the degree of action is zero and the multiplier co-efficient is 1, implying that there is no constraint on consumption rate. If ratio becomes zero the multiplier co-efficient is also zero thereby making the consumption rate also zero. In between the two extremes there is infinite choice of action represented by a family of S-curves. As the curves move closer to Y-axis they represent less and less risky policy as far as inventory shortages are concerned. The choice of curve represents the risky posture of the management. This methodology of identification of policy parameters, computation of ratio and reading the degree of action from S-curve has been applied in most of the cases for modelling production constraints as well as pressures pushing the production to go up.

Production flow simulation

The monthly simulation of production of a shop begins with calculation of the installed capacity. Installed capacity is represented by the level of machines which is also expressed in terms of maximum machine hours. These are then adjusted for downtime to arrive at available machine hours. Similarly the level of men employed is translated in term of available man-hours after taking into account absenteeism. To compare

the two, machine hours are translated into equivalent manhours. Minimum of the two represents the available capacity. The available capacity hours are then multiplied with various constraint factors. These constraint factors are computed in the manner discussed in para 5. The constraint factors have been designed to take care of conflicting situations also. Consider for example that the input material of a shop sinks below alarming level the policy parameter indicates throttling of production. At the same points of time it may also be the case that output material of this shop drops down to an alarming level thereby indicating pressure to push the production up. The model takes cognizance of the conflicting policies and adopt a moderate approach.

Model Validation

To validate the models of shops and finally the assemblage of these models i.e. the steel plant model, ex-post simulation have been made. During these simulation the environmental scenario inputs were the actual values and so were the strategic parameters. As far as strategic parameters are concerned only average values were used. Now it was expected that in case model formulation has captured the relevant causes of dynamic behaviour of production the model behaviour, should be in close proximity with the actual behaviour of production in the past. By close proximity it was meant that the average simulated value should be with in an accuracy of $\pm 1\%$ of actual monthly average of past 48 months. Also, on comparison at any point of time the monthly simulated production should not exceed $\pm 10\%$ of the actual production value. It was further expected that changes in trends of simulated production should be equal to or above 90% of such changes in reality. All these conditions have been finally satisfied before the model has been used for ex-ante simulations.

Applications

Model has been used to make simulations with two scenarios of environmental inputs based on optimistic assumptions and pessimistic assumptions; keeping the strategic parameter values same as had been used in

final validation run. This has been done to study the necessity of divestment, expansion investment, retrenchment and recruitment under the extreme behaviour of business environment. A simulation run based on a scenario input provides information about

- where to invest/divest
- when to invest/divest
- how much to invest/divest

The ex-post simulations have revealed that investments as suggested by model in some case have not been identical with these made in reality. In the course of discussion with management it has been appreciated that the investment proposals made using the model are taking into account an integrated view of the whole steel plant. Vide the conventional approach this integrated view is invariably overlooked and at times distorted to provide adequate justification for certain preferred, subjective choices of investment.

The steel plant model differentiates 6 stages in production arranged in series. During any simulation, run it highlights the stage that has produced the minimum quantity thereby suggesting that efforts to change strategic parameters should be concentrated here in the near future for the purpose of debottle necking.

The various projects that have been contemplated to improve the production of a shop over the simulated period can be evaluated for their priority as well as utility in the context of the whole steel plant in an integrated manner by making few simulation runs, one with the project implemented and the other in the absence of any such project. For the purpose of understanding and evaluating the financial implications of such projects, the material flow model has been extended to compute financial results but has not been taken up for discussion in this paper.

As explained earlier in para 6, incorporated in this model are a few policy parameters. Choice of these policy parameters can be tested against the objective of profit to understand the advantage of one choice against the other.

A System Dynamics Model for Corporate Planning—Case of Engineering Company

R. M. NARCHAL

This paper describes the design and application of a system Dynamics Model in simulating the future of an Engineering Company. The stress has been given in the paper to explain how system Dynamics Simulation Model can be used in designing long range policies of the management. The model also can be used in testing various strategic decisions of the management related to projects, investments and modernisation by simulating the impact of these strategic decisions on the objective variable. Thus the model assists the management in designing the policy to achieve the long range strategic results.

R. M. Narchal is with National Productivity Council, New Delhi.

Introduction

Corporate Planning is the process of translating corporate objectives into the policies of the organisation. Strategies are then worked out through these policies¹ which are then transformed into resources related to action plan that will achieve the objectives. In this process the company has to look into its future to understand the probable values of its objectives. The gap between the desired value of objectives and the probable values of the objectives has to be closed through a set of strategies within the policy framework of the Company². The robust policy design for a company to adopt the right strategies for achieving the desired objectives, has to be based on a complete understanding of the behaviour of different characteristics of the company through simulation Models.

Every company is interested in looking into its future to ensure its survival and growth. Most of the companies have been using the usual forecasting models to look into its future. The choice of the right type of model is essential for understanding the future of the company.

1. Edwards B. Roberts, Editor, Management Applications of System Dynamics, The MIT Press 1978

2. Narchal R.M.—Planning graph a Model for Corporate Planning—Productivity April—June, 1983

This is a case of an engineering company in which the management is interested in developing a computer based model of the company to understand its future. The choice of models available for use are limited to usual economic Models³, planning Graphs and simulation Models based on System Dynamics⁴.

The planning system for this company has been developed based on the System Dynamics simulation models keeping in view the dynamics of the system, the simplicity in understanding the model and its capabilities to evaluate the effect of each strategy based on feed back relationships.

The company and its Boundaries

This company is engaged in manufacturing of process control instruments. The company has got two factories located in Northern and Southern part of India. The company has been supplying these process control instruments in its loose form and as Turn Key System in nine Market Segments.

The company has been manufacturing a very large number of products. These products have been classified into the following product groups :

- * Temperature Transmitters
- * Primary Instruments
- * Secondary Instruments
- * Analytical Instruments
- * Pannels and Annunciators
- * Flow Instruments
- * Control Valves

For the purpose of developing the Model the company has been divided into two Strategic Business Units based on the product market combinations⁵. Each strategic business units has been divided into the following capacity centres. **PRODUCTION REALI-**

ZERS : These are those departments which are directly engaged in production. These departments carry out material conversion from one state to another^{6,7}. The manpower engaged in these departments carry out realizing function of the material. The following departments of the company are classified into this group.

- * Component Manufacturing
- * Assembly of Instruments
- * Erection and Commissioning
- * Packing and Forwarding

Production Informisers : These departments assist the production realizers with the information which is essentially required to carry out production. These departments transform informations from one state to another^{6,7} and do not deal with materials. The departments falling under this category are listed below :

- * System Design
- * Purchase
- * Ancilliary Development
- * After Sale Service
- * Marketing
- * Controllers

Supporting Services Realizers : These departments carry out realizer function to the supporting services available for use by the production realizer functions. These departments deal with materials which are not related to production and transform them from one state to another.

The following departments of the SBU's are listed under this category :

- * Maintenance
- * Tool Manufacturing

3. Naylor, Thomas H.—Corporate Planning Models

4. Rorrester J.W., Industrial Dynamics, MIT Press and John Wiley and Sons, 1964

5. King WR, and Cledand DJ., Strategic Planning and Policy, Van nostrand Reinhold Company

6. Simulation Model for perspective Planning—Case of a Steel Plant, Rakesh Kumar, Productivity July—September, 1982

7. Kumar Rakesh—Perspective Planning Model of a Steel Plant based on System Dynamics principles, Dynamic Vol. 9 Part II Winter 1983.

- * Prototype Development
- * Stores
- * Quality Assurance

Supporting Services Informisers : These departments provide those informations to the management which are not related directly with production. There are six departments falling under this category :

- * Tool Design
- * Indegenisation
- * Management Services
- * Personnel & Administration
- * Accounting & Billing
- * Controllers

Planning System

The planning system for this company consist of a set of System Dynamics Models of the company as given below :

- * Demand Model
- * Company Model—Unit 1
- * Company Model—Unit 2
- * Corporate Financial Model

Each of the above Model has been separately programmed, tested and validated with the exception of the Corporate Financial Model. The Corporate Financial Model although has a separate identity yet has to be seen in conjunction with the company Models for Business Unit 1 and Business Unit 2. The outputs of some Models are inputs to other Models. The Exhibit-1 indicates the flow in the different Models.

Demand Model

The demand of the process control instruments is closely related to the development in the different sectors of the National Economy in which the process control instruments are used. The demand of the company product groups is generated as soon as the investment in any of the sector is made. The total market, therefore, has been divided into the following Market Segments :

- Thermal Power

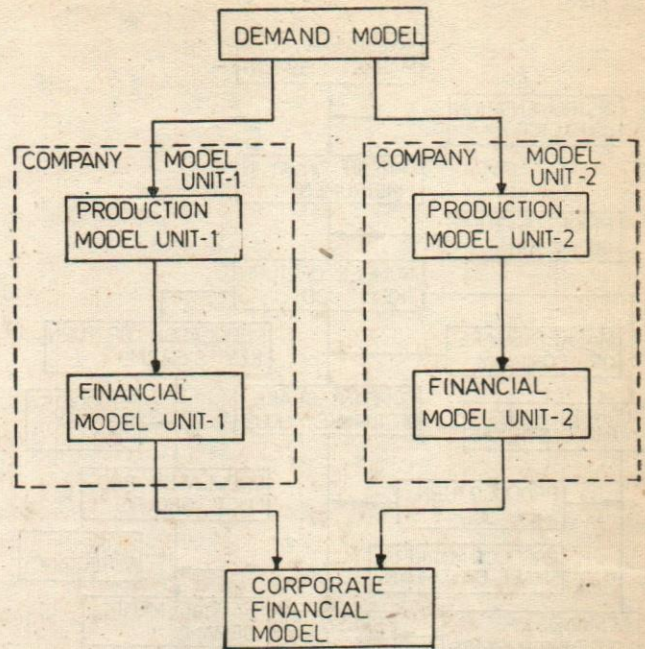


Exhibit-1

- * Steel
- * Refineries and Petrochemicals
- * Fertilizers and Chemicals
- * Paper
- * Cement
- * Non Ferrous Metals
- * Atomic Power
- * Oil Drilling

The Demand Model Works on the principle that demand of instruments in any market segment is primarily due to two reasons :

- Fresh investment in a Market segment leading to the creation of a new unit
- Replacement investment in a market segment at the expiry of the life of a instrument.

The demand for each category of product from each market segment is computed by the Model to generate the behaviour of total demand. Exhibit 2 gives the flow diagram indicating the working of the Demand Model.

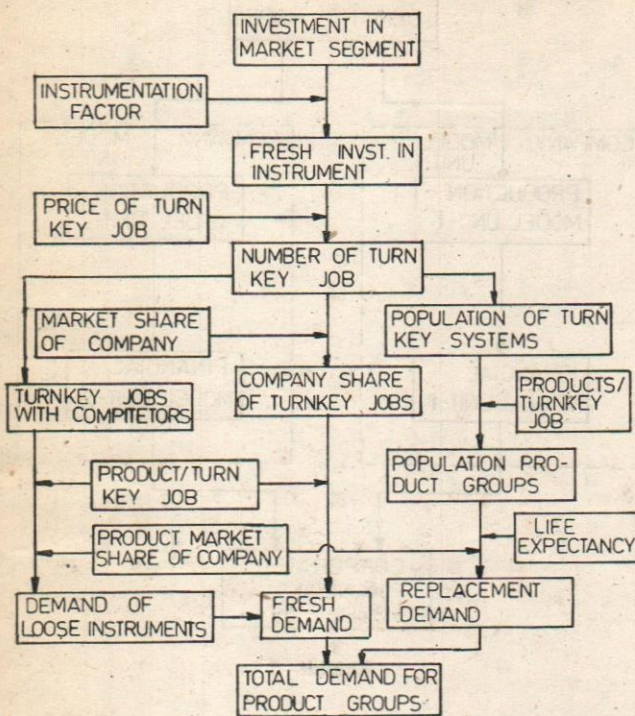


Exhibit-2

Assumptions in the Demand Model

In the demand model formation the following broad assumptions have been made :

- * Investment planned in any market segment actually lead to creation of a unit with a time delay.
- * The prices of the various product groups are inflationary in nature.
- * The plants and instruments have a life expectancy and they are replaced after the expiry of their life.
- * The technology of the plants remain constant over a period of time.

Outputs of the Demand Model

The demand model generates the following outputs :

- Total demand of "turn key jobs" in each market segment
- Productwise/Marketwise Total Demand of each product category

- Productwise/Marketwise Fresh Demand of each product category
- Productwise/Marketwise Replacement Demand of each product category

Company Models

There are two company Models one each for a Strategic Business Unit. The principles used in development of the models is same in both the units. The company models have two parts :

- Production Model
- Financial Model

These two models are coupled with each other and can not be operated independently. The production model simulates the behaviour of production of seven product groups and inventory behaviour of Raw Material WIP and Finished good. The financial model converts the outputs of the production model into its financial results.

The production model has got three types of Raw Material inventories :

- Raw Materials
- Bought out Components
- Completing items

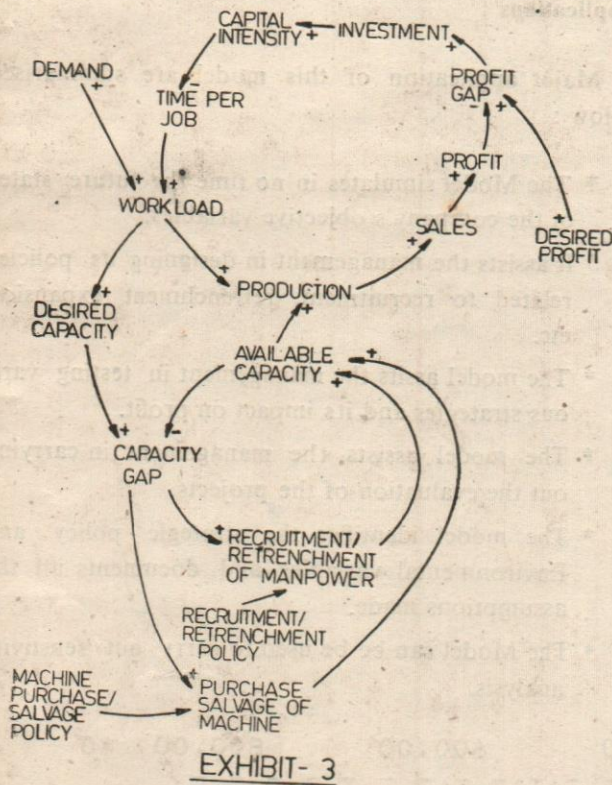
The company, as per its policy, is manufacturing only a few components. The rest of the components are either purchased from the market or given to ancillary units for manufacturing. Some of the completing items such as Voltmeter etc. which the company is not manufacturing, are also purchased from the market. The model computes the requirement of the Raw Materials, Bought out components and the Completing items based on a demand input given to the model. The model, through the feed back mechanism, lead time etc. and company policy of purchase, places order for procurement of these materials.

The model computes the workload placed on each shop after considering the demand of the different product groups. The model compares the workload with the capacity of the shop and the material available with

the shop for production. The production of the shop is then computed as minimum of the capacity, workload and material available all considered in the same units.

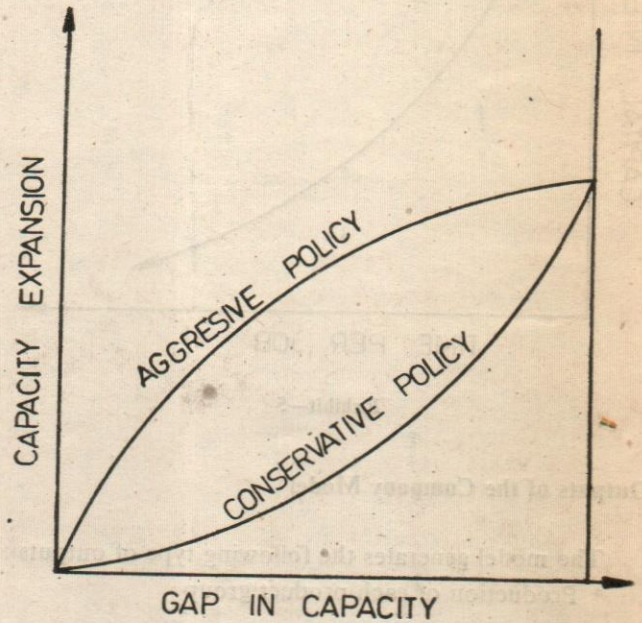
Feed Back Loops and Policy Design

There are three feed back loops in the model as given in Exhibit—3. The two feed back loops relate to capacity and they attempt to shrink or expand the capacity of the shop based on the fluctuations in the Demand and the management policy of expansion.



The management can have a conservative or aggressive policy. A conservative policy indicate that the management reaction of expanding or shirking its production capacity, in relation to fluctuation of demand placed on the company, is slow. In this case the advantages gained by the management when the demand is peak is also less however the risk of the management is also low. An aggressive policy means a fast reaction to the demand fluctuations leading to possibilities of high returns but with greater risks. The management can test different policies and then design a policy suiting

to its objectives. Exhibit-4 indicates the conservative and aggressive policy behaviour. The third feed back loop is for the entire company and its acts only when there is a gap in profit achieved and the desired profit by the management. It attempts to build management policy of investment for mechanising the operations in



Exhibit—4

the shops. It works on the principle that higher is the mechanisation lesser is the time per job. Exhibit-5 indicates a relationship between Capacity Intensity (Mechanisation) and Time Per Job.

The Model, based on the management policy of investment against a profit gap, determines the changes in the workloads and computes the new profit for the company.

Assumption in the Company Model

- * The Model assumes a particular flow of material in the company and changes in flow of material will require revision of the model.
- * The machines and equipment have a life span and they are replaced after their life span.
- * The absenteeism rate and turn-over rate of the employees are constants.
- * All the financial parameters of the company are inflationary in nature.

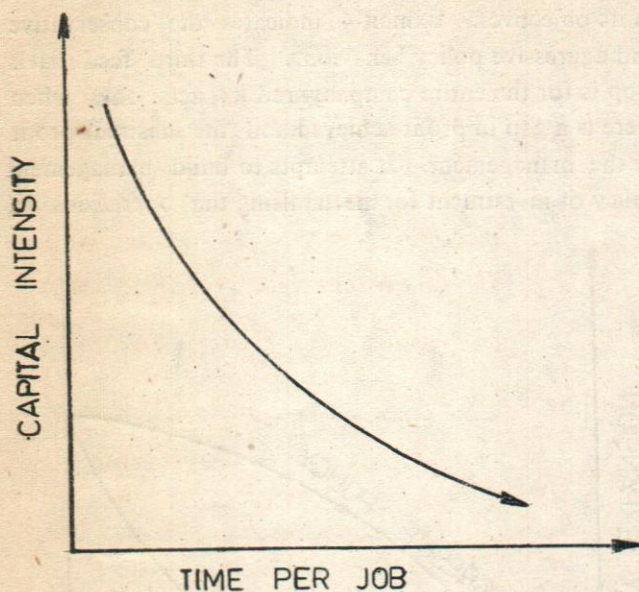


Exhibit-5

Outputs of the Company Model

The model generates the following type of outputs :

- * Production of each product group
- * Production of the semi-finished goods at each stage of production
- * Inventories of
 - Raw Materials
 - Components
 - Finished Instruments
 - Finished goods system at site

- * Other related variables with production such as capacity, manpower, equipment etc.
- * Financial results such as Return on Assets, Profit, Sales, Expenses
- * Assets and Liabilities, Receivables and Payable, Cash, Loan etc.

The company model has been validated for 12 periods and the validated production results for one of the products of the company i.e. primary Instruments is shown in Exhibit-6.

Applications

Major application of this model are summarised below :

- * The Model simulates in no time the future states of the company's objective variables.
- * It assists the management in designing its policies related to recruitment, retrenchment expansion etc.
- * The model assists the management in testing various strategies and its impact on profit.
- * The model assists the management in carrying out the evaluation of the projects.
- * The model identifies the strategic policy and Environmental variables and documents all the assumptions made.
- * The Model can be used to carry out sensitivity analysis.

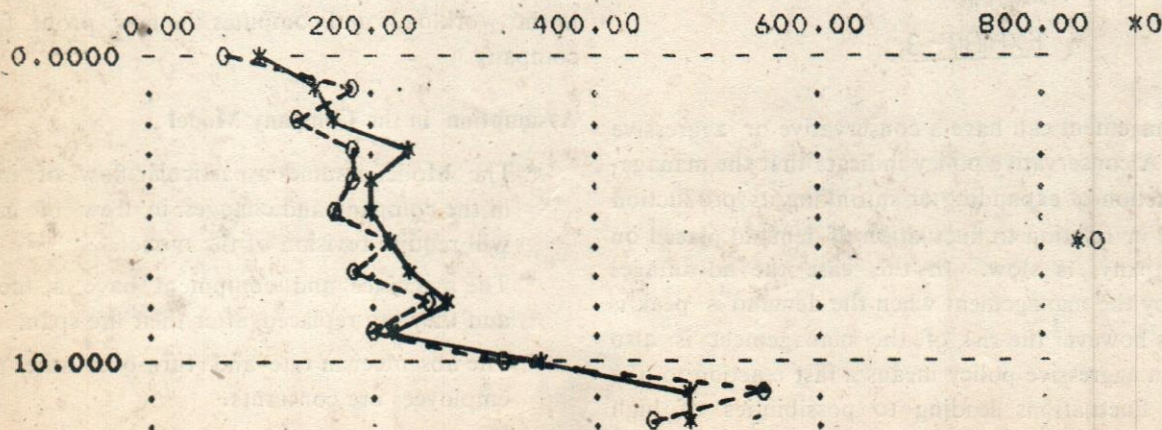


Exhibit-6

Corporate Financial Model

This model combines the company models for unit-1 and unit-2 and simulates the values of the financial objectives of the total company. This model, though is independent in its nature, yet it has no independent strategic importance for the company as the strategies of the company can not be tested in this model. This model has been designed separately to give a choice to the management to independently look into the performance of two strategic Business Units.

Conclusions

In the process of preparation of Corporate Planning System it is very important to ensure that probable state is correctly identified. An adhoc forecasting of probable state may only result in unrealistic value of the probable state of the system indicating a gap which may not be realistic. A simulation model assists the management in identifying a correct probable state and hence allows the management to direct its strategies and policies against a realistic gap to achieve company objectives.

The SIX most important words :
"I ADMIT I MADE A MISTAKE"

The FIVE most important words :
"YOU DID A GOOD JOB"

The FOUR most important words :
"WHAT IS YOUR OPINION ?"

The THREE most important words :
"IF YOU PLEASE"

The TWO most important words :
"THANK YOU"

The ONE most important word :
"WE"

The LEAST important word :
"I"

(Courtesy : FORD MANAGEMENT MANUAL)

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EXECUTIVE READINGS

Business Strategies of Multinational Corporations in India

Lalit M. Johri

Published by :
Vision Books Pvt. Ltd., 1983
36-C Connaught Place
New Delhi-110001
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pp. 172

Reviewed by :
Shri P. K. Dutta
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Kanpur

The multinational corporations have made considerable contribution in the economic development of the host countries. They have brought technical know-how in areas where indigeneous know-how does not exist. They have also brought capital and managerial skill and expertise. In the process these multinational corporations achieved a rapid growth in terms of assets, sales and a virtual domination over the market. Such phenomenal growth and domination in their field of operations together with large finan-

cial resources and managerial competence at their disposal, brought them at centre of controversies. It has also been felt that the business philosophy and policies followed by them are in conflict with economic and social policies of the host government and also pose potential threat to local enterprises. Nevertheless their ability to bring modern technology and capital makes them welcome to the host countries.

In order to control and regulate the operations of these corporations and make them confirm their policies to Government's social and economic objectives, the Govt. of India initiated various measures from time to time such as Industrial Licensing policy, Foreign Exchange Regulation Act etc. The effect of these regulatory and restrictive measures of Govt. of India brought a change in the operating environment of multinational corporations. The response of these corporations in changing their corporate policies with the changes in the environment is a good subject of study by the research workers. The work of Dr. Johri is a valuable contribution in this respect.

Dr. Johri has chosen Drugs & Pharmaceutical Industry for his study. The reasons for selecting the Drugs & Pharmaceutical Industry are (i) its dominant role in promoting good health of the people, (ii) its internationalisation of operations (iii) opportunity to provide a significant sample of companies operating within the same environment. Further Dr. Johri's selected 24 out of the 45 multinational Drug Companies in India because these Companies accounted 74% of the total turn over of the 45 companies in the country in 1974. The composition of the 24 companies with more than 74% foreign equity, 9 companies with foreign equity between 51% and 74% and 10 companies with foreign equity between 40% and 51%. They are from 7 countries.

The study analysed the interaction between the environment and the policies pursued by the companies and the consequent outcome of the policies. The environment is characterised by the various regulatory and restrictive measures of the Govt. The company policies, subjected to the analysis, relates to

(i) product and market diversification (ii) distribution and promotion, (iii) raw material production and imports and (iv) financial policies. The outcome of the interaction between environment and policies is measured by growth and profitability. The method used in the study is structured questionnaire and interview with executives of the Companies.

A attempt has been made in the study to establish the fact that companies which adjust and amend their policies with the change in the environment, achieved better results. These policies relate to (i) restricted distribution of profits as dividends (ii) low foreign exchange remittance (iii) production of drugs in conformity with the incidence of diseases in India, and (iv) production of bulk drugs and intermediates from basic stage. The findings of the study also provided an opportunity to the multinational drug companies operating in India to objectively evaluate their performance in comparison to other companies operating in the drug and pharmaceutical sector. Moreover, the study also focuses how growth and performances of company in a given environment is dependent on its corporate behaviour.

The corporate executives responsible for formulation of policies will find this book very much useful as the findings of the study enable them to get an insight regarding corporate behaviour within the limitation imposed by the environment. To the students of management, the book provides an excellent opportunity in understanding how

corporate policies influence the growth of a company.

Judicial Control of Labour Tribunal
Dr. Gyan Chand

Published by :
N. M. Tripathi Pvt. Ltd.,
Bombay 1983
Rs. 130/-
pp. 335

Reviewed by :
Dr. S. L. Agarwal
Prof. Indian Law Institute
Bhagwan Das Road
New Delhi

The book has seven Chapters relating to Introduction, Labour tribunals, Judicial control—the legal framework, Wages—a judicial analysis, Dearness allowance—a judicial analysis, Bonus—a judicial analysis and the Conclusion. It is not satisfying as to why the other important aspects which the industrial tribunals have been dealing with and on which there are many court decisions, have been kept outside the scope of such a book. Anyway, it is the reasoned decision of the writer. But certainly the scope of the book would have been quite comprehensive had there been a little discussion of other important aspects as well.

The author while writing this book probably had in mind that the awards of the labour tribunals are challenged before the High Court and the Supreme Court and therefore it may be worthwhile to study the judicial control in this area. But

if that is the objective it would have been worthwhile to study and analyse the awards on which the judiciary has departed and on what grounds and what principles it had laid down to be followed by the labour tribunals in subsequent situations. This indeed would have exposed the whole concept of the working of labour tribunals and the necessity and extent of judicial control over them. Unfortunately, this is missing in the book. At least a man of systematic reading of thoughts and ideas coherently presented and produced will be lost to read this book haphazardly written e.g. in Chapter II dealing with Labour Tribunals, the author speaks of adjudication—jurisdictional Issues and he starts with 'Reference' which is indeed not a jurisdictional Issue at all. Then various terms defined under the Industrial Disputes Act are interpreted differently at different times—their details are categorised under this heading whereas it was never a problem of jurisdiction. Then, how the heading 'Labour Tribunal and Collective Bargaining' fits-in on page 47? Again on page 51 the author comes to voluntary arbitration and on page 53 on employees prerogative. Page 72 deals with institutionalised framework of courts and origin of specialised institutions going back to 1215, 1641, 1851. This shows that different ideas are hanging without any joint. Sentences like—'judicial control of executive actions and affairs of the private individuals under the common law system was not just and reasonable'—'By and large, it has been the judicial philosophy of the common law that protection of the interest of capital was just and

reasonable'—'the Wedlock of Labour Tribunals with the ordinary system of law courts in India has resulted in procreating the issues of capitalism' have no meaning nor do they convey any thinking of the author.

Coming to Chapters IV, V and VI the author has tried to give court judgements under wages, dearness allowance and bonus but the judgements are not properly presented. The issues and the decisions are mixed up badly e.g. the author has not differentiated between obiter and ratio decided of a case and has treated them at par and while comparing them one finds confusion and contradiction.

The book has the advantage of having important labour judgements in areas of wages and bonus at one place and one can certainly find out that in how many cases the awards of tribunals had gone in appeal to the courts and with what result. It certainly has a good bookshelf value because of the nice get up.

Linear Programming for Management
M.P. Gupta and J.K. Sharma

Published by :
National Publishing House, New Delhi
23 Darya Ganj, New Delhi-110002
1983
Rs. 25/-
pp. 222

Reviewed by :
Shri Rama chandran
Asstt. Director
(Operations Research), National Productivity Council, New Delhi-110003

While only a few textbooks which give a fairly comprehensive coverage of the total field of Operations Research or Optimization Methods have so far been published by Indian authors through Indian publishers since 1969, there have been relatively more texts exclusively devoted to the one major sub-field of Operations Research, namely Linear programming, particularly since 1975.

This book, which is probably the fourth in its genre after Srinath (1975), Sinha (1979) and Narag (1979), is by far the best as regards coverage of the various aspects of the technique of linear programming for the non-mathematical reader. What particularly makes this text stand out from its three predecessors is the inclusion of material on quality (including dual simplex method), sensitivity analysis, time minimizing transportation problem, travelling salesman problem treated as an assignment problem, and the whole chapter on integer programming methods.

The collection of examples preceding and succeeding the conceptual development in each chapter, followed by the interesting fund of problems at the end of the chapter, serves well to sustain the motivation of the application-oriented reader for a complete reading of the book. However, in the opinion of the reviewer, the inclusion of live cases would certainly have helped in further enhancing the effect, particularly on the practitioners.

The book otherwise fulfils all

needs as a standard textbook on Linear Programming for students of management as well as for the non-mathematically oriented practitioners, and the authors' effort deserves appreciation.

Models for Planning in India
B. A. Chansarkar

Published by :
Himalaya Publishing House
Ramdoot : Dr. Bhabrao Marg, Girgaon,
Bombay-400 004
June 1983, Fifth Edition
U.S. \$ 20 £ 12.50
pp. 187

Reviewed by :
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College (Delhi University), Dhaulakuan
New Delhi-110021

Dr. Chansarkar in his, "Models for Planning in India" made an earnest effort to examine the basic framework of different five-year plans in India. After analysing the assumptions of the models critically, the effects due to errors in estimation of the parameters are considered. The models are then analysed in relation to each plan and a comparative study is made between performance of the Plan and the targets set therein. This procedure is followed for the models leading upto the Fifth Five-Year Plan. Notwithstanding the long period that is covered with the attendant problems of statistical coverage and accuracy of data, the author succeeded to a large extent, in making his study comparatively easy to students of Development Planning

with little or no mathematical orientation.

The analysis brought out in a coherent fashion the significance of agriculture, especially in achieving self-sufficiency in production of food grains, in the process of development. After reviewing the performance of agriculture over the period, a model for the production of food grains is then developed using multiple regression (ordinary least squares) technique. Variations in food production are explained in terms of the plan outlay, area availability of fertilisers, weather conditions, net imports and prices. However, agricultural labour is not considered, due to non-availability of information on an annual basis. "However, the omission of the labour", writes Dr. Chansarkar, "does not reduce the importance of results since the major variation is explained by other variables used".

A multi-regional input-output Leontief-Strout model is then developed for the Indian economy describing the entire economic system in terms of independent industries and inter-related regions (in this case, States of India). The model,

if adopted will enable the planners to choose flexible rate of development for the economy with certain minimum level of consumption. Even the State level planning, the author feels, will not bring the necessary active participation of the entire population. To achieve this end, the author suggests the creation of self-reliant and self-governing smaller units. On the whole, the work is a neat exercise.

A Guide to Transactional Analysis
Practical Hand Book for Managers and Trainers

By Ron Clements

Published by :

Insight Training Limited, Reprinted in India
 by The Indo-American Society, Kitab
 Mahal, 5, Raveline Street, Bombay-400 001
 1980

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 pp. 58

Reviewed by

Dr (Ms) Mani K Madala
 Dy. Director
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 New Delhi

Ron Clements, the special Fields
 Provisional Teaching Member, Inter-

national Transactional Analysis Association, has done a commendable job, in writing this booklet on T.A.

The book is enjoyable, stimulating and practical. The most striking thing about this booklet is its simplicity.

Transactional Analysis is undoubtedly a simple, yet effective tool for the Analysis of communication and behaviour. As such it is a skill most managers and Trainers could usefully apply to their organisational work. The booklet endeavours to present the theory of Transactional Analysis with nicely illustrated discussions on personality, patterns of communication, Behaviour patterns, Self Image, Time structuring and Psychological games. The language used being devoid of jargon is appealing. Towards the end, the application of T.A. in various areas : selling, team building, interview or Training is discussed. To beginners in T.A. this booklet would be valuable. The Get up of the book is excellent, the publishers having taken enough care about both the paper and the Print. Good work.

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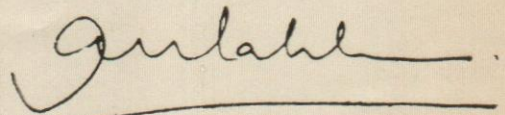
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Letter from the Editor-in-Chief

Productivity is the corner stone of efficient functioning of an enterprise as well as sound economic development for raising the quality of life of the society. Recognising this the country observed 1982 as a year of Productivity, when massive drive for Productivity was made to reach the nook and corner throughout the length and breadth of the country. Following the fruitful experience of India in this regard, the neighbouring countries such as Sri Lanka, Nepal and Malaysia have been trying to take similar steps. Also we may mention that in a small country like Singapore—a model of economic development in recent times, there had been “Productivity fever” which had swung its people to the tune of productivity.

In pursuit of productivity the policy makers, the administrators and the managers are required to plan and monitor productivity as one of their basic functions. In other words productivity is required to be managed for its accomplishment. In this process the measurement of productivity becomes an important link and unless suitable and effective methodologies for measurement are developed and used in the management process, the effective monitoring of the desired result cannot be achieved.

Many conceptual, statistical and theoretical problems arise in measuring and analysing productivity levels and its changes and in applying results of its formation and criticism on economic policy. For instance, in a developing country like India characterised by problems of unemployment and under employment, the early industrialisation programmes are labour intensive and labour productivity, therefore, became all important, initially. However, subsequently the measurement of capital output and capital productivity became even more important in evaluating efficiency of resource utilisation at both the unit level and the country level. It is very essential that all the factors which contribute to productivity are taken into consideration while measuring productivity. The special section in the present issue on Productivity Measurement tries to give the readers an over view of the various models which can help one in measuring productivity.



(A.N. SAXENA)

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