Corporate Failures: Why Organisations Fail to Learn?

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In the present era of environmental turbulence, why some organisations prosper and grow, while others collapse and disintegrate? The author explores the reasons which make organizations fail and decline.

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One of the prevalent concerns in the present times, for both management academics and practitioners, relates to the principles which determine corporate successes and failures. Stated as a question, this concern can be expressed as: in the present era of environmental turbulence, why some organisations prosper and grow, while others collapse and disintegrate?

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Most efforts to answer this question have focused on the principles and practices which make the organisations successful. Correspondingly, corporate success has been variously attributed to pursuit of excellence (Peters & Waterman, 1982), mastering the art of corporate change and transformation (Tichy, 1983; Kanter, 1985), transformational leadership (Tichy & Devanna, 1986), focus on core competence (Prahalad & Hamel, 1990), time-based competition and fast-cycle capabilities (Stalk & Hout, 1990), achieving total customer satisfaction (Horovitz & Panak, 1992), managing quality (Garvin, 1988), lean manufacturing technologies and continuous improvements (Suzaki, 1987; Hayes, Wheelwright & Clark, 1988; Harmen, 1992), and so on. These insights are also largely consistent with each other, and provide significant understanding about the dynamics of success. However, being primarily focused on the successful, they address the issue of corporate failures only by exception, effectively implying that failures result from the absence of one or more of the above attributes. This preoccupation with success of widely shared in the management

literature (with some notable exceptions, e.g., Cameron, Sutton & Whetten, 1988; Miller, 1990, Pauchant & Mitroff, 1992, etc.). While corporate failure is an age-old reality, its study is of a comparatively recent origin, emerging as a reasonably noticeable field only during the 1980s. Cameron, Sutton, & Whetten (1988) found that about 75% of literature on organisational decline and failure was published after 1978, possibly indicating greater consciousness, among the researchers, about the increasing environmental threats to corporate survival. This paper aims to explore the reasons which make organisations fail and decline.

From the life-cycle and population ecology perspectives, organisational decline and death seems to be a natural process, and needs to be understood. In a study of US Corporations, Nystrom & Starbuck (1984) found that close to 90% organisations fail to survive beyond twenty years of their inception. In India, investments worth Rs. 60 billion (about $ 1.9 bn) are held by about 2,000 sick small and medium scale units (Gopal, 1991). Another study (Pascale, 1990) reported that, within five years of their research, two-thirds of Peters & Waterman's 43 "excellent" companies were no longer excellent on the six financial criteria which were used for identifying them; eight of them, in fact, were in deep trouble. Similarly, a report in **Forbes** (Williams, 1988) found that only 22 of the 100 largest US companies of 1917 still figured in the list in 1987. Makridakis (1991) listed out some interesting facts about the prevalence of organisational failures from various studies, such as:

- On an average, it takes 8 years until corporate ventures become successful, while a majority of the new ventures never make a profit.
- For every successful corporate turnaround there are two that fail.
- There were close to half a million business bankruptcies in the world in 1988.
- Between 35 percent and 85 percent (depending on the specific study) of new products fail ever to make a profit.
- Within last 20 years, more than 350 major firms failed in the computer industry.
- In 1989, there were more than $7 billion losses among the top 200 world banks.
- In the automobile industry alone more than 1,500 firms failed in the past.

The fact that this aspect of business reality has been largely neglected is evidenced by Cameron & Whetten's (1983) finding that only one out of the ten organisational life-cycle models which they reviewed considered the phenomenon of organisational decline at all. The other nine seemed to assume, and indicate, an unending growth curve, or at least stability—a fact, which in the light of the findings quoted above, is open to question. Corporate failures and declines are apparently quite prevalent and common, but are somehow hushed up.

The systems view of organisation (Katz & Kahn, 1978) defines corporate success and effectiveness in terms of the extent of alignment and fit between the organisation and its perceived and real operating environments. There can, however, be numerous reasons and ways in which organisations may lose this alignment, and create conditions for failures. While the determining principles of corporate success are more or less similar in all cases, the paths to failure are different and varied. Correspondingly, this paper reviews the literature on the subject to identify broad categories of reasons for organisational decline and failure. It also aims to highlight that organisational inability to learn is a common theme which cuts across these categories.

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Corporate Failures: Reasons

When organisations fail (i.e., go bankrupt, lose market share, show low profits or losses for long periods, etc.), one tends to assign some single, and very often an external, event (e.g., a long-drawn labour strike, failure of a major product, a bad investment, etc.) as the cause. In management literature, corporate failures have been attributed to reasons which are both external (e.g., competition, changes in government regulations, scarcity of inputs, etc.) and internal (e.g., managerial incompetence, structural rigidity, lack of leadership, etc.). Various studies (e.g., Smith, 1966; Cohen, 1973; Argenti, 1976; Kibel, 1982; Lurie & Ahearn, 1990; Makridakis, 1991) have also listed down a number of probable reasons which are likely to make organisations prone to failures. A review of this literature brings out four broad (though not mutually exclusive) categories of reasons.

1. Decline is natural and predictable due to the industry and organisational life-cycles

The most obvious reason for organisational failure is, of course, a change in their "environment niche" (Cameron

& Zammuto, 1983), making it no longer possible for them to survive. Not only do organisations have life-cycles—i.e., they are born, grow, mature and die—but so do whole sectors and industries. During the industrial revolution, mass-scale manufacturing displaced agriculture as the primary means of creation of wealth. In the last few decades, service and information sectors have emerged as replacements for mass-manufacturing industries. Similarly, among industries, textiles gave way to industries like chemicals, steel, construction, etc., which are now giving way to high-tech industries, e.g., computers, bio-technology, etc. It would be natural for organisations to follow the life cycle dictates of their respective industries. They probably do not have much choice either, but to decline once they (and their respective industrial sectors) reach the limits of their S-curve. Makridakis (1991) described this rise and fall of organisations and industries as a natural process of evolution and selection in a changing environment.

In the last few decades, service and information sectors have emerged as replacements for mass-manufacturing industries.

> "As new technologies emerge, the growth patterns shift and new industries and firms appear and prosper. At the same time, the older ones become less competitive and lose their real or relative advantages. Although many of the older industries can operate for a long time after new technologies appear or consumer attitudes change, they lose their dynamism and their potential to generate adequate returns on investment. As they eventually slow down, they are merged into other companies, are bought out, or stop operating altogether."

The components of increasing competition (and consequent decline of less competitive organisations) are, thus, inherent in the life-cycle framework. Growth of an industry attracts more competition, both from new entrants and the existing organisation, both from new entrants and the existing organisations. If one analyses the factors constituting the competition, three basic sources can be identified:

First, competition comes from firms which compete around similar parameters (price, efficiency, cost, volume). Competitive advantage depends on learning to do more of the same thing, but better than the competitor—reduce costs for better profits, increase volumes for achieving economies of scale, provide more efficiency to boost demand, and so on. The Boston Consulting Group's concept of "experience/learning-curve" also implies that a firm's capacity to stay ahead in competition depends on its ability to learn by performing more of similar activities. To do so, the organisation must evolve more complex and sophisticated capabilities for information processing (Galbraith, 1973). That is, it must develop structures, systems and processes which can scan and filter relevant information about competitive environment, draw appropriate pictures of opportunities and threats, and match its internal planning and coordination decisions for gaining competitive advantage.

The second source of competition is from the fragmentation of market by the new entrants, who carve out a specialised segment for themselves. The oft repeated pattern is the emergence of formidable competition from the lower end of the market. These new competitors focus on producing and selling low-price low-margin commodity products, an area usually negelected by the established players. For instance, the main competition to Xerox copiers in the late 1970s, came not from industry rivals like IBM and Kodak, but from new Japanese companies like Canon and Sevin, who had nibbled away its monopoly starting from the lower end. Similarly, in India, the dominance of established companies, like HMV and Polydor, in the audio cassettes market was challenged by a newcomer, Super Cassettes Industries, which started offering low-priced music cassettes to the lower-income group market. The price of Super's cassettes was about Rs 15-18 (with a margin of one rupee), which was one third of those sold by the established competitors, who had so far focused only on the urban elites. In a period of a decade, by the end of 1980s, Super Cassettes had annual revenues of Rs 2.15 billion (about $ 67 million), and a 60% market share. The high volumes possible at the lower-end also provide the new entrants with ample learning experience of technologies, markets, and managerial practices, which is necessary for gradual forays into other higher segments of the market. For the established firms, the counter-competitive strategy would revolve around capitalising on their long experience in the market, i.e., on developing a more differentiated perception of the market-environment, deriving unique and realistic criteria for segmentation of the market, and learning about the specific needs of the particular segments. Organisations which fail to survive and thrive through this kind of competition are those which are unable to translate their learning into marketable products and/or services.

Lastly, the third kind of competition comes from substitutes which replace the existing products and technologies. These constitute products, services and technologies, which emerge out of technological advances, and serve the market needs in a more efficient, but different, manner. Many established and successful companies often ignore the new developments as a passing fad. For instance, the Swiss watch manufacturing company, SSIH, went into a decline because it was unable to recognise that the technological advances had shifted the base of manufacturing technology from mechanical to electronics. Similarly, the Ramington Rand of India Ltd., a one time market leader in the typewriter market, lost out in competition during 1980s—and registered losses—because of its failure to recognise the shift of the technological base from mechanical to electronics and word-processing. New and technologically advanced products initiate a qualitative change in the structure and shape of competitive environment. Companies fare better against this kind of competition, if they (a) learn, develop and maintain a pool of technological assets, (b) are able to combine different types of technologies and use technological interdependences, (c) conduct more and early experimentation in the field, and (d) keep up with the technology trends (Itami, 1987).

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As one would note, the key to hold against the decline (determined by the competitive forces inherent in the life-cycle perspective) is in the ability of the organisation to scan the environment for potential threats and opportunities, analyse this information for better control and coordination of its functioning, and take decisions which can focus on the multiplexity of the environment. A study of 107 successful and 54 unsuccessful companies showed that the former were consistently better in their use of information (scanning, analysis, control, communication, decision-making, etc.) than their counter parts (Miller & Friesen, 1983). Moreover, this difference was apparent across all stages of organisational life-cycle (birth, growth, maturity, revival and decline). In other words, corporate success depends on learning from the environment, one's competitors and one's own actions. Or as De Geus (1988) observed: "the ability to learn faster than your competitors may be the only sustainable competitive advantage."

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2. Organisations tend to get trapped in their past success-patterns, and lose their flexibility to change and adapt.

It would not be entirely accurate to describe organisations as failure-prone. Ironically, the underlying strategies and processes to both corporate successes and failures are often substantially similar (Hedberg, 1981; Miller, 1990). Miller (1992) noted:

> "In fact, it appears that when taken to excess, the same things that drive success—focused, tried-and-true strategies, confident leadership, galvanized corporate cultures, and especially the interplay of all these elements—also cause decline."

For instance, the phenomenal growth of People Express in the early 1980s was built on its entrepreneurial strategies, and unusual culture. It expanded its market share by following a low-margin high volume strategy. It created an informal organisation, with only three hierarchical layers, and keeping the employees motivated by making them share-holders, and by following a strict policy of promotion from within. In a matter of just five years, it had become the fifth largest domestic airlines in US, with an annual sales of $1 billion. However, when competition came, these same qualities which had borne it to success, also became the reasons for its crash landing. Its low margins and entrepreneurial acquisitions did not leave much resources to invest on the infrastructure and match competitors on quality. The policy of internal promotion left the organisation with inexperienced people with little technical expertise to handle critical functions like scheduling, maintenance, etc. And under the pressure of competition, its informal culture could not maintain efficiencies. In 1986, five and a half year after its first flight, People Express had piled up huge losses, and had to be sold off for just $ 300 million (Byrne, 1983).

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To understand why success breeds failure, it is necessary to look at how organisations use their success. Success is a learning experience for organisations: it reinforces behaviours which they must practice to succeed. Correspondingly, organisations "programme" themselves around their successful strategies and processes so that they can consistently replicate their success experiences. One way in which this programming takes place, is at the informal cultural level. Corporate success produces strong cultural norms, based on the belief in the correctness of one's actions. Such strong cultures, however, are also resistant to change, and reduce the flexibility of organisational responses. Kotter & Heskett (1992) found that low performing cultures generally were quite strong, and invariably had a history of past success. As Weick (1985) noted:

> "A coherent statement of who we are, makes it harder to become something else. Strong cultures are tenacious cultures. Because a tenacious culture can be a rigid culture that is slow to detect changes in opportunities and slow to change once opportunities - - - - , strong cultures can be backward, conservative instruments of adaptation."

The other way in which programming of success takes place is through bureaucratisation. Successful organisations formalise their effective practices and procedures, start operating around assured market segments, standardise their successful products and services, make capital investments in tried and tested technology to achieve economies, and so on. They also create inventories, buffers and slack resources to insulate their core activities from getting affected by environmental fluctuations. This process of bureaucratisation is further enhanced because success brings growth, and to cope with growth, organisations need to bring in people who can rationalise and stabilise organisation's activities. Thus, they hire and select people whose major competence is in maintaining status quo, rather than in bringing about change (Kotter & Heskett, 1992).

In either case, the programming of success-routines has an unfortunate consequence for the organisation: it reduces the need to make a conscious analytical response to environment, and so, organisations lose touch with their environment. They become less sensitive to the competitive demands and appear to operate in an imagined environment. For the successful companies, their past learning becomes a hinderance to new learning necessities—they must "unlearn to learn" (Nystrom & Starbuck, 1984). Even when they perceive a need to change, they are constrained by their self-programming, and by their belief in the rightness of their approach (Starbuck, Greve & Hedberg, 1978). This is true not only of the bureaucratised companies, but also of the highly entrepreneurial organisations. Positive past performance seems to be a major stumbling block in the process of strategic reorientation (Lant, Milliken & Batra, 1992). Hyderabad Allwyn, an Indian company, for instance, was a pioneering organisation, which was the first in the country to produce double decker buses, refrigerators, and quartz watches. It had technical collaborations with companies like Mitsubishi, Hitachi, Seiko and Nissan, and had an impressive product portfolio comprising buses, watches, refrigerators, sewing machines, LPG cylinders, compressors, office furniture, etc. Having learnt that success lies in diversifying and growth, the company kept following a target of 30% growth, even though, in the process, it spread itself too thin, and started facing problems of coordination and integration of its operations. By 1993, its various divisions were in loss, and the company was up for sale.

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3. Inappropriate strategic biases and "mental models" hamper the processes of strategic flexibility and reorientation.

Mental models are an essential feature of any kind of strategic action. They help one in making sense of and coping with complex and abundant data. While they provide a focus and cognitive anchoring for perceiving, analysing and deciding about strategic issues, strongly held mental models also influence the managers to overlook important environmental changes.

As would be apparent, strategic biases and "mental models" also result from past successes. It is useful to treat this point separately, however, since they can also arise out of other factors, e.g., CEO's personality, composition of top management team, corporate history, etc.

(Bantel & Jackson, 1989; Wiersema & Bantel, 1992; Lant, Milliken & Batra, 1992). The research on human cognition also suggests that there are human limits to accurate comprehension of the reality, and it is natural (and inevitable) for people to create models of reality to interact with. Kelly (1955), for example, found that most people use just about fifteen personal constructs (mental/perceptual pigeon holes) in making sense out of reality. Similarly, Miller (1956) proposed the "magic number seven plus minus two" as the limiting capacity of number of variables a person can attend to at a time. In the context of managerial decision-making, one of the unsetting implications of March & Simon's (1956) concept of "bounded rationality" is that, not only managers do not, but also *can not*, make decisions based on a complete and accurate picture of the reality. Rather their decisions are based on their, to use March & Simon's phrase, "limited, approximate, simplified model" of the reality.

There are three ways in which mental models, held by managers in the strategic apex, influence organisational decisions, and can create mismatch between the environmental demands and strategic action. First, mental models determine the nature of "relevant" information, which should be considered for strategic action. Managers focus their attention on information which supports, or is relevant in terms of, their current mental model, while ignoring other potentially important environmental changes (Kiesler & Sproull, 1982; Whetten, 1988). For example, in focusing all its efforts on the mainframe market, IBM failed to acknowledge the market potential of personal computing, and, during the 1980s, lost its dominance to newcomers like Apple and Compaq.

Second, mental models determine how the received information will be analysed and interpreted. Thus, if mental models so dictate, even if changes in external environment are noticed, they may be interpreted as "temporary fads" not requiring strategic change (Dutton & Jackson, 1987; Sapienza, 1987). When Singer's sewing machines' sales dipped down, for instance, company's incumbent management found it difficult to believe that the nature of market had changed. Even when the trend was repeated in Europe, it was attributed to the communist victory in France, and was seen as a passing phenomenon (Gopinath, 1991).

Last, mental models also limit the range of options which managers can exercise in the change process. They describe what actions are "possible", "important", or "necessary", and so circumscribe the range of alternative managerial and strategic solutions (Bateman & Zeithamel, 1989; Duhaime & Schwenk, 1985; Dutton, Fahey & Narayana, 1983; Mintzberg, Raisinghani & Theoret, 1976). Atari's success in the video-games market during the late 1970s, for instance, was built on a mental model which gave importance to marketing and sales promotion. Faced with increasing competition, it recruited more marketing personnel and gradually increased its advertising revenue from $6 million in 1977 to $ 125 million in 1982. In the process, it neglected the engineering, software and product-development functions. It lost to its competitors because of its inability to bring out new products in time, and in 1982, for the first time since its meteoric rise since 1977, it registered losses of more than $ 100 million (Hector, 1983).

Obviously, organisational decline follows when mental models fail to change in response to the feedback coming from the environment (Hedberg, Nystrom & Starbuck, 1976; Hedberg & Jonasson, 1977). One must admit that often it is difficult for the members of the strategic apex to decipher whether a downward performance trend is due to a cyclical dip or to a qualitative change in the environment. For instance, Premier Automobiles (India) was amongst the worst recession-hit companies during the early 90s because of its inability to detect the early warning signals of change. Even when sales dropped, it kept up the production. In fact, it even invested in increasing its capacity, which became a financial bottleneck later for producing diesel-driven cars, for which the market was opening. This resulted in large inventories, cash-flow problems, a loss of more than Rs 200 million, and a loss of market share from 23% to 11%.

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There are also a number of reasons why mental models are resistant to change. It often requires dramatic changes in the environment to force organisations to question and scrutinise their mental models (Ginsberg, 1988; Starbuck & Milliken, 1988). This, unfortunately, is not always possible, since, mental models often remain well-protected by the environment and the organisation. Often a munificent or benevolent environment may shield the models and confirm outdated solutions and actions. Hambrick & D'Aveni (1988), for instance, noted that significant weaknesses were apparent in failing companies even 10 years before they go bankrupt; but they would go unnoticed because the environment remained either

munificent of benign. Often short-term growth and profitability can hide significant weaknesses, and in the process, confirm and strengthen outmoded models.

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The organisational information processing mechanisms often filter useful information which can bring changes in the operating models. In formalising their information processing and reporting procedures, organisations inevitably tend to focus on discrete, quantifiable, and communicable events of certain magnitude and nature. This limits the probability of relevant information from reaching the managers and forcing them to change their mental models. Starbuck, Greve & Hedberg (1978) noted that the efforts to focus only on tangible and quantifiable information often cause a neglect of more relevant issues:

> "Many unanticipated events are never perceived at all; others are perceived only after they have been developing for some time... organisations tend to overlook the earliest signs that crises are developing, because the earliest signs are poorly observed variables and they are communicated orally in informal reports."

Organisations fail, thus, when they are unable to add to, change or develop new and different mental models in correspondence with a changing environment. Or in other words, the failure of organisations is often rooted in their failure to learn new ways of perceiving the reality in which they operate.

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4. When faced with threatening circumstances, organisations respond by adopting a rigid posture, which decreases their chance for successful adaptation and survival.

One would anticipate that an experience of a crisis or threat would normally encourage, or even force, an organisation to review its strategies, processes and practices. In fact, many a time this does happen. For instance, the tough competition which Xerox had to face during 1975-85, made it more conscious of quality and customer needs. More often, however, organisations respond to crisis by behaving in just the opposite manner: they become more rigid, and predisposed to rely more on previously learned dominant response patterns (Staw, Sandelands & Dutton, 1981). While this may be a useful strategy to meet the demands of an incrementally changing environment, in conditions of radical change, this proves to be maladaptive, and further intensifies the threat.

Organisational responses to threatening conditions are very similar to how individuals and groups respond to crises. This is also natural, since, after all, organisations consist of people, and their actions are determined by individuals who constitute them, especially those who form the power coalition in the strategic apex. To understand how organisations respond to threats and crisis, it is necessary to understand the behaviour of individuals and groups under similar conditions.

One major impact of environmental threat on individuals and groups is on their information processing capacities. Numerous experimental and field studies on human cognition (e.g., Postman & Bruner, 1948; Postman & Brown, 1952; Menninger, 1952, 1954; Easterbrook, 1959; Broadbent, 1971; Eysenck, 1976, etc.) have shown that under stressful conditions, individuals find it difficult to differentiate and discriminate among elements of their experienced reality. They tend to narrow their range of perception, ignore clues which are peripheral (i.e., "peripheral" to what they consider central), and perceive and respond to the unfamiliar reality in terms of their previously held "internal hypotheses", which may no longer be applicable under the new circumstances. Studies on policy making behaviour during international crisis (e.g., Snyder & Paige, 1958; North et al, 1963; Holsti, 1964, 1971; Paige, 1972; Smart & Vertinsky, 1977, etc.) also substantiate these findings. They showed that under a crisis situation, policy makers tended to simplify and stereotype their assessment of the situation, considered fewer alternatives and consulted very selectively, soliciting information only from those who had similar perceptions and information sources as themselves.

Studies on group dynamics under stressful conditions (e.g., Schacter et al, 1954; Janis, 1972) also replicate a similar pattern. They showed that against an impending threat, groups tend to centralise their leader-

ship and try to maintain cohesiveness by self-censoring those beliefs and information inputs, which are divergent to the group norms (even though these inputs may actually be critical for effective action by the group). Staw, Sandelands & Dutton (1981) suggested that under an external threat, groups operate with an assumption that it is necessary to remain cohesive and to have a leader; this creates impediments in the free-flow of information among members, and a constriction of freedom of individual members. They noted:

> "The group will seek consensus and in so doing will generally support the policies and position of existing leadership. Reaching consensus, however, will often entail the restriction of information, ignoring divergent solutions and downplaying the role of deviant positions. Consensus seeking also involves a constriction of control, such that the opinions of dominant members may prevail and their influence may become centralised. Such changes in information and control processes may, of course, lead to faulty group decision making processes."

It is not difficult to see how these individual and group level processes get transferred to organisational level functioning. Many studies (e.g., Rubin, 1977; Pfeffer & Leblebici, 1978; Starbuck, Greve & Hedberg, 1978, etc.) have shown that faced with environmental threats, organisations tend to emphasise control over effective information-processing and problem-solving. They become more centralised in their decision making, develop taller hierarchies, standardise their activities, and routinise their practices. Even though their information search may increase, it fails to yield new and genuinely novel alternatives, because information sources are selectively exploited. Moreover, the standardisation of their procedures merely yields more-of-the-same-kind of information, and it is interpreted in the same old ways (Starbuck, Greve, & Hedberg, 1978). In other words, when faced with threats and novelty, organisations tend to behave precisely in the manner in which they should not. Bozeman & Slusher (1979) summarised this paradoxical and self-destroying response of organisations:

> "Scarcity-induced stress cause organisations to behave as if complex, dynamic and interrelated environments are in fact simple, static and unrelated. These behaviors include narrower domain definitions, reductions in labor intensive technology, increasing specialisation of technologies, and more mechanistic structures with tighter administrative control. The public organisation's turbulent environment is essentially demanding an increased domain. However, the organisation's response is to constrict its domain."

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Implications

It is clear from the preceding discussion that the causes of corporate failures lie more within the organisations than outside. While external events may trigger a crisis, it is the nature of organisational response to these events which determines their success or failure. The reasons for corporate failures, discussed in the paper, also described the maladaptive organisational responses in the face of a changing environment. As could be seen, one common theme which circumscribes these responses is the inability of the failing organisations to develop and use new knowledge and competencies for developing new adaptive solutions. That is, organisations fail when they don't know how to learn and acquire new perspectives and responses, and to reorient themselves to the emerging environmental demands (Table 1).

One common theme which circumscribes these responses is the inability of the failing organisations to develop and use new knowledge and competencies for developing new adaptive solutions.

Table 1. List of Reasons for Failures

Reasons for Corporate Failures	Underlying Learning Disabilities
1. Life-cycle Decline	Inadequate environmental scanning, and internal competency-building.
2. Trapped by Past Success	Complacency and arrogance leading to rigidity and lack of openness to new knowledge.
3. Inappropriate Strategic Biases and "Mental Models"	Lack of self-critiquing and self-reflection causing misalignment with the environment.
4. Rigidity in Response to Crisis	Defensive and self-destructive routines and practices hampering with adaptive response.

One can also speculate about the required managerial actions and mechanisms, which are necessary to overcome these learning disabilities. Firstly, organisations become failure-prone because they lose touch with their environments. To counter this tendency, organisations need to develop environmental learning mechanisms, which can bring in new information on a continuous basis. Regular and institutionalised practices of customer-feedback surveys, benchmarking, technological collaborations, competitive analysis, etc., can be useful sources of new learning for the organisation, and help it to realign itself with the new needs and challenges.

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Secondly, organisations can themselves generate new and relevant knowledge by consciously investing in the internal development of new competencies. *Internal competency building* activities focus on creating new organisational skills and expertise by enabling its people and systems to learn through experimenting and acquiring new knowledge. For instance, the organisation may invest in technology development by an increased focus on R & D and product development efforts. Similarly, it may build new competencies through activities like training, strategic job rotation, creating a new competency-base by redesigning its recruitment practices, and other innovative human resource practices.

Thirdly, acquisition and generation of new knowledge and skills, however, does not ensure that they will be necessarily used for organisational renewal. Organisations also need *self-critiquing mechanisms* to create receptivity to divergent perspectives. Forums for post-project appraisals, organisational diagnostic studies, executive retreats, OD exercises, etc., are some of the common and widely practiced ways in which organisations force themselves to self-reflect. Such activities also help the organisations to use the resources of their own "loyal opposition" (Toffler, 1985) to create new corporate visions and mental models.

Lastly, organisations do not change, unless they have a direction to change. New knowledge — acquired from the environment, or developed internally through competency building and self-reflection — can be quite an unsettling experience. In the absence of a vision for transformation, it can even make the organisations more defensive and rigid. Organisations, therefore, also need to develop *envisioning mechanisms* to help its members look beyond the existing reality. For instance, if the leadership processes in the organisation emphasise innovation and transformation over conformity and obedience, it would encourage its members to be more receptive to change. Similarly, empowering employees for experimenting and risk-taking would make them more attuned to developing and participating in new corporate visions.

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Researchers in most cases, have focused on innovation typology — technical, technological, administrative innovations (Damanpour & Evan, 1984), or on innovations that range between minor — major/incremental — radical/evolutionary — revolutionary. These studies are mostly cross-sectional, limiting the understanding of innovation life cycle. However, there are some exceptions concentrating on innovation process and the time period of innovation: Van De Ven (1986), points out two models that vary in the design of product innovation. One is the technology-driven model where new ideas are developed in the R & D department and then sent for engineering, production for innovation and then to sales/marketing for distribution to customers. In the second model viz, the customer or need-driven model, new ideas come from customers through marketing department's interaction which are later realized as innovation, through the interaction of engineering, production departments etc. Referring to Galbraith (1982), Van De Ven et al, (1986), state that the question of whether innovations are stimulated by technology or customer need is debatable. But Rothwell's (1977) studies indicate that majority of successful innovations (on an average 75 per cent) arise in recognition of a need, called need-pull as opposed to a new technological potential called technology push. However, innovations could be produced if and only if organizations are sensitive to the environment (Aguilar, 1967; Khan & Manophichetwattana, 1989). Further, Van De Ven et al (1989), conducted a longitudinal research on the process of innovation, and made observations about a wide variety of innovations, as they develop in natural settings. They analyzed and made comparisons across innovations which lead to a clear understanding of how innovations differ in their development, how and why innovations develop over time, how to manage the innovation journey etc.

Majority of successful innovations arise in recognition of a need, called need-pull as opposed to a new technological potential called technology push.

In analyzing the relationship between properties of organization and innovation, Normann (1971), divides the innovation process in two stages viz, initiation and realization. Initiation begins with the process of idea formation and ends when the basic properties of the new product are conceptually outlined and some decision is made to take up the idea and continue the project. Perceiving external events, screening and legitimizing ideas as well as the motivation to take up the ideas seem to be crucial. The second stage, realization, covers the rest of the process, that is, until the product has been put on the market, and possibly to judge the success of the project. Utterback & Abernathy's (1975) study, reports the results of the stages of the development of the production process and how the innovative processes differ in terms of their competitive strategies. Gee (1978), defines innovation time-period as the time elapsed between the conception of an innovation and its introduction into the commercial market. The period covers the point of first invention or basic discovery through various phases of research and development, test, design engineering, manufacturing and so forth. Further, the study explains how different sources of technology, and firm size influence getting an invention to the market place, with reference to the time span of the innovation periods.

These studies deal with product innovations, the competitive strategies of the firms, innovation period and the factors affecting it, the time span of the innovation, market life cycles/product life cycles (Buzzell & Gale, 1987) and technology life cycles (Ryan, 1984). They fail to provide knowledge about the ability of an organization to conduct and manage ILC, and what type of efforts and strategies are required at each stage of the ILC mode. Earlier theories also fail to recognize the role of the environment in influencing ILC. Research of this kind will lead to a theory that would provide some fundamental "laws of innovating" (Van De Ven et al, 1989), proving normative for organizations that aim towards innovating.

Life Cycle Process

Figure 1 is a representation of innovation process in an organizational context. For survival and growth firms collect information about the environment. This

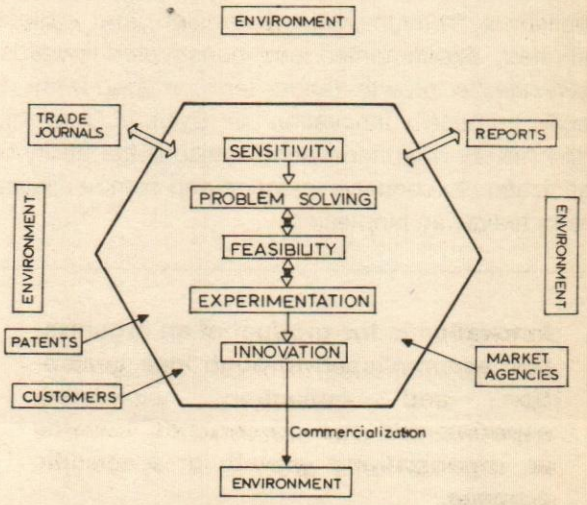

Fig. 1 Innovation Process

'environmental scanning' (Aguilar, 1967; Tushman, 1977, 79), helps the organization to analyze and adapt to the environment in terms of changes in market, technology, consumer attitudes, competitors and their strategies, new market opportunities etc. Personnel from sales, marketing, purchase and R & D engaged in environmental scanning are called 'gatekeepers' (Tushman, 1977). The gatekeepers communicate the gathered information the relevant department (e.g., planning, production, R & D etc.), for utilization. This is the stage where the process of new learning gets initiated as the members of the organization become aware of the environmental changes, needs/demands. This inward flow of information, is followed by meetings or brainstorming sessions for solving problems and identifying new means for accomplishing tasks. These sessions constitute interdepartment personnel, forming a multidisciplinary group. One of the characteristics of the innovating organization is an effective link between different departments and co-ordination of tasks (Lawrence & Lorsch, 1967).

On top management's approval, the generated are sent for testing. This process called experimentation is advantageous as the viability of the ideas/solutions is tested at a small level, involving less risks. The success or failure of the tests is communicated to the relevant departments for further activities like planning, production, marketing. But prior to this, necessarily if not compulsorily, a feed back loop exists between experimentation group(s) and problem-solving group(s). If the experimentation group perceives the need for modification or needs clarification communication continues between them. Once the prototype is finalized after successful experimenting, the firm goes in for production at a larger level to realize innovation. Thus innovation is "the product of an organization accomplished through idea generation and collection, evaluated, experimented and constructed towards an organization's growth (short term or long-term) or a specific purpose". Innovation Life Cycle (ILC) is defined as the history of an innovation, which is the ability of an organization to conceive, develop and commercialize an idea to realize an innovation.

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ILC Model

Innovations are concentrated and/or collective efforts to develop and implement an idea, involving different resources. Every innovation has a life-birth, growth and death, and follows a cyclic pattern. Figure 2 is the representation of the innovation life cycle, indicating various stages. Y-axis represents the degree of the organization's innovativeness. X-axis represents the time taken by an organization to successfully innovate. The following stages are involved in the innovations process:

Stage 1. *OA-Sensitivity:* In the graph, OA indicates the idea formulation stage, wherein the organization collects information and seeks opportunities through both scanning and idea generation.

Stage 2. *AB-Problem-solving:* The second stage is problem solving where the organizational members are involved in solving the problems that are identified, generated and collected. This is the stage where an idea gets fully conceived.

Stage 3. *OE-Feasibility:* This is the stage where the conceived ideas are tested for feasibility. Feasibility in this context is an evaluative criterion, which checks the fit between the solution and the organizational perception of its potential for the furtherance of organization goals.

Stage 4. *EF-Experimentation:* Those ideas that are found feasible are experimented at a smaller level. Experimentation tests the viability of the solution to a product/process. Essentially, experimentation leads to the realization of innovations.

State 5. *BC-Commercial Life:* This represents the commercial life of the innovation, say, product/process.

Stage 6. *CD-Decline:* This represents the declining stage, where the products/processes reach obsolescence. This happens when the product has no demand and/or when market share shrinks.

The organization's innovative ability is reflected in all the stages, OA, AB, BC, OE, and EF but not in the stage CD (hence, depicted in dotted lines), where the innovation reaches obsolescence. Once the product reaches maturity in the market, the organization's efforts concerning the product may also decline. This process which is akin to product life cycle (PLC) and technology life cycles (TLC), is a continuous process and is a characteristic of an innovative organization. The process and the stages of ILC are perpetual in an innovative organization.

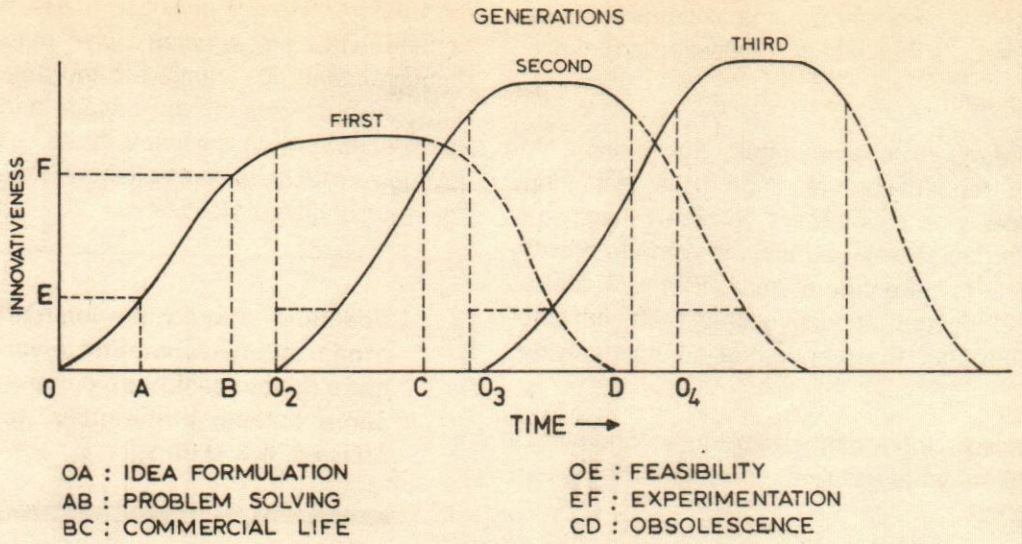

Fig. 2 Innovation Life Cycle

Life Cycles

Innovations are born, grow and die; sometimes they are reborn. Innovations develop over a period of time following the stages of idea formulation, problem solving, feasibility and experimentation leading to innovation realization and commercialization. However, there is no inevitable linear sequence of stages in ILC although there may be similarities among innovations. Some innovations unfold easily and have a smooth process. In some cases, setbacks arise and the innovation journey folds up or the entire process has to be repeated. Some innovations show a rapid growth from the very conception to commercialization. A few have larger commercial life as opposed to some others, which die faster. In some cases a product takes up a recycle pattern, For instance, a firm XYZ on recognizing that market share has shrunk substantially for one of its products despite an existing demand may reintroduce the product with changes/innovations ranging from incremental to radical or minor to major. In this process, the firm experiences another ILC, which is a recycle pattern or second generation (figure 2). A firm after experiencing the first generation of an innovation is likely to attempt the second generation. In other words, after conception, problem-solving, experimentation and commercialization, the same sequence of events may follow for a different product/process or a recycle pattern may follow for the same product(s)/process(es). The period from the conception of the idea to realization and decline for the same product/process or for a new product/process is the second generation. As represented in figure 2 the cycle for the second stage starts before the decline of the first generation. That is, when the first generation product(s)/process(es) are under commercial life, the next generation starts and it experiences the same process. Similarly, before the second generation comes to an end, the third generation starts its commercial life. However, arriving at an average duration for an innovation life cycle stage is difficult. Similar forms of innovation life cycles are likely to be experienced by organizations for every product created. After one generation of a life cycle, the organization's ability to innovate increases owing to experience and/or success leading to reinforcement.

After one generation of a life cycle, the organization's ability to innovate increases owing to experience and/or success.

Innovativeness & ILC

Innovativeness is one of the characteristics influencing the survival and performance of organizations. Hence, innovativeness is the general, fundamental, characteristic of organizations. Meadows (1980), defines innovativeness as "the degree of need to find new things to do and new ways of doing things as perceived by the group's members and managers". Innovations are contingent upon the organization's ability to innovate. Depending upon the degree of the ability, that is innovativeness, the organization may realize innovations.

Proposition I. Innovative organizations may experience more ILC's than less-innovative organizations.

ILC & Environment

Firms operating in a dynamic environment are evidenced by frequent changes in products, technology, services, prices and government policies (Khandwalla, 1977). The organizations operating in such an environment are likely to be entrepreneurial (Burns & Stalker, 1961; Miller, 1983 etc.), innovative (khan & Manophichetwattanna, 1989) than those operating in benign environments.

Proposition II. Innovating organizations operating in dynamic environments are likely to have more generations of ILC's.

Proposition III. The time span for each generation may be shorter for the organizations operating in dynamic environments as opposed to organizations operating in benign environments.

Proposition IV. The innovative organizations operating in a dynamic environment are likely to have more ILC's than less innovative organizations.

Proposition V. The less innovative organizations that operate in benign environments may have less ILC's.

However, when ILC is compared across organizations belonging to different industries/environment, generalizations prove erring (Van De Ven & Ferry, 1980), considering the contention that necessity is the mother of invention. Secondly, innovations are of different types e.g., product, process, market, structural etc. Roughly these different types of innovations can be classified as technical and managerial innovations. Depending on the need and demand, an organization may pursue one or more innovations. Further, organizations operating in different environments pursue different kinds of innovations and the temporal sequences of the ILC vary. Therefore, generalizations should be made industry/environment and innovation specific.

Implications

Life cycle is widely accepted as a useful model for entire markets and industries. As Porter puts it, the life cycle is 'the grandfather of concepts for predicting the probable course of industry evolution' (Buzzell & Gale, 1987). The life cycle model has been used not only to predict the future evolution of markets and industries but also as the basis for 'strategic prescriptions'. Thus, a study on ILC is a useful tool for innovation management. ILC helps recognize the distinct stages in realizing an innovation. Corresponding to these stages are distinct opportunities and problems with respect to innovation management. By identifying the process/stages of an ILC, an organization can manage and develop innovations effectively. ILC concept could be useful mainly as a framework for developing effective corporate strategies in different stages of life cycle.

Scanning should be intensified if the organization's operating environment is more dynamic with rapid changes in consumer tastes, preferences, government policies, R & D efforts.

In stage 1, the sensitivity stage, an organization has to be highly sensitive to the environment for new ideas and opportunities. The organization has to monitor the environment continuously and use efficient scanning channels like R & D personnel, sales and marketing people, market research agencies etc. During this stage the personnel who generate successful ideas should be rewarded. And the scanning should be intensified if the organization's operating environment is more dynamic with rapid changes in consumer tastes, preferences, government policies, R & D efforts. In stage 2, the problem solving stage, the top management should develop an organizational climate for stimulating/supporting creativity. The organization should conduct regular problem solving sessions reward personnel for successful ideas and incorporate those suggestions. Organizations operating in dynamic environments need to engage more in problem-solving sessions and exploit the members creative potentials to remain successful. In stage 3, the feasibility stage, the organization should examine the fit between the ideas and its goals. The organization should also plan for resources in terms of capital, manpower, raw material etc., for carrying out the innovation process successfully. In stage 4, the experimentation stage, the organization should have a supportive climate. For example, in Raychem U.S.A., says Cook, the chief executive officer, employees presenting successful ideas are given commissions and their names are added to the patents (Taylor, 1990). Further, the organization should have tolerance for failures and provide the necessary facilities and freedom to experiment with different ideas. In terms of environmental influence, organizations operating in dynamic and complex environments may have to experiment more for introduction of innovations, thereby R & D investment increasing. In stage 5, the

commercial life stage, appropriate marketing strategies should be formulated. For example, if a product in the market reaches maturity, the organization should plan for appropriate strategies, for instance, sales maximizing or performance maximizing strategies (Utterback & Abernathy, 1975), depending upon the environment. In stage 6, the decline stage, the organization can plan for a new product or reintroduce the product with changes/innovations ranging from incremental to radical. Improving product quality and/or adding new features or identifying new markets/new market segments/new marketing techniques could be some of the strategies.

Examining ILC promotes a new theory useful for both applied and basic research. Theory on innovation life cycle improves organizational performance as it could be used as a strategic and corporate tool. For example, organizations operating in a dynamic environment may have shorter ILC's and hence may attempt on performance maximizing strategies as opposed to organizations operating in a benign environment which may attempt on sales maximizing strategies (Utterback & Abernathy, 1975). Similarly, in a growing market performance maximizing strategies should be adopted while sales maximizing strategies are essential for a nature market. Thus, organizations operating in different environments and/or markets may appropriately choose the strategies to manage ILC's. Further, the ILC's also help the organizations to plan for its resources.

The proposed theory could be prescriptive for organizations that take an innovation journey. The proposed model can be also employed for comparison of ILC's across organizations and environments. The results of such comparison that agree with judgements independently arrived at, will provide a test of the validity of the model and the models proposed here.

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Feature

Organizational Productivity — How to Account for ?

M.K. Kolay

The author conceptualizes two basic functions of an organization to account for its level of productivity achievement. They are development of the asset bases and utilization of the same towards the achievement of the corporate profitability objective. An organization has been thought of as having five asset bases: human resource, plant, suppliers, customers, public image. The appreciating or depreciating nature of asset bases when judged in relation to the investments made on them reflect the productivity of their development process. The factor productivity of the consumable inputs in relation to the nature of the asset bases reflects the productivity of the utilization process of the latter concludes the author.

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The growth and diversity of business in this era of rapid technological advances and acute competition depend on the level of productivity achievements. Way back in 1955, Davis in his efforts to account for organizational productivity, introduced the concept of productivity as the output in relation to the inputs. Since then various approaches and methodologies have been advocated to measure the productivity of different systems. The concept of partial productivity of different factors like the materials, energy, labour, capital etc. and total productivity has emerged (Kendrick & Creamer, 1965; Craig & Harris, 1973; Taylor & Davis, 1977; Stewart, 1978; Sumanth, 1979 and Sink, Dervies and Tuttle, 1984). However, such a concept defines the productivity of the long term assets on the same lines as that of consumable resources, i.e. the materials, energy and services. Effective annual cost principles may be used to assess the relevant periodic cost of the plant like the cost of materials consumed during a particular period but the productivity of the plant can not be considered at par with that of the consumable resources like materials. In fact, the productivity of the materials and other consumable resources may be the returns on the long term investments like the plant and infrastructure and such a return on investment (ROI) may be a reflection of productivity of the plant base itself with ROI as the surrogate measure of productivity (Risk, 1965; Gold, 1974; Eilon, Gold & Soesan, 1976; Miller, 1987). Moreover, the organizational investments may not be on plant and infrastructure alone; the suppliers, the customers and the public image and above all the human resource could be the other asset bases of an organization (Kolay, 1993a). Again, the earning of more returns today by way of higher level of productivity attained on the consumable resources may be the overriding goal of any organization but not at the cost of depleting the asset bases and eroding the future returns. Along with the periodic returns, the appreciating or

depreciating nature of the asset bases needs to be considered to reveal the real level of productivity achievements of an organization during a specific period.

Earning of more returns today by way of higher level of productivity attained on the consumable resources may be the overriding goal of any organization but not at the cost of depleting the asset bases and eroding the future returns.

Productivity defined

An organization makes periodic investments to build up, maintain and develop its different asset bases (herein termed as the development of asset bases) and utilizes them at the cost of their servicing to convert the inputs into the outputs to continue to achieve the corporate profitability objective. Thus, the basic functions of an organization focus on the development of asset bases and their utilization.

Development of asset bases

Amongst the various assets used by an organization, human resource (HR) is perhaps the most important. Investments are made to acquire the required manpower, to train and develop them. Besides initial investments, suitable strategies are adopted to update their skills from time to time and maintain their morale and motivation. Measures are taken to retain such a developed asset of the organization. The initial investments together with the cost of such efforts over the years build up and maintain the quantitative and qualitative (i.e. total) dimension of the human asset of an organization. Investments are made by an organization to acquire, renovate and modernize its plant and infrastructural facilities i.e. the plant. Efforts are made to maintain them in good running condition. Routine maintenance may be considered as a servicing component of the plant, however, a portion of the maintenance efforts may improve the condition or perhaps increase the life of the plant. Cost of such developmental efforts over the years together with the investments in plant acquisition lead to the maintenance and development of the capacity and condition of the plant asset base of an organization.

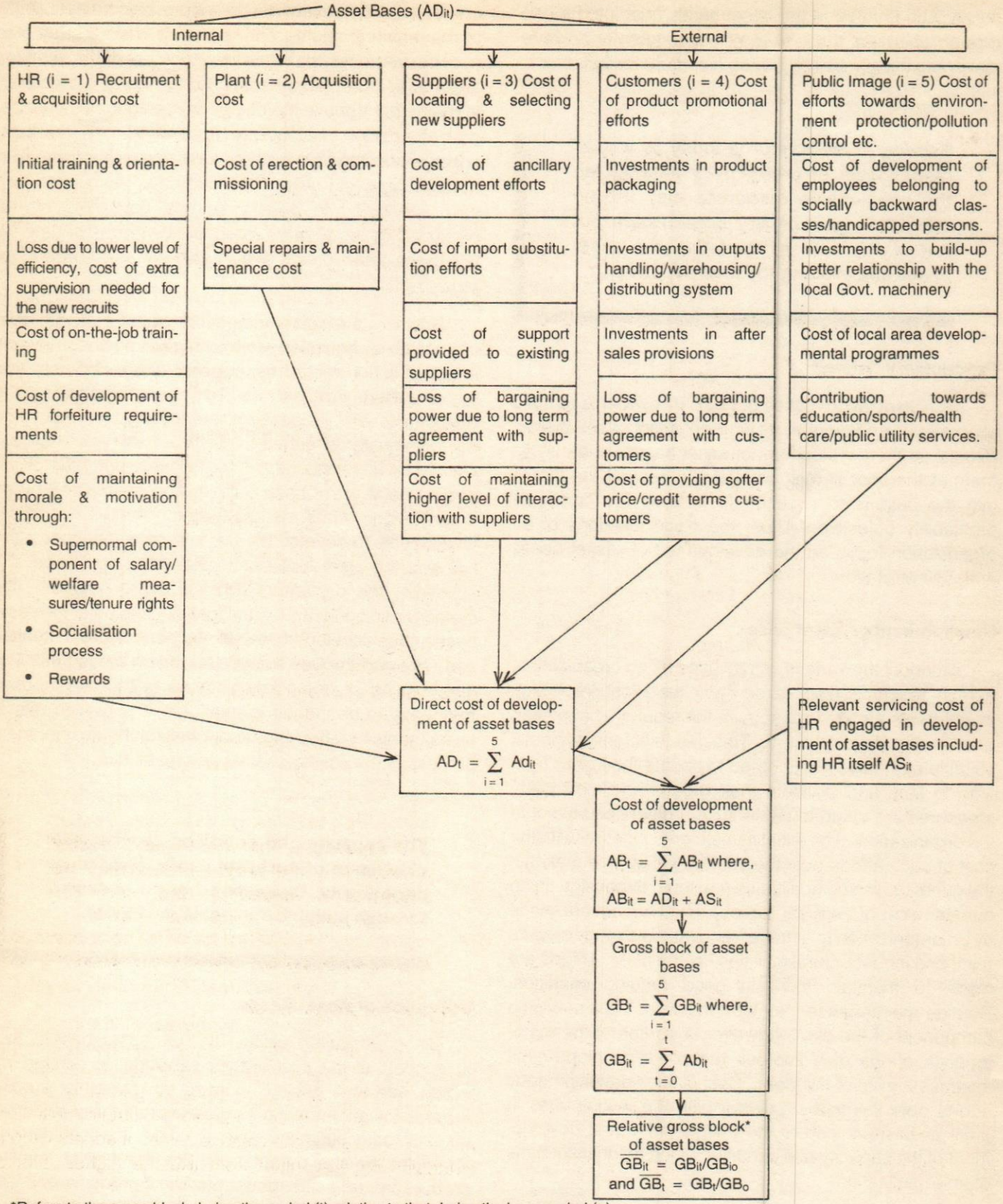
Besides the HR and the plant, the two internal asset bases, an organization adopts suitable strategies to strengthen the relationships with the existing suppliers and develop potential ones to ensure smooth availability of the required inputs. The total cost of such strategies over the years relates to the development of the supplies asset base of an organization (Kolay, 1993b). Similarly, at the output front, in the course of marketing its outputs, an organization may decide to develop new markets, serve new customers and reinforce the relationship with the existing customers. The total costs associated with such strategies to ensure smooth marketing of the produced goods at more remunerative terms of sale relate to the development of the customer asset base of an organization.

Besides the development of suppliers and customers, an organization while running its business invests in anti-pollution measures, community development and social welfare programmes, besides strengthening the relationship with its bankers, the local government and the community in general. Such efforts with their associated costs reflect the future benefit potential of the public image asset base built up and maintained by an organization. Thus, an organization makes necessary investments to develop the two internal asset bases, the HR and the plant and three external asset bases, the suppliers, the customers and the public image. The capacity and condition i.e. the total dimension of the asset bases, thus developed, need to be periodically assessed and reviewed through suitable surrogate measures. The appreciating or depreciating nature of the asset bases may have to be judged in relation to the growth rate in investments to reflect the productivity of the development process of the asset bases of an organization.

The capacity and condition i.e. the total dimension of the asset bases, need to be periodically assessed and reviewed through suitable surrogate measures.

Utilization of Asset Bases

An organization utilizes its five asset bases, thus developed, at the cost of their servicing, to convert the inputs into the desired outputs to generate surplus towards the attainment of corporate profitability objective, not only today but in the years to come. It adopts various strategies on the output front like the higher level of production and sales, better quality of products and services produced, richer product mix, better customer service and at the same time minimizes the cost incurred at the input front like the cost of purchase of materials,



*Refers to the gross block during the period (t) relative to that during the base period (o)

Fig. 1: Investments in asset bases of an organisation

energy and services and the amount to be paid in the form of levies and taxes to the local government. While converting the inputs into outputs, an organization adopts suitable strategies to service the five asset bases used, suitably pay wages and salaries to the employees, maintain the plant in normal working condition, honour the suppliers' bills as committed, accommodate the customers with the normal credit terms, so also maintain cordial relationship with its bankers, the local government and the community in general. On the whole, an organization attempts to improve the conventional factor productivity of all inputs while utilizing the asset bases, not only of the materials, energy and services but also the cost of servicing the asset bases like the wages and salaries, plant maintenance and other overhead costs including the cost of working capital holding of the organization. The growth in the conventional factor productivity of such inputs has to be judged in relation to the total dimension of the five asset bases utilized to reflect the productivity of the utilization process of the asset bases of an organization.

Integrating the productivity of the two basic functions of an organization i.e. development and utilization of the asset bases, the productivity of an organization during a particular period may be reflected by the multiplicative effect of the productivity of two functions i.e.

$$\text{Productivity of an organization} = \text{Productivity of development process of asset bases} \times \text{Productivity of utilization process of asset bases.}$$

$$= \frac{\text{growth rate in value of asset bases}}{\text{growth rate in investments towards development of asset bases}} \times \frac{\text{growth rate in conventional factor productivity of inputs}}{\text{growth rate in value of asset bases}}$$

To implement the proposed concept the following steps may be adopted:

Investments towards development of asset bases

The different investments periodically made towards the development of the five asset bases may be recorded to work out the relative gross block to reflect the growth rate of investments in asset bases over the years as compared to the base year as shown in figure 1. In view of future benefit potentials such cost elements are considered as asset rather than expense. Normal cost of servicing the asset bases like the cost of power required to run a machine may not constitute an asset, however, the supernormal component of salary, benefits etc. may be contributing significantly towards maintaining the morale and motivation of the employees, thus constituting an asset. Moreover, the cost of servicing the human resource, engaged in the development and maintenance of different assets has been duly considered to form part of the development cost of the asset bases.

The capacity and condition of the five asset bases may be assessed and reviewed periodically to judge their relative values (AV_{it}) appreciating or depreciating during a particular period relative to a chosen base period. Suitable surrogate measures may be developed using the relevant factors as presented in table 1, with suitable weightages assigned depending on the specific situation, to reflect the value of the asset bases related to the chosen base period.

With profitability as the overriding goal of the business, the cost-based factor productivity of different inputs may be assessed for a specific period relative to the chosen base period using the available cost and production records of an organization(figure 2). The cost inputs in the proposed productivity assessment would differ from the conventional input costs to the extent that these do not include:

- Any cost element that promises future benefit potentials towards development of asset bases.
- The normal servicing cost of the human resource engaged in the development of asset bases including the development of the HR itself.

With profitability as the overriding goal of the business, the cost-based factor productivity of different inputs may be assessed for a specific period.

Assessment of Organizational Productivity Level

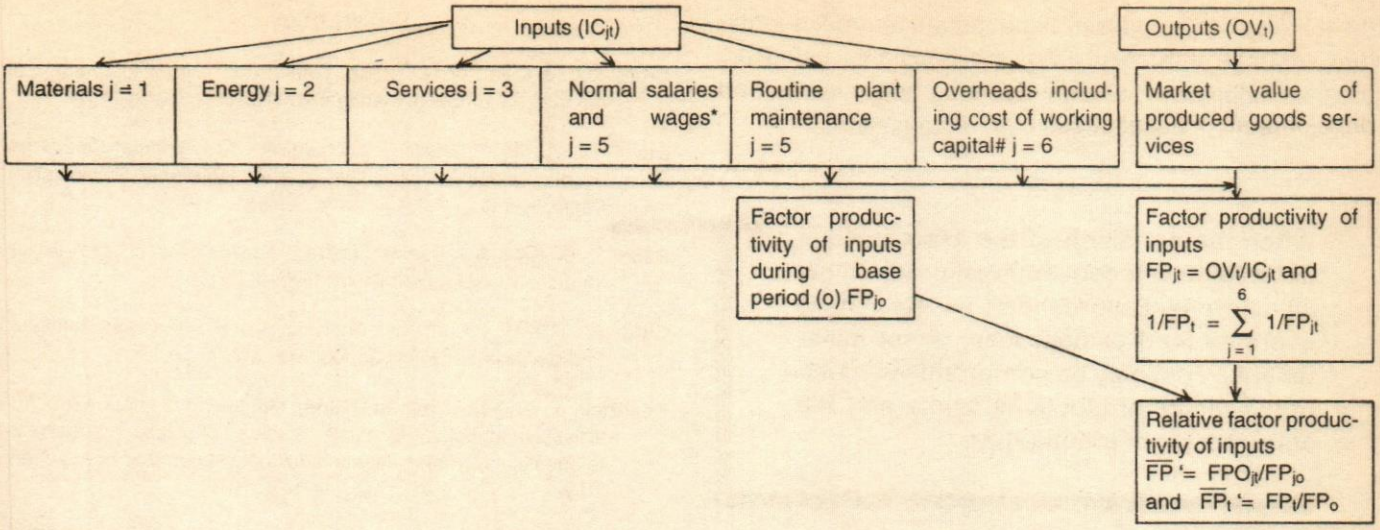
Based on the conceptual framework, the methodology for assessing the organizational productivity in terms of productivity of development and utilization of its five asset bases as the productivity centres is presented in figure 3.

The proposed conceptual framework relies on the two basic functions of an organization i.e. development of its asset bases and utilization of the same towards achieving conventional factor productivity levels, rather than utilization alone as in the case of available produc-

Table 1: Condition of the Different Asset Bases

Human Resource (HR) Asset Base	Plant Asset Base	Suppliers Asset Base	Customers Asset Base	Public Image Asset Base
Proportion of technically qualified HR	Rated capacity of plant	Service level	Growth in relative market share	Level of demand for org. shares/debentures/fixed deposits/bonds.
Avg. Age level of HR	Age of plant on an Average	Reliability of service level	Growth in volume of goods sold	Extent of gap between market value and intrinsic value of shares
Avg. experience level of HR	Maximum possible attainable capacity of plant	Quality level	Growth in sectors/areas/market serviced	Extent of co-operation received from Banks/Financial Institutions.
No. of formal & informal groups and the extent of formal interactions amongst them	Extent of plant availability	Reliability level	Growth in export sales (volume)	Extent of co-operation received from Banks/Financial Institutions in crisis situations
Extent of supervision needed	Extent of plant breakdowns	After-sales service level	Proportion of sales through long term contracts	Extent of co-operation received from the local Govt. for issue licences, sanctions of proposals etc.
Extent of achievements against targets	Average time between breakdowns	Extent of price competitiveness	Extent of rejections/complaints received	Extent of controls by the local Govt.
Extent of suggestions made towards productivity improvements	Extent of repairs and maintenance needed	Extent of availability of discount/credit terms	Proportion of advertisement cost to volume of sales	Extent of responses received for employment other than at regular entry point.
Accident rate with severity thereof.	Extent of supervision needed	Service level under crisis situation	Proportion of selling and distribution cost to volume of sales	Extent of org. represented in local development/regional councils/Govt.
Grievance Rate	Estimated remaining life of plant	Extent of service available w.r.t. non-routine/development items	Extent of price advantages enjoyed	Extent of suggestions received from the public in general
Extent of absenteeism	Minimum possible rejection rate	Proportion of purchases through long-term arrangements	Extent of credit & discount terms enjoyed	Extent of public responses/co-operation received in crisis situation
Frequency of strikes, go slow, non-cooperation	Maximum possible material yield	Proportion of purchasing cost to volume of purchases	Extent of credit realization in relation to credit collection cost	Extent of mandays lost in relation to industrial environment in neighbourhood
Extent of labour turnover	Minimum possible energy consumption rate	Level of adverse relationship with suppliers	Level of adverse relationship with the customers	Extent of adverse relationship with the Govt./Banks/Fin.Inst./local agencies.

tivity measurement approaches. Use of effective cost principles to assess the plant factor productivity reflects the recognition of asset status to the plant and infrastructure; in the existing productivity literature, recognition is only accorded to the plant and that too, its factor productivity has been considered at par with that of consumable resources. The proposed framework conceptualizes that special repairs and maintenance may enhance the life of the plant or perhaps add on to its capability, but what is still more relevant perhaps, is to consider the suppliers, the customers, the public image and above all, the human resource as the asset bases of an organization. Infact, it introduces these five asset bases as the productivity centres around which the organizational productivity germinates. The proposed method while differentiating the consumable resources from the asset bases, reflects not the results alone in the form of factor productivity or the resultant return on investments as in the available productivity literature but would allow the management of an organization to analyze the same in relation to the relative value of the asset bases deployed.



*(excluding relevant servicing cost of HR engaged in development of asset bases including HR itself)

excluding relevant cost towards development of asset bases

Fig. 2: Relative Factor productivity of inputs

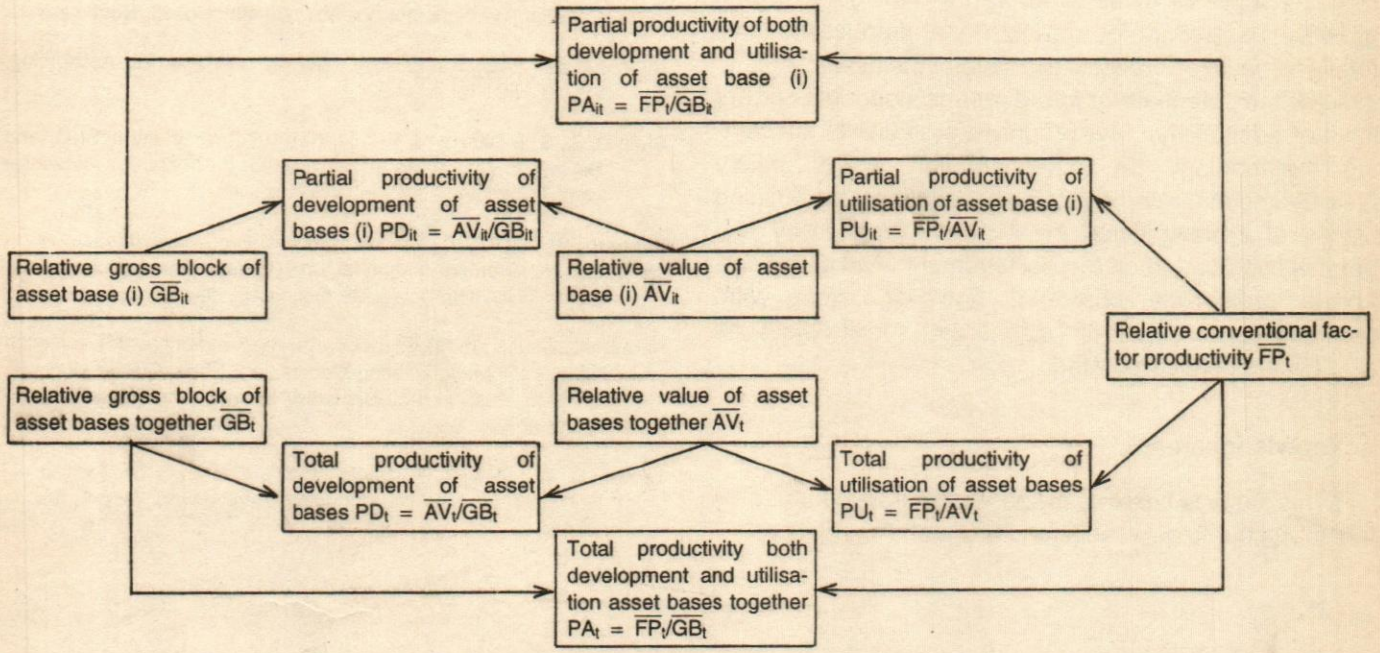


Fig. 3: Productivity of development utilisation of asset bases as productivity centres

To measure the productivity of development of asset bases, managers need to evolve suitable surrogate measures to assess the relative value of the asset bases over time. Implementation of such a measurement methodology would no doubt facilitate monitoring the condition of the asset bases periodically and guide the management to adopt appropriate strategies to maintain and improve their condition.

When the condition of the asset bases is not reflected in conventional productivity measurement approaches, assets may be overstretched at times or necessary asset maintenance cost may be compromised to improve factor productivity levels and the current level of profitability. Implementation of the proposed method will dissuade the profit centre managers to improve their current profitability at the cost of depleting the organizational

asset bases. Infact, asset management approach rather than expense approach as in the traditional practices, goes a long way towards assuring the growth and development of asset bases of an organisation.

When the condition of the asset base is not reflected in conventional productivity measurement approaches, assets may be overstretched or necessary asset maintenance cost may be compromised to improve factor productivity levels and the current level of profitability.

Conclusions

The proposed concept of organizational productivity focuses on the development and maintenance of the internal and external asset bases to enable the organizations to continue to earn profits for their survival and growth. To account for organizational productivity in its total perspective, it reflects the state of the asset bases to indicate the potentials for future returns along with current level of profitability. The proposed productivity accounting methodology on implementation would greatly facilitate the management of the asset bases, the building blocks of organizational productivity. Productivity has been viewed based on the achievement level of the corporate profitability objective; however, along with profitability, the extent of fulfillment of social objectives should also be incorporated.

Acknowledgement

This study is a part of the research project funded by Indian Accounting Association Research Foundation.

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In every economy ... there is one crucial and definitive conflict ... the struggle between past and future, between the existing configuration of industries and the industries that will someday replace them.

GEORGE GILDER

Value Management for Cost Effectiveness & Industrial Renewal in India

B.M. Lall Nigam

Value Management has a proven track record the world over as an outstanding tool to reduce costs, improve value to the customer and increase profits for the producer. Coupled with life cycle costing, this technique should be adopted by the whole gamut of our business enterprises, for India to make her mask on the global scene opines the author.

B.M. Lall Nigam is a Visiting Professor, Department of Accounting, State University of New Jersey (USA).

Amongst the approaches to trim costs and promote product performance, Value Analysis (VA) or Value Engineering (VE) has gained an increasing acceptance. Together with Life Cycle Costing (LCC), VE has come to represent an outstanding group of methods to improve value to the customer, reduce costs and increase profits for the producer. In optimum utilisation of and economising on resources, and import substitution, it has a proven track record the world over. The technique is associated with the name of Lawrence D. Miles, the purchasing agent of the General Electric Inc., (USA). He developed VE in 1947 at the instance of Harry Erlicher, Vice-President (Purchases) who looked for alternate materials and processes during World War II shortages. Miles reached two conclusions in his study : Conventional approaches stifled imagination by restricting thinking to existing objects and designs and concentrating on function requirements produced greater mental freedom. The technique was initially called "Value Analysis", but subsequently its name was changed to "Value Engineering" as it came to be applied in many diverse engineering concerns and operations. For the past few years, the term has been increasingly referred to as "Value Management", and for right reasons. Its domain is no longer confined to engineering and construction, but has been employed in such extensive fields, as marketing, purchasing, office work, and hospitals. Its tools have been applied with success in product enhancement, market share growth, and profit improvement. As a dynamic discipline, it is fast getting intermeshed with the concepts and practices of just-in-time, expert systems, cycle time management, automated work instruction, flexible manufacturing, and computer aided design and manufacturing. Hence, and caption "Value Management"[1] better explains what the technique stands for in the present scenario.

[1] In practical life, VA, VE and VM have been used as synonyms, and so in this paper. However, the term VE will be generally employed in the text.

The Concept

Literally, value engineering is engineering for value. The two words describe, if not precisely define the term. Various interpretations apart, value[2] is the relationship between function and cost, i.e., Value = $\frac{\text{Function}}{\text{Cost}}$. For a given function to be performed or end-use of an item, price being paid is the major determinant. Value is no doubt a subjective notion, but its ingredients are well known consisting of quality, efficiency, safety and service. It is related to ultimate economy and satisfaction of the consumer. By dissecting these components, an optimal combination is sought which obviously is the least cost value. This lowest overall cost alternative value has to be consistent with the requirements of performance, maintainability, appearance etc. The needed performance has to be at the minimum cost. Engineering is the application of science and mathematics by which the properties of matter and the sources of energy in nature are made useful to people in structures, machines, products, systems, and process. As such, value engineering could be formally defined as "a systematised approach to seek out the best functional balance between the cost, reliability and performance of a product or project" (Zimmerman, et al 1982 : 2). Put differently, it is an organised, systematic effort focused at analysing the function(s) of a product or service. Rather than the hardware, it is the systems, equipment facilities, procedures and supplies which are closely looked into in terms of their functional requirements. Analytical and creative techniques are employed to accomplish the functions which go to make a product's value at the lowest overall cost. it is a research, exploration with the central objective, "equipment performance for lower cost". The mission is to get the greatest possible mileage out of the given resources and make cost = worth, if possible.

Value engineering could be formally defined as "a systematised approach to seek out the best functional balance between the cost, reliability and performance of a product or project".

Obviously, it is a team effort work which seeks to bring the best out of in-house experts. It is in this context that the Chartered Institute of Management Accountants, London, refers to it as, "a systematic, inter-disciplinary examination of factors affecting the cost of a product or service in order to devise means of achieving the specified purpose most economically at the required standard of quality and reliability" (Chartered Institute of Management Accountants, 1990: 44). Indeed, as a result of *VE* methodology, the product is far more potent and fulfils far greater expectations. *VE* is an organised technique of attaining a basic function at the least possible life cycle cost without degrading the integrity of the project, product or system[3]. It is a pure, simple common sense, rather robust common sense whose essence is a disciplined, imaginative thinking aimed at value enhancement, but constantly in relation to outlay[4]. Isola refers to it as "a creative, organised approach whose objective is to optimise cost and/or performance of a facility of system" (Dell'Isola, 1982: 2). For general understanding, it could be taken as a specific branch of engineering that deals with the analysis of cost and efficiency of products and services. Its core is to identify unnecessary costs with a view to eliminating them in a phased manner.

Hallmarks

The two hallmarks or crucial planks of VE are functions, and creativity. The functions, basic or secondary, performed by an item are continuously examined in all their facets so as to reduce the cost in securing them. In fact, every cost is in terms of functions needed by the consumer or the user. Basic function is the specific work which a product or service is designed to do. Secondary functions support or arise during the performance of the basic function; they would disappear if a different design approach was adopted to perform the basic function. Usually, it is not possible to eliminate the basic function, but secondary functions may often be found redundant. After their identification, functions are arranged in a diagrammatic form, and then examined for rationale and logic by the acid test questions: How is the function performed, and why is this function performed? The relative importance of different functions has to be established starting from the higher order; basic functions to

[2] Total value has the aspects of use value, esteem value, cost value and exchange value. But here, it mainly refers to the use value.

[3] Value engineering is a complete system for identifying and dealing with the factors that cause unconditioning cost or effort in products, processes or services. This system uses all existing technologies, knowledge and skills to efficiently identify costs or efforts that do not contribute to the customers' needs and wants. Its effect is to help the "good achieve even better.

[4] " This continuous improvement" is Kaizen in Japanese. For those who practise Kaizen, small things are important. Stressing small but continuous improvements enables everyone in a company to participate in the process of change. One of the principal aims of Kaizen is to eliminate waste.

the lower order functions. This gives an idea of where the cost should really be incurred for good value, and brings in the role of the second key element of VE, viz., creativity or creative thinking. The foundation of functional analysis rests with creative thinking which consists of constructively seeking new and bold innovations, albeit inventions never thought possible. It marks a break with the routine so as to design or produce through imaginative skills something new not only from the cost point of view, but also from the operational aspects of the user. Dissatisfied with the status quo, there is a restless aspiration for improvement. Creativity impels to strive for the betterment of what exists. The imaginative ability or ingenuity is no doubt "learned out" by past negative experiences, yet it can always be re-learned. In the creative approach, a fresh look has to be given to the old things to generate ideas for alternative means of doing them. Here, no holds are barred, though high potential functions receive the priority. VE is implemented in well defined steps or phases[5]. Maximum creative energies are exercised in spotting of unnecessary costs involved in different functions, and their elimination. Unnecessary costs are the costs which are incurred in the normal way, but do not improve its quality or efficiency. These must be located and removed, of course, without adversely affecting customer features. After all, the gist of VE is the substitution by lowest-cost alternatives. To put it differently, VE signified an a increased use of surrogate, less expensive materials, abilities of specialised suppliers, cheaper designs and purchasing, and newer technologies of manufacture. Instead of persisting with the pre-conceived notions and conventional processes, better and cost-effective options thereof are devised. The more one thinks of an existing situation and analyses it in all its dimensions, the greater will be the number of ideas which come to the mind as alternatives. This evidently requires obtaining the information from knowledgeable persons and brain-storming groups[6]. Conscious attempts are made to encourage them with the purpose of achieving the relevant functions at the lowest overall cost consistent with the ingredients of value. All the functions which go to make up the product's value such as performance, reliability, durability appearance, safety, etc. are sought to be achieved through VE at the least cost possible monetary and non-monetary sacrifice.

[5] Seven such phases are general phase, information phase, function phase, creation phase, evaluation phase, investigation phase, and recommendation phase.

[6] The four basic general rules of brainstorming are : no criticism, freewheeling, quantity, and combine and expand.

Maximum creative energies are exercised in spotting of unnecessary costs involved in different functions, and their elimination.

Life Cycle Costing

Value engineering is not a one-time affair, rather an-ongoing exercise. Yet the best opportunity to perform the analysis is prior to the introduction of a product. This permits the manager to define the action needed and designate the person responsible. However, lifecycle costing (LCC) covers not only the initial cost, but all operating, maintenance and disposal costs throughout the lifecycles of the article/item. With this concept, the economics of a product/service is evaluated like a capital asset from its conception to the point of termination. LCC, is a complementary and ever-present companion of VE. In projects involving heavy capital commitment, LCC techniques assure long-term rewards in operating, maintenance, energy costs, in addition to immediate investment savings.

Applications & Benefits

The validity and utility of value engineering or value analysis, by now, have been well reckoned the world over. Government and semi-government organisations as well as private and public sector undertakings have found it useful to increase their value, and thereby achieve national objectives. After the lead given by the GEC, it was adopted by the US Department of Defence and Government. It has had applications in the area of design production, building/project construction, software, administrative process, utilities, and services. Every type of industry, viz., engineering, automobile, aerospace, textile, leather, metallurgical, steel, chemical, defence, and administration has applied the technique with success. The US Department of Defence alone, according to authenticated figures, derives a benefit of over $2,500 million a year. In India too, the users of VE are such large corporations as ACC, Bajaj, Best and Cromptons, BEL, BHEL, Britannia, CMC, Coal India, Crompton Greaves, Escorts, Hero Honda, HEC, HMT, Indian Air Force, Army and Navy, Railways, J.K. Synthetics, Keltron, Kelvinator, Kirloskar, L & T, Mukand Iron, Nelco, RITES, SAIL, TELCO, TISCO and VTS. In fact, VE as a discipline has become an international movement to cut costs and increase product performance. An estimated 15 to 25 percent manufacturing costs have been

30 sick companies and is matched by an equal number of non-sick companies on the basis of industry, size and fiscal year. Financial information for these companies has been obtained from the Bombay Stock Exchange Official Directory for a period of five years prior to their sickness. 30 financial ratios have been selected for the purpose of the study, keeping in mind their popularity in literature, the performance of such ratios in some of the studies undertaken earlier and the potential relevance of such ratios for the present study. These financial ratios have been classified broadly under four groups namely profitability, solvency, liquidity and activity ratios to represent different operational aspects of the companies.

The statistical tools and techniques used in this study are t-test, F-test, and Dichotomous Classification Test for analysis and interpretation of data. The mean values and standard deviations of different financial ratios for five years before sickness have also been calculated. The t-test and F-test were administered to find out the differentiating power of various financial ratios in segregating sick companies from non-sick companies. The Dichotomous Classification Test has been applied with a view to know the classification accuracy error of individual financial ratios.

Analysis, Results & Discussion

The study utilises financial ratios as indicators to predict corporate sickness in Indian industries. For this purpose, the mean values of 30 financial ratios of both the sick and non-sick companies were calculated. The aim of calculating the mean ratio values is to see whether there is any marked difference in mean ratio values between the sick and non-sick companies. With the application of t-test, 19 financial ratios were found statistically significant at 0.01 level. It is clear that 19 financial ratios possess the differentiating power under the t-test. Further, it is evident from the t-test results that the majority of profitability ratios and liquidity ratios have discriminating power. On the contrary, except very few ratios, the solvency ratios and activity ratios do not make any substantial contribution in discriminating the sick group from their nonsick counterparts. On the basis of t-values, the ratio of total liabilities to total assets is found to be the most important variable having the highest discriminating power. The t-test further reveals that the net income to total assets, total liabilities to total assets, net working capital to total assets and net worth to net sales variables were the leading ratios in the profitability, solvency, liquidity and activity ratio groups respectively.

Table 1. Mean and t-values of financial ratios for the two groups one year prior to sickness

Ratio	Group 1 mean	Group 2 mean	't' value
Profitability Ratios			
cash flow/net sales	–0.0551	0.1047	3.28
cash flow/total assets	–0.0145	0.1336	5.87
cash flow/total liabilities	–0.0075	0.2153	6.21
net income/net sales	–0.0649	0.0854	3.09
net income/total assets	–0.0802	0.1103	7.07
net income/total liabilities	–0.0708	0.1928	5.53
EBIT/total assets	–0.0131	0.1577	5.74
EBIT/net sales	–0.0293	0.1212	1.97*
Operating profit/net sales	–0.1169	0.0643	4.87
EBIT/interest	0.3438	19.4744	1.40*
net income/net working capital	–1.2351	1.0829	4.06
Solvency Ratios			
current liabilities/total assets	0.7812	0.5824	3.92
total liabilities/total assets	1.0264	0.6832	7.38
total liabilities/net worth	3.9277	2.4683	0.37*
long term liabilities/net worth	2.0593	0.4116	0.72*
Liquidity Ratios			
cash/total assets	0.0271	0.0481	2.34*
quick assets/total assets	0.2436	0.3805	3.99
current assets/total assets	0.6269	0.7246	2.84
net working capital/ total assets	–0.1542	0.1421	6.42
cash/current liabilities	0.0393	0.0823	2.84
quick assets/ current liabilities	0.3546	0.6868	3.96
current assets/ current liabilities	0.8742	1.3048	4.36
Turnover Ratios			
Debtors/net sales	0.1581	0.1667	0.31*
inventory/net sales	0.3981	0.2785	1.77*
quick assets/net sales	0.2882	0.3006	0.14*
current assets/net sales	0.6863	0.5794	0.74
net working capital/net sales	–0.2845	0.1048	3.22
fixed assets/net sales	0.4847	0.2343	2.06*
total assets/net sales	–0.1854	0.8202	1.44*
net worth/net sales	–0.0338	0.2521	6.17

Group 1 represents sick companies
Group 2 represents non-sick companies
t1, 58(0.01) = 2.39
* denotes not significant at 0.01 level.

Again to test the differentiating power of financial ratios, the analysis of variance (one way classification model) i.e., F-test was applied (Table 2) 19 financial ratios have the power to discriminate the sick companies from the non-sick ones. It is interesting to note that the

same set of ratios, which were considered statistically significant under t-test, have also been found significant under F-test.

Table 2: F-values of financial ratios for the two groups one year prior to sickness

Ratios	F-values
Profitability ratios	
CF/NS	11.11
CF/TA	35.06
CF/TL	39.63
NI/NS	9.84
NI/TA	51.37
NI/TL	31.72
EBIT/TA	33.37
EBIT/NS	3.99*
OP/NS	24.22
EBIT/Interest	2.02*
NI/NWC	17.15
Solvency ratios	
CL/TA	15.79
TL/TA	52.91
TL/NW	0.14*
LTL/NW	0.54*
Liquidity ratios	
Cash/TA	5.00*
QA/TA	16.24
CA/TA	8.27
NWC/TA	42.36
Cash/CL	8.14
QA/CL	16.21
CA/CL	19.65
Turnover ratios	
Debtors/NS	0.08*
Inventory/NS	3.25*
QA/NS	0.02*
CA/NS	0.52*
NWS/NS	10.74
FA/NS	4.42*
TA/NS	2.16*
NW/NS	39.17

* denotes not significant at 0.01 level
F1, 58(0.01) = 7.09

The t-test and F-test reveal the difference in ratio values of sick group and non-sick group companies. However, they fail to disclose anything about the predictive power of the financial ratios. So, to ascertain the predictive power of ratios on individual basis, another technique known as Dichotomous Classification Test was applied. In this test, a separate array for each financial ratio was made and the ratio values of both sick and non-sick companies were inserted in their respective array. The ratio values were arranged in the ascending order and an optimum cut-off point for each ratio was selected to divide the array into two parts with the minimum possible number of misclassification. Finally, the percentage of classification error for each ratio was determined. Under the Dichotomous Classification Test, 19 ratios which were found significant both under t-test and F-test were employed to ascertain the classification accuracy/error. The classification errors of the 19 financial ratios are presented in table 3.The majority of profitability ratios illustrate superiority over other ratio groups in predicting corporate sickness. The best single predictor variable emerging under this test is the ratio of net income to net working capital. This ratio gives only seven percent misclassification one year prior to sickness and twenty per cent misclassification at five year prior to sickness.

Table 3: Percentage error of 19 financial ratios on Dichotomous Classification Test

Ratio	Year before sickness				
	1	2	3	4	5
Profitability ratios					
cash flow/net sales	15	25	28	33	35
cash flow/total assets	15	30	33	30	32
cash flow/total liabilities	13	23	28	25	28
net income/net sales	10	17	18	20	22
net income/total assets	13	20	20	15	23
net income/total liabilities	10	17	20	15	20
EBIT/total assets	15	25	28	25	30
operating profit/net sales	10	17	17	25	22
net income/net working capital	07	15	17	20	20
Solvency ratios					
current liabilities/total assets	25	33	33	37	35
total liabilities/total assets	10	17	20	20	25
Liquidity ratios					
quick assets/total assets	25	33	30	30	33
current assets/total assets	25	28	17	17	30
net working capital/total assets	10	18	20	20	25
cash/current liabilities	35	37	37	42	45
Quick assets/current liabilities	15	22	22	28	30
current assets/current liabilities	10	18	22	20	28
Turnover ratios					
net working capital/net sales	10	17	17	30	22
net worth/net sales	10	15	20	20	22

they have used energy rather comprehensively. Money and materials are also energy input. The thrust of their approach is that an organisation, as an open system involved in transactional relationship, needs to survive. Renewal is thus a significant requirement for organisational survival. To arrest the entropic process, they have sought to diagnose an organisation system in terms of energy, some components of which get absorbed in the transformation process. Should much of the energic inputs go into maintenance activities, less would be available as energic outputs. In system theory tradition, Katz & Kahn are concerned with an organisation system maintaining a state of ultra-stability, a capacity to persist through changes in structure and behaviour for which energy concept has been utilised. Borrowed from biological sciences, organisational energy can be linked to performing a metabolic function in an organisation.

Etzioni (1968) also used "the energy" concept while expounding the theme of human mobilisation for purposefui collective social action. In his formulation, energy is expressed as a psychic and social resource. Human beings as members of a social system can be activated through reflected-upon experiences to commit themselves to a transcendental mission of bringing about societal change (De, 1979). Potential of collective human energy is the key to Etzioni's conceptual map of societal change. Ingalls (1976) postulated that the normal rational behaviour expected in an organisation refers to task objectivity and the need for certainty. Such a type of behaviour called type A, runs into difficulty when we observe human behaviour manifesting itself in interpersonal misunderstanding, human conflict, generation of mistrust and organisational power struggle. These are some of the phenomena which consume human energy to maintain the system. Consequently, less will be available as energic output. The author propounds the type B behaviour which operates on effective interpersonal relations and tolerance of ambiguity.

Ingalls(1976) sums up the thesis in these words: " The four poles of the field of action ambiguity, certainty, object (task) and relation create, as it were, a magnetic field. A tugging or pulling of energy occurs because of the inherent psychological properties of those four factors and also because of their reciprocal and complementary relations. All four poles are fundamental and basic to life. They represent the bedrock foundation of the human energy system" (p 20). Here we get implicitly a glimpse of two components of human energy — energy generation and energy drainage. The author, however, does not come to grips with environmental forces and parameters of collective action as Etzioni does. Owen (1978), as a practising manager, discusses the management energy crisis. Using a finite concept of "a particle of management energy" he is of the view that once used an element of energy is expended. This approach is physical-law bound. However, he also highlights the need for the use of management energy to purposes which span over interface and environmental issues and impinge on managerial effectiveness. At the same time, there is an awareness that the current organisation systems have failed to tap the potential energy that is embedded in the managerial cadre. Like Ingalls, the author echoes the Argyris' point of view that the roots of organisational ineffectiveness lie in psychological barriers.

Hjelholt (1979) has approached the energy issue as a diagnostic tool for social system analysis. He depends upon qualitative data analysis through the interview process. Psychic energy as reflected in different work activities is manifested in energy generating and energy draining activities which, can be reduced to an "energy count" (energy generating divided by energy draining). The issues, which came up in his consulting situation are relationship among staff members, the content of work itself, organisation structure, other social systems and home life/free time. Hjelholt has used his data for an energy conference involving the interviewees which provided them an opportunity of seeking alternatives and stabilised work-system so as to create conditions for positive human action (energy generating situation) and regulate conditions which can reduce such human behavioural modes which sap human energy. The objective, in this approach is to increase energy count for improving organisational effectiveness. De (1981) using the concept of "Organisational energy" compared six organisations (five from the public sector and one from the private sector). His results indicated the following key factors as contributing to the variations in organisation health:

- Government's role towards the enterprise
- Role of Chief Executive in controlling the enterprise's functioning
- Financial and other performance records of the enterprise
- Technological differences
- Difference in age among managers.

Dhawan (1982) using a modified version of De's(1981) questionnaire compared two organisations in the private sector. The results focussed on manager's role, his hierarchical position, his authority and respon-

sibility and the demographic characteristics of those organisations.

Psychic energy as reflected in different work activities is manifested in energy generating and energy draining activities which, can be reduced to an "energy count".

Methodology

The main aim of the present study is to assess the use of mental energy by scientific personnel. Our assumption is that scientists working in any set-up have to use their mental skill more often compared to those personnel who are involved in routine though important tasks. Therefore, it is vitally important for social scientists working on "organisational diagnosis", to understand those factors and forces (both within and outside the organisation) which activate or deplete the mental energy of the scientists. The future of R & D or for that matter Science and Technology (S & T) in India, depends to a great extent on what our young educated generation with science background feels about the importance of S & T in national development beside satisfying some of their own basic needs also. An equilibrium has to be developed between the individual scientists needs and the S & T needs of the country or organisation.

Keeping this aspect of assumption in mind we interviewed 60 young scientists of a national laboratory of Council of Scientific and Industrial Research (CSIR). The sixty scientists were of the age group between 25 to 30 years and represented lower and middle cadre in the hierarchy. The levels in no way reflected that they were involved in less important tasks. In fact, they were all working on an internationally important research theme in India. The data were collected using a questionnaire developed by De (1981) and modified by Dhawan (1982). We also used an open-ended schedule for interviews and observed them in group meetings. To map out an individual scientists' energy use, a cumulative picture of organisational energy was sought to be established.

The main focus of the study was on the following relationships:

- Tasks and activities perceived as Energy Generating (EG) and/or Energy Draining (ED)
- Relative value attached to those activities
- Development of an index Energy Count (EC) to measure the health of the organisation/laboratory
- Comparative picture of EC for activities seen within the functional area and activities seen outside the functional area
- Relationship of EG (ED) scores with the background data of the scientists
- Steps suggested at the individual level and at the organisational level to increase EG activities and to reduce ED activities.

The questionnaire consisted of eleven questions. First four items dealt with the background information of the respondents such as age, length of service, etc. For the fifth item, respondents were asked to take one year as their time frame. They listed out six activities/tasks which, in their judgement, were considered as most important energy generating activities. They were at this stage advised to concentrate on activities/tasks, which spanned over their own functional area/department/division. Similarly, they were instructed to list out six most energy draining activities/tasks. For the sixth item, they were asked to distribute, assuming that they had one hundred units of energy in the kitty, between energy generating and energy draining activities on the basis of importance given to various items earlier enlisted by them. The seventh and eighth questions were similar to item five and six, in the context of inter-departmental, inter-locational and environmental situations. They listed six EG activities and six ED activities but here, falling outside their project area/department/division. Both qualitative and quantitative responses were obtained. The ninth item of the questionnaire was designed to integrate the quantitative responses under items fifth and seventh. The question posed was how, in the event of a scientist being endowed with a total of one hundred units of energy only, he would distribute the same in four sectors of a box as follows:

	Within area	Outside area
Energy Generating	A	B
Energy Draining	C	D
	A + B + C + D = 100	

The tenth and eleventh questions dealt with the coping mechanism. Respondents were asked to indicate as to what concrete steps they could themselves take to increase energy count in their work activities. They were also asked to suggest, specifically, what action research laboratories could take to improve the situation. Analysis was done for the total sample as well as for scientists at

middle and lower levels. The index of energy count EC was calculated by dividing EG score with ED score.

Results & Observations

As stated earlier, the sample of sixty young scientists were drawn from a national laboratory of CSIR. The group had interdisciplinary educational background but the project in which they were involved was such that they had to work in a coordinated fashion so as to obtain optimum level of efficiency. Further, their job involved field visits to deep sea for about three months in a stretch. Majority of them underwent a crash course related to their job abroad. Table 1 gives the background information of the respondents. The total sample was also divided into middle level and lower level groups based on their designations in the laboratory. The age group of scientists was between (26-31) years. There was no difference in age between middle or lower level. However, combining standard deviation (S. D of table 1) with the mean we find that the middle level was slightly younger, had less length of service and less service in the laboratory. Overall the total group represented young scientists with limited work experience.

These young scientists were asked the following questions:

- Why have you joined the scientific line?
- What expectations you had before joining this laboratory?
- What expectations were met and what were not met while working here?
- What is the meaning of work to you?
- What future do you see in this line/organisation?

Table 1: Background Information of the Respondents

	Background	Total Sample (N=60)	Middle level (n1=41)	Lower level (n2 = 19)
1.	Age			
	Mean	26.53	26.82	26.37
	S.D	4.94	2.37	5.93
2.	Length of Service			
	Mean	4.15	2.19	5.29
	S.D.	4.28	0.72	5.01
3.	Service in the Lab			
	Mean	2.83	2.00	3.30
	S.D	2.19	0.61	2.60

A large majority of the respondents have joined the scientific line not because they were interested in it but because of "secured nature of job", "wanted a job and got this," or with "limited idea about this line". A few of them did mention that they were really interested in scientific work and were lucky to get this opportunity. In fact, what these scientists reflect is the general problem of unemployment faced by our educated youth, many of whom are forced to grab whatever chances of employment are thrown on to them. In this process, some may find themselves in a better position like these young scientists (?) compared to many others who roam on the streets or accept non-scientific jobs. India may rank third as far as scientific population is concerned, but in terms of utilisation of this knowledge we may be far behind many other countries possessing comparatively fewer people with scientific background.

On the third item as to what expectations were met and what were not, responses were of different nature. This is understandable keeping in view the unclear expectation they had from the research laboratories. Responses ranged from, "mostly clerical job", "no variety", "slow moving organisation", "tasks not related to our educational background", to "good library", "working on new instrument", "gaining new knowledge". On issue "tasks not related to educational background", we may mention that these scientists are involved in a project where they have to work with scientists having different educational backgrounds. Efficiency depends upon how best one coordinates his or her activities with other people. Perhaps, these scientists are still learning of mutual support and cooperation. The role of the leader becomes very crucial in this respect.

Efficiency depends upon how best one coordinates his or her activities with other people. The role of the leader becomes very crucial in this respect.

Regarding their future in the research laboratories, majority of them mentioned the traditional hierarchical system such as after five years they will move to higher scale and so on. Future of a scientist, to us, does not only mean their "level in the organisation", but what additional knowledge they will gain so that the country becomes self reliant in some areas or less dependent on other developed countries. Such items were clearly missing in their psyche. Related to fourth question was the fifth item as to what exactly they mean by work. Without any hesitation, they indicated the job which they are involved in as work to them.

Table 2 presents the Energy Counts for the total sample as well as for the middle and lower level scientists. The overall EC was also divided into two parts: EC within the project area and EC outside the project area. Looking at the total sample we find that all the three ECs are greater than one. It shows that these young scientists have perceived greater or higher valued Energy Generating activities compared to Energy Draining Activities. The same is true for the middle level and lower level scientists. In fact, for middle level EC within the project area was about two.

Table 2: Energy Counts (EC)

	Total sample	Middle level	Lower level
Overall EC	1.54	1.74	1.67
EC within the project area	1.72	2.01	1.57
EC outside the project area	1.04	1.06	1.14

While comparing EC within the project area and outside the project area, we find that the three energy counts: total sample, middle level and lower level, EC within the project area is comparatively higher than EC outside the project area though all ECs are greater than one. The results suggest that these young scientists have perceived greater or higher valued EG activities within the project area. This is particularly higher for the middle level scientists. Though these scientists joined the laboratory with limited knowledge and expectations, clearly the environment is providing them with greater opportunities to use their mental energy and they are finding higher valued energy generating activities.

These are young scientists with about 4 years of work experience. We should note the point made by Hamner (1980) in his work of "Organisational Shock" that when one enters an organisation the first thing he faces is the process of socialization where they are forced to follow organisational culture. Presthus (1990) also pointed out that cultural values and institutions largely mould individual personality and behaviour. Is it the health the organisation/laboratory which makes these young scientists feel more energetic or is it the incentives they are receiving like training abroad?

The scientists have accommodated themselves in the organisation in a healthier way. However, this accommodation may occur in two stages: disenchantment and indifference (Presthus, 1990). The former characterises those who come into the organization with great expectations (which is limited in our case). But organisational experience and their personal limitations blunt their hopes, and they become disenchanted leading to indifference which is also the second stage. We are raising this issue despite the fact that the three ECs are higher that with higher ECs, because even with limited variations in table 2, we find that middle-level people with lower service in the laboratory are significantly more energetic than the lower level scientists who have comparatively longer service record. Is it the level or the length of service which had made these differences?

To understand these relationships let us consider table 3 which presents Pearson Correlation Coefficients between background data on the one side and EG, ED activities score on the other side. Since we were interested in middle level and lower level differences, these correlations were not calculated for the total sample. With increase in age, the EG score within the project area goes up for the lower level whereas for the middle level the correlations are negative but not significant. For ED activities, the difference between middle level and lower level is quite clear. With increase in age, ED score within the project goes down for middle level whereas for lower level it goes up. For outside project area, ED score goes up with age whereas it goes down for lower level. In other words, for lower level both EG and ED goes up with increase in age. Therefore some part of EG would be giving positive reference to mental energy of lower level whereas the other part increases ED activities. We acknowledge that lower level people more or less spend their time within the project area. Whatever energy gained or consumed, has to be within the project area. The middle level who might be interacting with outside people, organisations etc. are gaining or losing energy outside the project area. Similar differences could be seen in the relationships between EG (ED) scores and service in the lab. It raises a fundamental question whether the project activities are contributing more ED to lower level scientists and they are compensating this drainage with some activities outside the project area.

Table 3: Relationship between EG (ED) scores & background data of respondents

		Age		Service in the Lab	
		Middle	Lower	Middle	Lower
EG	Within Project	−.02	.37*	−.03	.26
	Outside Project	−.21	−.12	−.17	−.16
ED	Within Project	−.34*	.62*	−.06	.64*
	Outside Project	.32*	−.57	.12	−.44*

*$p < 0.05$

Table 4 provides the qualitative responses mentioned under energy generating and energy draining ac-

tivities within the project and table 5 mentions these responses for activities outside the project. We have taken 20 percent as minimum frequency or agreement to include a factor in these tables. We find that for activities within the project, there exists sufficient agreement among the scientists whereas for activities outside the project, this agreement is limited.

Table 4: EG (ED) activities within the project

EG activities	ED activities
Scientific & Technical	*Scientific and technical work in particular*
Scientific discussions	Continuous field visits
Taking part in various activities at field	*Group process in particular*
Working on research problems	Non cooperation within group members
Collection, analysis and writing technical reports	Groupism based on language/region
Self/skill development in particular	*Role of the leader in particular*
Adequate training	Lack of guidance/cooperation/ encouragement from the head
Scientific seminars	
Studying technical articles	Personal problems are not attended
Role of the Leader in particular	*Job satisfaction in particular*
Encouragement from the head	Routine nature of work
	Lack of recognition
	No incentives for hard work
Job satisfaction in particular	*Working conditions in particular*
Feeling of importance and doing something important	Lack of proper food and other entertainment facilities at cruisk
	Bureaucratic set-up
Working conditions in particular	*Non-scientific work in particular*
Adequate working facilities	Administrative work
	File work
	Doing odd jobs
Departmental functioning	
Adequate planning of different activities	
58% weightage	42% weightage

The quantitative distribution of 100 units of mental energy to EG (ED) activities within the project is 58 percent for EG and 42 percent for ED. For EG (ED) activities outside the project also, this distribution is same. In other words items listed under EG have 58 percent importance compared with 42 percent importance given to ED activities. Thus, the activities given under column ED have received sufficient importance in the psyche of these scientists. Ignorance of these activities, at a later stage may lead to frustration or dissatisfaction with the job.

Further, we find that some factors listed under EG have also appeared under ED. There could be two reasons: First, a part of the factor is viewed as EG whereas some other part as ED, and secondly, some scientists have viewed these factors as EG whereas others, perhaps equally strong, have viewed them as ED.

Table 5: EG (ED) activities outside the project

EG activities	ED activities
Self/skill development in particular	*Interdepartmental cooperation and coordination in particular*
Training received abroad	Delay of work
Going for scientific seminars	Lack of cooperation from purchase, administration and finance
	Lack of cooperation between scientists of this project and other scientists
Scientific & Technical work in particular	*Welfare in particular*
Meeting scientists of other labs and organisations	Bad canteen food
Environmental issues in particular	No proper accommodation
Help from other national labs and institutes	
Working in collaboration with other organisation	
Knowing about different organization set-up	
Interdepartmental coordination in particular	
Cooperation from other division of the laboratory	
58% weightage	42% weightage

Table 6 provides a list of action steps which the respondents felt could be possible by individuals and the organization to increase EG activities and reduce ED activities. The list indicates that these young scientists do feel that there are areas where some improvement could be possible. Further, they are not blaming the organisation but have suggested actions which they themselves can take. For bringing about any meaningful change, the first step should be to start with those actions which an individual can take. This may lead to a change or improvement in the overall system as well.

Table 6: Suggestions towards increasing EG & reducing ED

What individuals can do	What organisation should do
Updating skill through discussions, training etc.	Better welfare activities
Helping colleagues and creating team spirit	Better working conditions
	Giving some responsibility to junior scientists
Providing guidance in research	Proper guidance and information sharing
Adapting present system	
Spending more time on EG and avoiding ED activities	Proper recognition
	Holding regular workshops and seminars
No contribution is possible	Better project planning
	Proper work distribution
	Streamlining administrative and financial procedures.

Concluding Remarks

The tool "organisational energy" can be used to explain the scientists' needs to increase energy count, both for themselves as well as for the research laboratories. The need for such a tool has arisen because most widely dispersed management techniques have their origin in the industrialized countries of the West (Kanungo & Jaeiger, 1990). Countries in the developing world are advised and feel themselves, that they must strive to adopt Western thought and practices to achieve R & D prosperity within the shortest period time. As Sinha & Kao (1988) pointed out, many organisational practices and management training programmes in the developing countries in modern times are based on 'an uncritical emulation and extrapolation from the experiences of the models of western countries, grossly disregarding the fundamental differences in socio-cultural constraints and local conditions and circumstances'.Though Sinha & Kao's point was regarding general principles of management these conclusions are true for R & D management also. In India, it becomes very essential that such a tool be developed understanding the peculiarity of the cultural norms of the society. The Research and Development component attracts the maximum attention in national planning for almost all the sectors. But the information base regarding scientists' needs, ethos and functioning style in research laboratories is grossly inadequate. Researches that have been carried out in the past are not sufficient to conceptualize the various issues that emerge in common man's mind about why people join scientific line, what are the motivating factors that keeps their mental skill alive and similar related issues.

Majority of the scientists are young and have joined this line because of *socio-environmental needs* — secure job. This had led to *uncertainty* in their minds about their tasks. This uncertainty could lead to both positive as well as negative impacts on their job performance. They may try to work hard and attempt to develop their identity (as happens with most young employees) or it may create a frustration in their minds leading to "apathetic", "antagonistic", or "adaptive" attitude. The suggestions listed in table 6 indicate that at this stage, both types are present in our sample — "adapted to the present set-up" versus "updating skills" or "no contribution" (apathy) to "providing guidance in research". The overall Energy Count was considerably high indicating that the work climate in the project generates more energy than consuming it. An interesting trend observed was that while the middle-level scientists find more higher value energy generating activities within the project, for junior scientists, it is more for activities outside the project. Such variations are an indication of the extent of involvement or commitment of the scientists towards the project. Is it that the lower-level scientists are busy doing activities which they perceive fall outside their project and try to generate energy from those activities? We have hypothesised three reasons for these variations.

Employee's role: If employees feel or perceive their role falling more within their functional areas, such employees will have high EG for within the functional area.

Employee's hierarchical position: At higher levels in the organisation, employees have to interact with other divisions/departments and outside agencies in many ways (for information, interface decision making etc). Unless a coordinated system is developed for organisational functioning and supportive attitude is shown by the outside agencies, energy consumption will be more on activities outside the functional area. The qualitative responses indicate that inter-departmental cooperation exists only to a limited extent. Further, maintaining relationship with outside agencies requires sufficient skill in inter-group functioning, judging the values of the other party and some knowledge about their activities.

Employee's authority and responsibility: In an R & D set-up, a project leader may have some liberty to deal with issues related to his area but for activities outside he has to depend on others. The degree of energy generation or consumption will depend on his equation with the outside power group.

Unless a coordinated system is developed for organisational functioning and supportive attitude is shown by the outside agencies, energy consumption will be more on activities outside the functional area.

Relating the EG (ED) score with the background information of the respondents, we found positive association (for lower level particularly) between ED within the project and the age, length of service, and service in this particular lab, and negative correlation between background information and ED outside the project. One must interpret this result carefully. The plain statistical interpretation is that with increase in age, and length of service their energy consumption goes up for activities within the project area whereas it goes down for those outside.

India, and for that matter most of the developing countries are faced with a strange paradox. On the one hand, there is a continuous increase in the educated population with science background and as our employment situation is not yet developed to the extent to absorb most of them, it has created an environment where many scientists are either leaving their area of specialisation (underutilisation of manpower) or are leaving the country (the problem of brain-drain). On the other hand, there is a great need for self-reliance using their own R & D potential. Thus, an immediate problem before social scientists is to systematically analyze those factors and forces in the work climate or functioning of research laboratories that help or hinder in the smooth operation of scientific activities. Understanding such factors or activities will help in developing action strategy(ies) to increase mental energy of scientists on the one hand and organisational efficiency on the other.

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Feature

Policy Design with a Complex Socio-Economic Model

Purnendu Mandal

The approach to policy design in socio-economic studies is still intuitive. Often great efforts are put in developing models for complex systems, but due to lack of a systematic approach to policy design, the models are exploited only partially. Here an attempt is made to provide a comprehensive view of policy design for models dealing with socio-economic situations. A taxonomy of policies based on the level of application, the basic purpose, the configuration and the continuity of policy actions is presented. The paper discusses the application of these concepts in designing policies for Indian socio-economic development based on a system dynamics model.

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Modellers use either inductive or deductive approach (Schnaars, 1990) to policy design for scenario analysis. The inductive approach is essentially intuitive in nature and relies heavily on the modeller's perception of optimistic or pessimistic or some dominant 'theme' of the future for the system. This approach is usually applied to small systems with a few dominant factors. On the other hand, in deductive approach (When many factors are involved) the modeller first decides on the tone of the scenario (i.e. optimistic or pessimistic or a theme) and then specifies values of the factors conforming a particular tone. For example, if a planner is expecting an optimistic investment and growth prospect in an economy in the future he might set a high target investment at 15 per cent (say) of gross domestic product. Even in deductive approach there is no precise procedure which enables a modeller to generate all possible alternatives with the model. However, rational decision making demands evaluation of all possible alternatives and, therefore, the generation of policy alternatives should be comprehensive.

Taxonomy of Socio-Economic Policies

Policy design can be considered as a process of inventing, developing and finetuning a course of action (Dryzek, 1983); as a blueprint for purposeful action (Bobrow, 1974); as invention of policy alternatives (Alexander, 1982). To be effective in policy design one must pay attention to the following three core elements (Bobrow & Dryzek, 1987):

- Clarification of values (i.e. criteria for comparison) which can provide clear guidance for developing and weighing policy alternatives.
- Characterisation of the context of policy (i.e. aims of policy analysis).
- Selection of audience to whom policy design will serve.

Policy design can be considered as a process of inventing, developing and finetuning a course of action as a blueprint for purposeful action, as invention of policy alternatives.

Unlike in engineering and architecture systems, policy design in social systems faces a fluid environment, uncertainty, conflicts of values and interests. Hence, 'it is (not) surprising that sporadic policy design efforts have stopped far short of a fully articulated set of strategies for the would-be policy designer' (Bobrow & Dryzek, 1987, p 201).

It is evident that there is no mechanical method of generating policies and analysing scenarios. The methods vary from highly qualitative (Khan, 1968; Durand, 1972) to quantitative (Helmer, 1981; McNamara, 1976; Cazes, 1976; Gershuny, 1976). One obvious advantage of the quantitative approach is that a modeller can numerically assess and depict the behaviour of the system under various policies. Moreover, this approach can provide an avenue for systematic search for policy interventions. System dynamics is a quantitative technique and has been applied to scenario analysis of socio-economic systems (Forrester, Mass & Ryan, 1976; Stover, 1975; Wolstenholme & Mandal, 1989). However, most of the published literature concentrate on conveying the results of the policy analysis and very little is told about the design consideration in generating policies. This specific issue is given emphasis in this paper.

In socio-economic modelling there a number of attributes or system characteristics which govern the modelling effort. These characteristics are the purpose of modelling, the level of policy intervention, the configuration of the system and the continuity in policy implementation. Each of these attributes influence policy design and are discussed in detail.

Level of Application

The controls can be exerted at different levels of the socio-economic system and the degree of importance of the policies varies from level to level. For a national socio-economic model, there are essentially three levels (national, inter-sectoral and sectoral) where controls can be exerted (Figure 1). This classification of policies at the national, inter-sectoral and sectoral levels helps to create a visual overview for policy analysis which stresses the hierarchical nature of the policy process. Performances in the sectoral level determine the success of policies in the inter-sectoral level and, ultimately, success at the national level. The control in terms of both the number of decision points and effectiveness of policy measures increases as one moves down from the national level to the sectoral level. In terms of the overall sensitivity of the policies, the decisions made at the national level have greater impact than those of policies at lower levels.

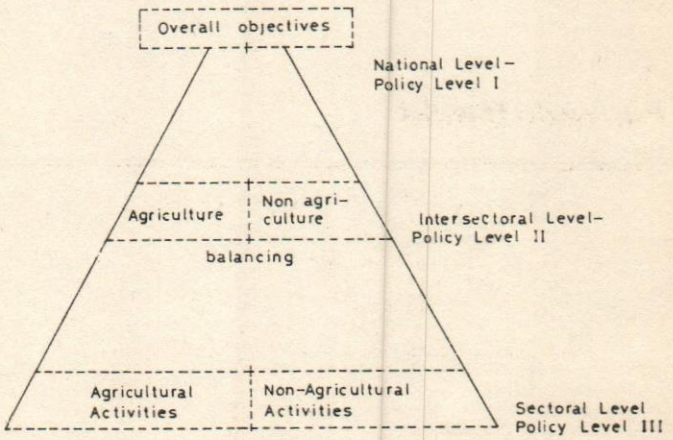

Figure 1: Level of Policy Applications.

Purpose of Policies

The basic aim of the policies, whether to influence growth or equity of both, are also important in the characterisation of control policies.

System Configuration

The other major factor which helps policy classification is the system's configuration. The system behaviour will be different based on whether the system is 'closed' or 'open'. 'Open' system may be considered as being where the major outputs of the system do not feed back information to the controllable variables of the system. The opposite is true for a 'closed' system where major outputs feed back information to the controllable variables. In an open system configuration, the decision concerning the application of a policy is made at the beginning of a period and policy remains operational throughout the period irrespective of changes in the states of controlling variables. This mode of representation is exactly in keeping with how policy implementation takes place in developing countries — many policy plans are created and implemented with little monitoring of their effect. This view is confirmed by the literature where most policy analysis in developing economies are based on non-adaptive assumptions (Holland & Gillespie, 1963; Saeed, 1980; Wolstenholme and Mandal, 1984).

In the case of a closed system configuration, the policies are made adaptive and the states of the controlling variables are used to decide whether a policy should remain operational or not.

For the socio-economic systems, an open system configuration can be defined as one where model growth rates and income distribution do not influence any policy parameters. But in the closed system configuration of the model, there is lot of scope for the growth rate and income distribution to influence policy application. Some of these possibilities can be seen in figure 2 where information on the growth rate and equity at any time are fed back to suitable variables at different levels of the model.

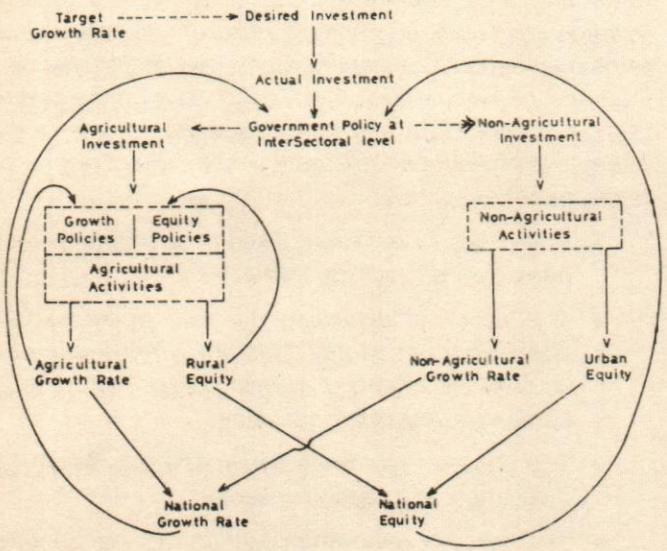

Figure 2: Scope of Information Feedback in a closed System.

Continuity in Implementation

Finally, the policies can be classified according to the approach in implementation. From a system's point, particularly for a 'closed' or adaptive system, a policy can operate continuously or it can be made operational only in the case of system's criticality. A system is assumed to have reached criticality when the output falls below a set target. For example, if the growth rate is set at the minimum of 2 per cent per year and if the system generates growth rate below 2 per cent then it is considered to be critical with respect to growth. In the case of criticality the policy measures are drastic and remain in force so long as the criticality exists. Figure 3 reveals the possible policy interventions matrix when one considers all the characteristics of a socio-economic system. The taxonomy presented in figure 3 is a general one and the matrix will change depending on the actual situation. In designing policy alternatives for Indian socio-economic development all the foregoing points are considered.

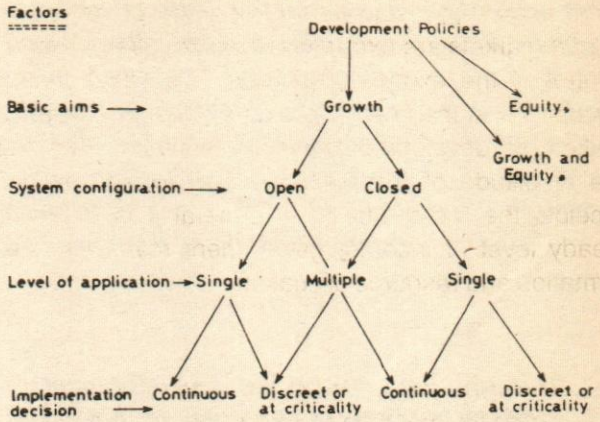

Figure 3: An Ideal Taxonomy of Policies for Socio-Economic System
* Note: Branching of Equity and Growth-Equity policies are similar to Growth policies.

Policies Concerning Socio-Economic Development

The policies, based on the purpose, can be classified into growth, equity and growth-equity policy.

Growth Policies

Economic development, without paying distributive effects, can be enhanced by higher investment availability and allocating investment in such a way which assures balanced growth or leads to a particular pattern of development. The economic development of India is considered here at three levels of the economy: national, agricultural-nonagricultural and agricultural.

Economic development, can be enhanced by higher investment availability and allocating investment in such a way which assures balanced growth.

Growth policies at national level

The growth policies at the national level considered in this study are of three kinds. Firstly, an attempt is made to improve growth prospects by increasing investment by a substantial amount of foreign borrowing. There is ample evidence of governments using external borrowing in the case of an investment shortfall. Secondly, it might be possible to overcome an investment shortfall by an emphasis on producing exportable agricultural goods and maintaining a surplus on the balance-of-payments ac-

count. Though an export-led development strategy might be of particular advantage for developing countries with their well established agriculture sector, this may inflict a great degree of instability on the development process. Export markets are extremely unstable, often beyond the control of the exporting country, This effect produces disruptions in the flow of foreign exchange receipts and makes the development process unstable. The higher the amplitude of the fluctuations in foreign exchange receipts the more difficult in general it is to maintain steady level of income, government revenues, capital formation and resource allocation.

Though an export-led development strategy might be of particular advantage for developing countries with their well established agriculture sector, this may inflict a great degree of instability on the development process.

The third and final action which can be taken at the national level is the implementation of a strategy of so-called balanced growth — establishing a pattern of mutually supporting activities in both agriculture and non-agriculture sectors of the economy. If the peasantry is incapable of producing surplus food above its own subsistence needs there will be little or no market for manufactured goods. By the same token, agricultural improvements may be inhibited by the lack of a market for farm products if the non - farm sector of the economy is backward or underdeveloped. Balanced growth is achieved by mutually supporting investments over a range of agricultural and non-agricultural activities. The other factors that determine the optimum pattern of diversification are to do with technology, physical conditions and other conditions prevailing in the country. The concept of balanced growth is somewhat qualitative and there can be no standard prescription of universal applicability. 'We are concerned with a point of principle and cannot deal with the precise forms of its (balanced growth) implementation in practice' (Meier, 1976, p. 643).

Growth policies at inter-sectoral level

Inter-sectoral rates of growth are of great importance particularly when the standards of living of rural and urban people are considered. About 70 per cent of the population in developing countries live in rural areas and to improve their standard of living a high growth rate of the agricultural sector seems to be a precondition. This requires, logically, a higher investment in agriculture. However, higher investment in agriculture may not necessarily guarantee higher growth rate. There might be long term constraints associated with agricultural development. This is certainly true as physical resources become limited, which as time passes results in agricultural development (also in non agricultural development), becoming more costly. A higher rate of development with higher investment in agriculture is likely to raise development costs sharply in later periods. It is important therefore to study the growth pattern under various agricultural and non agricultural investment patterns.

There are many ways of deciding investment patterns and they depend on the government's attitude towards agriculture and non agriculture. Investment patterns may remain constant or many vary at discrete time intervals, or even continuously, depending on the performance of agriculture and non agriculture. Some of the alternative investment policies that have direct reference to this paper as follows:

- The policy of reviewing fixed proportional investment over a long time frame.
- The policy of reviewing the investment pattern after every ten years. This policy considers particularly the effects of normal, low or high proportional investment in agriculture.
- The policy of reviewing five yearly alternative full investment in a particular sector.
- The policy of reviewing continuously intersectoral investment decisions. This is associated with the concept of a closed system configuration. However, the major outputs of development, such as growth rates and equity values, may be considered at each point of time to arrive at a decision of agricultural/non agricultural requirements. Again, these decisions may depend on the attitude of the government towards the priority in equity improvements and growth improvements. The implementation of decisions can also be continuous or can be held over to such a time when the system reaches its criticality.

Growth policies at sectoral level

Sectoral growth policies are concerned with monitoring intrasectoral activities. The actual agricultural production pattern can be monitored easily by selecting the appropriate investment allocation policies from among the various activities of agriculture. Investment

allocation policies are important instruments to reveal long term bottlenecks associated with the development of individual activities, such as land creation, irrigation, etc. An increase in agricultural productivity is usually identified with the success of the green revolution to produce the necessary foodstuffs for the nation. Though the green revolution deals with a package of measures the most important one is the introduction of higher generation seeds to increase the yield rate. The effects of high yielding variety seeds and abnormal weather conditions (shortfall of rain) are two very important factors which need careful study in determining the success or failure of the green revolution.

Investment allocation policies are important instruments to reveal long term bottlenecks associated with the development of individual activities, such as land creation, irrigation etc.

Equity Policies

Equity policies directly affecting private income are of prime importance for any socio-economic study. There are essentially three prominent income equalisation policies which need investigation. Firstly the redistribution of existing assets. The most important asset in India is land and its distribution is highly skewed in favour of the big farmers. Attempts have been made to bridge the income differences by introducing land reform legislation, but, for some reason or other, implementation of this policy has been very unsatisfactory. It would be interesting to evaluate the income distribution situation if the land reforms could have been made a complete success.

Secondly, in the Indian situation a large number of studies have shown that a large proportion of the total fertiliser consumption is shared by the big farmers. It is evident from the operational mechanism of the production system that the big farmers consolidate their purchasing power of fertiliser because of their high level of solvency. In this situation a government policy of providing subsidised fertiliser to the small farmers through a public distribution system seems to be an effective way of increasing the incomes of the small farmers. Fertiliser subsidy provides an incentive for the small farmers to buy more fertiliser and increase income from the land by way of increasing the yield rate. Subsidisation will at first put a drain on budgetary resources, but this may be offset by the prospect of increased foodgrain production and even by the foreign exchange earnings from foodgrain exports. In practice there is no such policy in operation in India, but it may be very illuminating if it could be implemented.

Finally, the imposition of a minimum wage rate. The establishment of a minimum wage regulation is expected to improve the income situation of the wage earners and at the same time reduce the size of the profits accruing to the rich. The situation may not be so, in practice. Imposition of a minimum wage may force the employers, i.e., the big farmers, to reduce their labour force and that may ultimately worsen the economic situation of the wage earners. Again the transfer of income from the big farmers to the wage earners may put constraints on the resources available for development expenditure and may retard growth prospects. Though some of the regional governments in India have legislated minimum wage rate act, the implementation of it is far from satisfactory. The repercussions of the strict imposition of a minimum wage rate policy therefore, need to be studied.

The above three policies can be imposed on their own or in a combined form. The combination of two or more policies becomes necessary when a policy fails to deliver the desired improvement on its own. Not all the equity policies are effective to the same extent. Considering the income equalising power of each policy the minimum wage rate is the most powerful instrument, followed by a land reform policy and, lastly, a fertiliser subsidy policy (Wolstenholme & Mandal, 1984).

Considering the income equalising power of each policy the minimum wage rate is the most powerful instrument, followed by a land reform policy and, lastly, a fertiliser subsidy policy.

The imposition of an individual equity policy or a combination of policies is essentially fixed in nature irrespective of the level of inequality. Since, the degree of inequality is likely to vary over the simulation period and the ability of equity correction policies differ, it seems reasonable to apply an equity policy or a combined policy after considering the existing degree of inequality. The logic is very simple. If the existing degree of inequality is high, apply a drastic policy. This policy remains in force so long as the equity situation shows an unacceptable value. If equity improves, subsequently, the system is switched over to a less drastic policy.

design of the policies for the Indian situation as suggested in Figure 6 and Table 2 stem from an ideal classification of policy alternatives as shown in Figure 3. The system dynamics models of socio-economic development for other countries are also amenable to the classification suggested. Because of the generic nature of system dynamics modelling (Forrester, 1968) and its ability for easy conversion (Sterman, 1984) to other similar situations, it is hoped that the design procedure suggested in this paper will go a long way in avoiding the duplicating effort in policy designing for individual country models.

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When the group or civilization declines, it is through no mystic limitation of a corporate life, but through the failure of its political or intellectual leaders to meet the challenge of change.

WILL and *ARIEL DURANT*

R & D Budget Allocations — A Goal Programming Study

M. S. Tyagi & S.C. Rastogi

Inadequacy of funds, entails optimal planning of expenditure. This is true in the case of expenditure incurred in Research & Development organisations where paucity of funds is a serious threat to accomplish even the minimum objectives. In this study the use of Goal Programming technique is illustrated for making budget allocations for R & D organisations working under the administrative control of a corporate body.

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In Management Science, several approaches have been developed to deal with multi-objective decision making problems (Zeleny, 1982; Cohon, 1978). Of these techniques Goal Programming (GP) (Lee, 1972) appears to be the most promising tool due to its flexibility. GP and its variants have been applied to wide ranging problems successfully (Can & Houck, 1984; Ignizio, 1976; Minguez et al, 1988; Tyagi & Swaroop, 1979; Tyagi et al, 1978). In this study, the recurring and capital budget, papers, patents and processes are considered as the parameters to develop a Goal Programming Model. The GP Model evaluates the contribution of research output from an organisation to the corporate productivity and optimise the budget allocation for the same accordingly.

Objectives

The primary aim of this study is to develop a model for demonstrating the application of Goal Programming (GP) technique, for budget allocations by an R & D corporate to its organisations. (The budget allocations are made to the organisations on output basis). Some other objectives are as follows:

- To identify the organisations which are not able to provide sufficient output for increased budget demand
- To reward the organisations giving more output by allocating additional budget
- To allocate minimum budget, as an opportunity for improvement, to organisations having low output

Goal Programming (GP)

The basic components namely the choice variables, constraints and objective function for the model are determined on the basis of the decision making environment. In GP goals are rank-ordered according to their priorities in the decision making environment. The goals are con-

sidered one at a time from the highest to lowest priority level. The objective function of the problem consists of deviational variables with pre-emptive priority factors P's for ordinal ranking and W's for weightage at the priority levels.

Let C be a 2m components row vector whose elements are products of P and W such that

$$C = (W_1 P_1, W_2 P_2, W_3 P_3, ..., W_{2m} P_{2m})$$

where P (i = 1, 2, 3, ..., 2m) are pre-emptive priority factors. P's and W's are real numbers.

Suppose d is a 2m components column vector whose elements are d^{-1}'s and d^{+1}'s such that

$$d = [d_1^{-1}, d_2^{-1}, \ldots d_m^{-1} ; d_1^{+1}, d_2^{+1} \ldots, d_m^{+1}]$$

Then the Goal Programming problem involving multiple-conflicting goals can be formulated as

$$\text{Min} \quad Cd$$

$$Ax + Rd = b$$

$$x, d > 0$$

where A and R are $m \times n$ and $m \times 2m$ matrices respectively.

The objective function is to minimise deviations (either negative or positive) from set goals with certain pre-emptive priority factors assigned by the planner in accordance with the policies, environment and judgement.

Basis & Assumptions

1. A corporate entity has been assumed controlling administratively twelve organisations which are actively engaged in performing R & D activities.
2. The past average research output and the expenditure are considered as the structural inputs for the development of GP model.
3. n^{th} Year is assumed as the current year.
4. $(n+1)^{th}$ year is taken as the budget year for the study.
5. A total sum of Rs. 90 crore is assumed to be available with the R & D corporate for making budget allocations to its research organisations for the budget year.
6. For an organisation, the ratio between the expenditure in n^{th} year and the average is taken as the expenditure ratio for the n^{th} year.
7. Goals assumed for allocating budget in $(n+1)^{th}$ year to an organisation are as follows:
   - minimum limit would be equal to n^{th} year expenditure i.e. the current year expenditure.
   - maximum budget limit to an organisation is fixed at 25% higher than the current year expenditure.
   - the sum of the budget allocated to all the organisations under the corporate is assumed equal to total budget available for allocations i.e. Rs. 90 crore.
   - desired corporate output from the organisations.
8. For Model development, the following weights for different types of R & D outputs are assumed;

Output	Weight
(i) Process	70
(a) in production	
— exclusive	70
— non exclusive	65
(b) licensed	
— exclusive	60
— non exclusive	55
(ii) Patents	
(a) abroad	
— accepted	20
— sealed	18
(b) in India	
— accepted	19
— sealed	17
(iii) Papers (NIF)	1

Data Input:

For the organisations considered under the corporate entity, average number of processes, patents and papers, as assumed, for this work are exhibited in table 1.

The average recurring and capital expenditure are assumed for the same period as in the case of average output and given in table 2.

From the above average expenditure data and the expenditure incurred in n^{th} year, the budget ratios are computed for each of the organisations.

$$\text{Expenditure Ratio for } n^{th} \text{ year} = \frac{\text{Expenditure in } n^{th} \text{ year}}{\text{Average expenditure}}$$

Decision Variable

X_i is the i^{th} decision variable in the model. This is a ratio of the expenditure in the current year to the average expenditure for the i^{th} organisation of the corporate.

Table 1: Organisationwise Average Output (Processes, Patents & Papers)

Organisation	Processes				Patents				Papers (NIF)
	In Production		Licensed		In India		Abroad		
	Exc*	NExc**	Exc	NExc	Accepted	Sealed	Accepted	Sealed	
A	2	—	1	4	47	42	2	—	253
B	—	9	5	10	52	32	2	—	112
C	3	1	3	6	15	9	—	—	63
D	—	1	—	—	15	12	—	—	44
E	—	4	—	21	16	14	—	—	209
F	—	4	—	14	5	2	—	—	89
G	1	6	—	2	2	1	—	—	85
H	—	2	1	4	8	3	—	—	93
I	—	4	1	7	9	8	—	—	20
J	—	5	—	4	17	15	—	—	120
K	2	9	10	10	1	1	—	—	47
L	1	3	16	14	77	40	1	—	528

* Exc : Exclusive, ** NExc : Non-Exclusive

Table 2: Average Recurring & Capital R & D Expenditure

(Rs. Lakh)

Organisation	Recurring	Capital	Total
A	453	120	573
B	284	122	406
C	299	116	415
D	437	114	551
E	375	94	469
F	278	61	339
G	175	79	254
H	337	127	464
I	305	99	404
J	192	78	270
K	299	181	480
L	549	188	737

Process Development Constraint

Process development is the weighted sum of the processes in production or licensed on exclusive or non-exclusive basis developed by the organisations in the corporate. The total weighted sum of all the processes is greater than or equal to a preassigned value PRO such that

$$\sum_{i=1}^{m} \left(\sum_{j=1}^{l} W_j \cdot PR_{ij} \right) \cdot X_i \geq PRO$$

where

PR_{ij}: Average Number of j^{th} process from i^{th} organisation

W_j : Weight for j^{th} process

X_i : Expenditure ratio for i^{th} R & D Organisation

m : Number of R & D Organisations

l : Number of types of Processes

Patent Development Constraint

It is the sum of all the weighted patents licensed or sealed in India or abroad from all organisations in the corporate. PT is some preassigned value for the patents developed and is computed as given below:

$$\sum_{i=1}^{m} \left(\sum_{j=1}^{n} W_i \cdot PAT_{ij} \right) \cdot X_i \geq PT$$

Where

PAT_{ij} : Average Number of j^{th} type of patent from i^{th} organisation

W_j : Weight for j^{th} patent

n : Total patent's types

Paper Impact Factor Constraint

Total Impact Factor for Papers is the sum of Impact Factors assigned to all the papers published from the R & D organisations in the Corporate and is greater than or equal to a preassigned value PP.

$$\sum_{i=1}^{m} (PAP_i \cdot X_i) \geq PP$$

where

PAP_i : Average Impact factor from i^{th} organisation

Corporate Output Goal

The corporate output (CO) is the sum of weighed Processes, Patents and Paper Impact Factors from R & D organisations in the corporate and is calculated as follows.

$$CO = PR + PT + PP$$

Recurring Budget Constraint

Recurring Budget (TRB) is the sum of recurring budget allocated to each of the organisations in the $(n+1)^{th}$ year i.e.

$$\sum_{i=1}^{m} (R_i \cdot X_i) \leq TRB$$

where

R_i : Recurring expenditure in n^{th} year for i^{th} organisation

Capital Budget Constraint

TCB is the sum of the capital budget allocated in (n+1) year to the R & D organisations in the corporate.

$$\sum_{i=1}^{m} (C_i \cdot X_i) \leq TCB$$

where

C_i : Capital expenditure for i^{th} organisation in n^{th} year

Total Budget Goal (TB)

TB is the sum of the recurring and capital budget allocated to all the organisations and is less than or equal to the available budget of the corporate for the $(n+1)^{th}$ year. For this study the total corporate budget available is Rs. 90 crore.

$$TRB + TCB \leq TB_6$$

Budget Allocations Goals

Minimum

For all the R & D organisations of the corporate, the minimum budget allocation is, at least, equal to the expenditure in n^{th} year. Therefore, the decision variable should be greater or equal to ratio of n^{th} year and average expenditure :

$$X_i > r_i \text{ for } i = 1, 2, 3, \ldots\ldots m$$

where

r_i : Ratio of n^{th} year and average expenditure for i^{th} organisation.

Maximum

For an organisation the maximum budget allocation in the $(n+1)^{th}$ year is 25 per cent more than the expenditure in the n^{th} year i.e. decision variable should be less than 125 per cent of ratio of n^{th} year and the average expenditure.

$$X_i < r_i \times 1.25$$

MODEL Dimensions

— No. of Variables	: 68
— No. of Constraints	: 35
— No. of Objectives	: 4
— No. of Priorities	: 4
— No. of Added Priorities	: 22

Model Capabilities

The present Goal Programming model has a number of capabilities some of which are as follows:

- Variations in corporate output and organization budget may be studied by changing corporate — capital or recurring or even total budget.
- Combined Output and budget variations for individual organisation may be studied by making changes in maximum and minimum budget allocation limits.
- Variations in output and budget for an individual organisation may be studied assigning priority factors by the decision makers in accordance with the policies, environment and judgement.

Results & Discussion

Based on the assumed inputs, the GP model provides the budget allocations for the given corporate combined research output. Along with the budget allocations the model is also employed to study the componentwise (Process, Patents and Papers) corporate research output. This discussion has an incidence mainly on following model outputs:

- budget allocations
- research output

The organisation-wise budget allocations for a feasible range from 9500 to 9975 units of the corporate combined output are obtained and are exhibited from Fig. 1 to Fig. 12. It may be mentioned here that the model would allocate budget money until the budget exhausts completely. Three cases — I, II & III corresponding to 9500, 9700 and 9900 units of the corporate combined

BUDGET ALLOCATIONS VS OUTPUT

ORGANISATION A
(Budget min.858.1 & max.1072.6 Lakh Rs.)

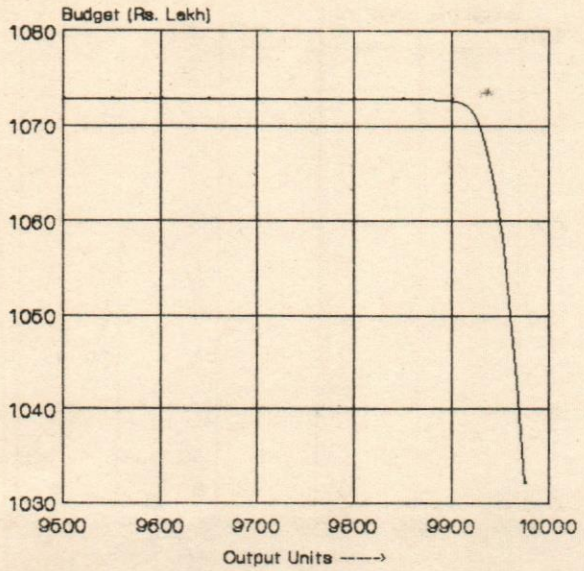

Fig.-1

ORGANISATION B
(Budget min.630.1 & max.787.8 Lakh Rs.)

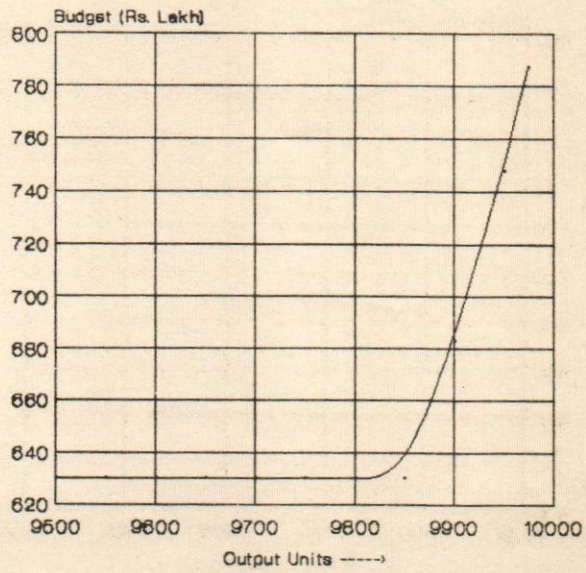

Fig.-2

ORGANISATION C
(Budget min.604.2 & max.755.2 Lakh Rs.)

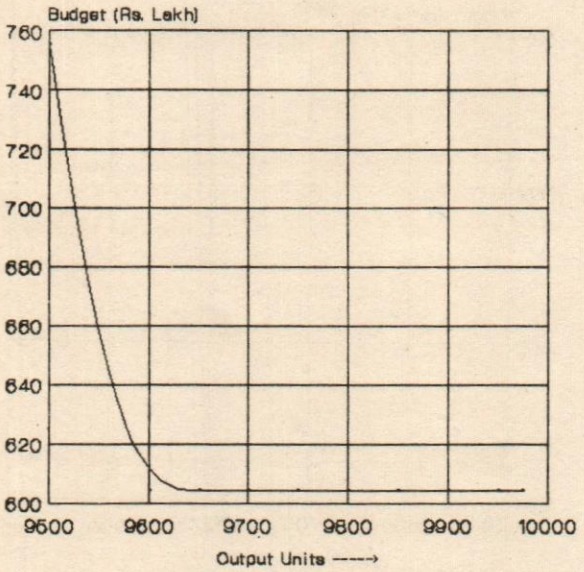

Fig.-3

ORGANISATION D
(Budget min.757.4 & max. 846.6 Lakh Rs.)

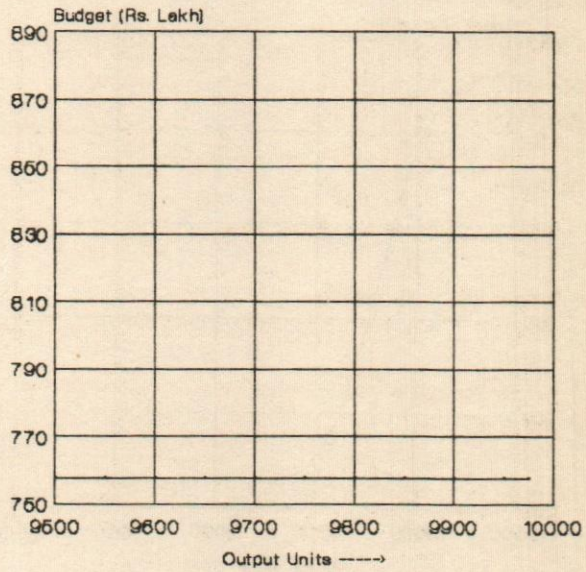

Fig.-4

OUTPUT • PROCESSES • PATENTS • PAPERS

BUDGET ALLOCATIONS VS OUTPUT

ORGANISATION E
(Budget min. 619.6 & max. 774.6 Lakh Rs)

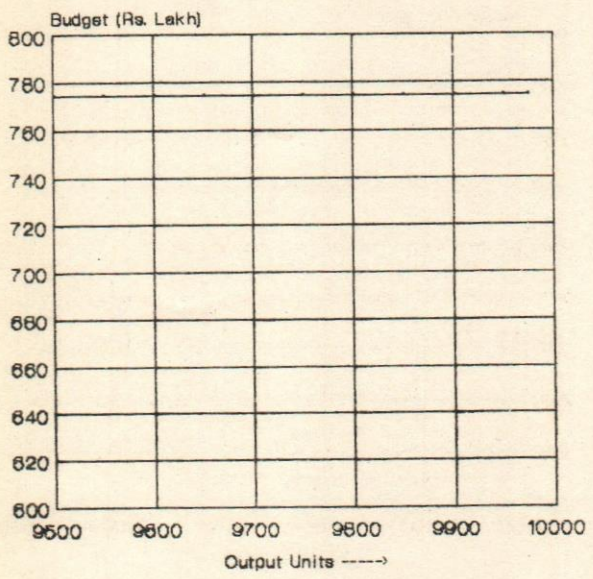

Fig.-5

ORGANISATION F
(Budget min. 519.5 & max. 654.5 Lakh Rs)

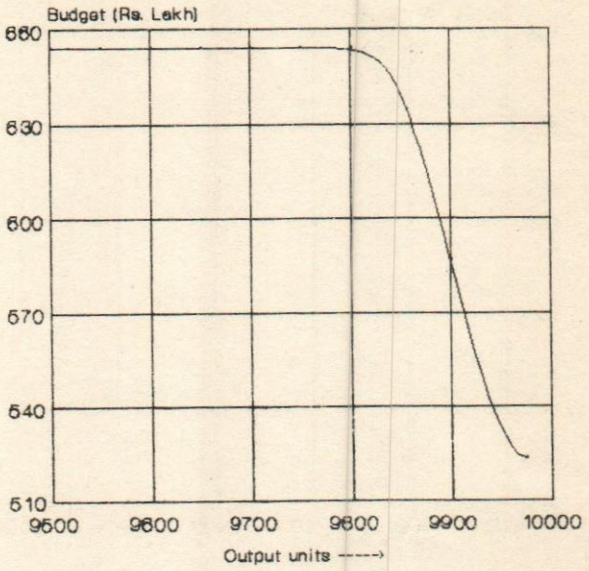

Fig.-6

ORGANISATION G
(Budget min. 345.9 & max. 432.6 Lakh Rs)

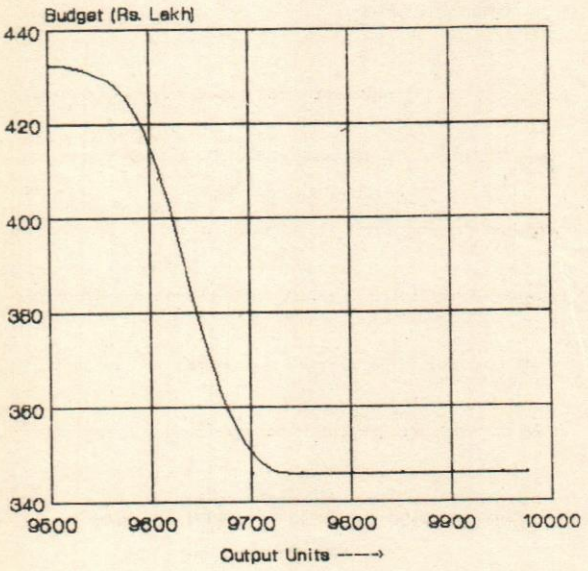

Fig.-7

ORGANISATION H
(Budget min. 649.4 & max. 687.5 Lakh Rs)

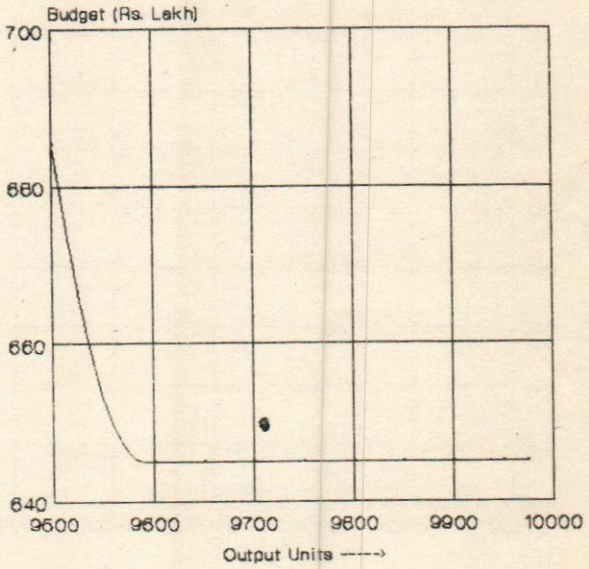

Fig.-8

10

OUTPUT = PROCESSES + PATENTS + PAPERS

BUDGET ALLOCATIONS VS OUTPUT

ORGANISATION I
(Budget min. 626.9 & max. 786.2 Lakh Rs)

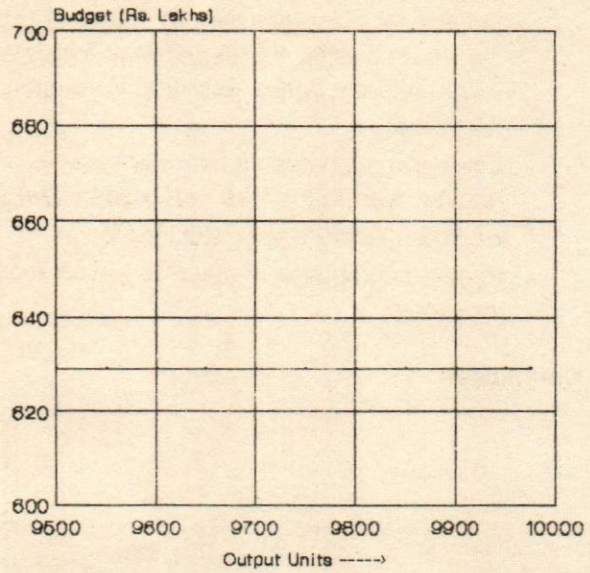

Fig.-9

ORGANISATION J
(Budget min. 405.1 & max. 506.5 Lakh Rs)

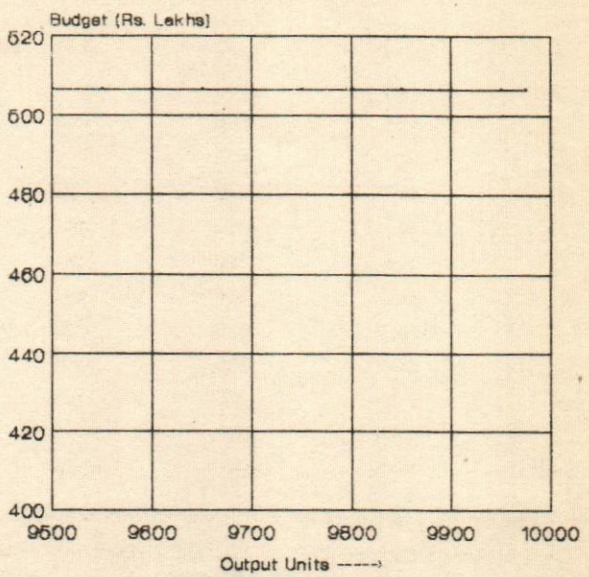

Fig.-10

ORGANISATION K
(Budget min. 716.9 & max. 899.5 lakh Rs)

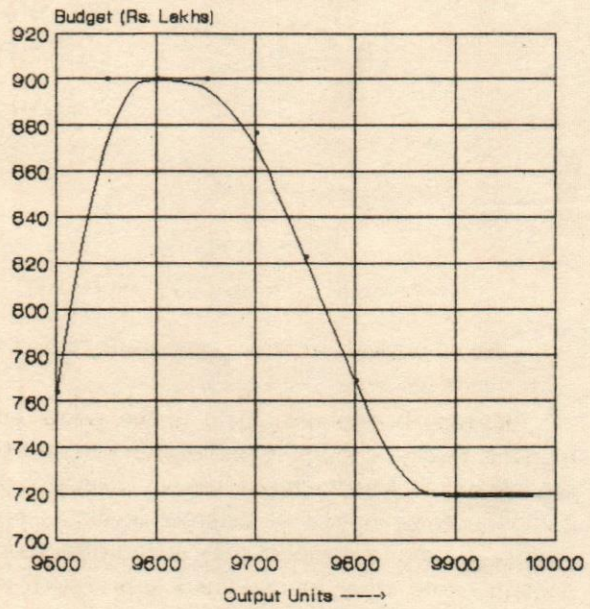

Fig.-11

ORGANISATION L
(Budget min.1343.3 & max.1679.3 Rs lakh)

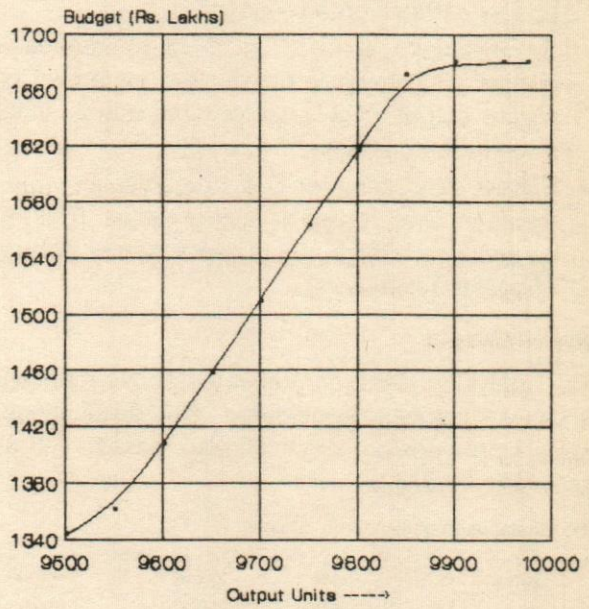

Fig.-12

OUTPUT • PROCESSES • PATENTS • PAPERS

output are considered for making some of the observations regarding the budget allocation exhibited in table 4.

Table 4: Budget Allocations for Research Organisations

Organisation	Budget Allocations (Rs. Lakh)		
	Case I	Case II	Case III
A	1072	1072	1072
B	630	630	683
C	755	604	604
D	757	757	757
E	774	774	774
F	654	654	587
G	432	346	346
H	685	644	645
I	629	629	629
J	506	506	506
K	763	875	718
L	1343	1509	1679
Total	9000	9000	9000

The following are some of the main observations :

- It may be observed that model allocates maximum budget for organisations E & J throughout the feasible range. This is mainly due to the lower output cost and lower budget requirement of these organisations.
- In case of B & L organisations the budget allocations show increasing trends. A probable reason for this may be the lower output cost but higher budget of these organisations.
- Organisations A,F,K,G & C show decreasing budget allocations trends for the increased corporate output. The point of deflection is shifting towards left gradually.
- Budget allocations for D & I organisations are at minimum level for whole output range. This may be because of high output cost together with high budget requirements.

Research Output:

For analysing research output the above mentioned three cases have been considered. The distributions of research output components for these cases - I, II & III are provided at table-5.

Table 5: Distribution of Research Output

Output	Case I	Case II	Case III
1. Combined	9500	9700	9900
2. Components			
— Processes	3830	3904	3871
— Patents	2758	2814	2943
— Papers	2912	2982	3086

The research output distribution may be observed from Fig - 13 for other output levels. Some of the observations regarding the output distribution are as follows:

- Under the above mentioned assumptions the contribution of the processes in corporate output is maximum. Initially this contribution increases upto 9600 units and starts declining for almost rest of the range.
- The trend of contribution for the patents is almost reverse than that of the processes. The patents increasing trend is quite significant.
- Papers contribution in output is almost in increasing order.

Conclusion

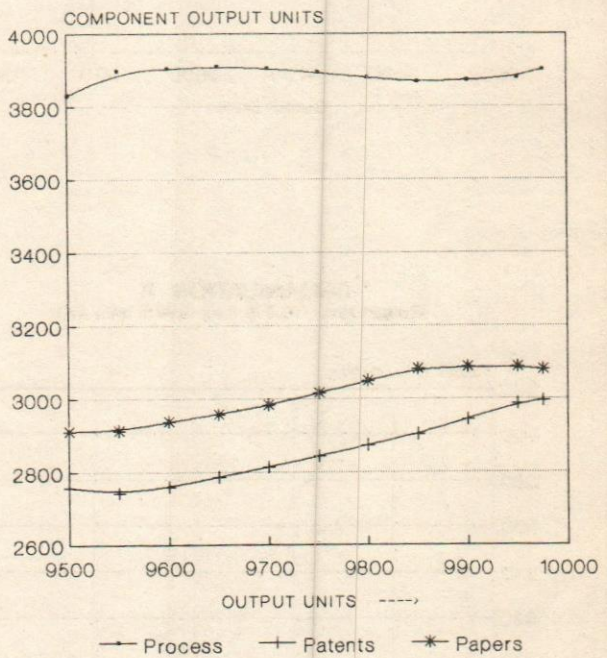

Fig. 13 Distribution of Process, Patent & Paper Output

Although budget allocation is the prime goal, the model is flexible enough to operate on different limits for organisations. Also the model may be utilised to compute componentwise output at different levels of corporate output. Further the model may suitably be modified to accommodate other management goals such as manpower planning, cash flow and Human Resource Development etc. Constraints may also be imposed on the model to achieve a particular desired component of the corporate output.

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When you have hard and fast rules and leave no room for exceptions, you lock everybody in a mould. You destroy initiative and you destroy imagination.

FLETCHER BYROM,
Chief Executive of Koppers Company

Privatisation: The case of Punjab State Road Transport Undertakings

B.S. Ghuman

Employee-friendly privatisation in a phased form is advocated for SRTUs of Punjab. Initially, employee participation in equity of PRTC (upto 20 percent) in the form of free shares per employee, matching share per employee, and open sale of shares is recommended. This is to be followed by limited 'employees buyout' form of privatisation. For newly privatized fleet, only co-operative form of organization is recommended. These measures would result in retention of employment; improvement in vehicle, fuel, labour and capital productivities; revenue to government; wider ownership; and more choice to customers.

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Researchers and policy makers the world over are evincing serious concern over the poor performance of public enterprises (PEs). One of the remedial approaches advocates privatisation as the panacea for the ills of public enterprises. A large number of developed and developing countries are adhering to this approach (BÖS, 1993); Cook & Kirkpatrich, 1988; Mohnot, 1991; Pack 1989; Ramanadham, 1989; Sankar & Reddy, 1989; Vickers & Yarrow, 1988). Granting operational autonomy and enforcing accountability commensurate with authority in the PEs are the central focus of another approach. This approach is implemented through a contract between public enterprises and government — the owner of the PEs. It is known as Memorandum of Understanding (MoU) (Basu, 1991; Chalander, 1986; Heath, 1990; Jain, 1986; Kumar, 1991; Mohnot, 1991; Jena & Ramanna, 1991; Trivedi, 1990; Trivedi & Kumar, 1989; World Bank, 1983). This approach is practised mainly in France, Senegal, Korea, New Zealand and Pakistan and has been recently adopted by the Government of India to improve the performance of its enterprises. Privatisation and MoU, till recently, were conceived as substitutes for each other. However, it is now realized that MoU alongwith other non-privatisation reforms can contribute substantially towards the success of privatisation. Thus these two approaches are now considered complementary to each other. In the present paper also these two approaches are conceived as complementary.[1]

In India the public sector has been playing a dominant role in the field of passenger road transport. On the eve of Independence, the passenger road transport was mainly owned and managed by the private sector. Keeping in view the shortcomings of the private sector, the passenger road transport was progressively brought under the control of public sector. Over time,

[1]For details see Ghuman (1993).

MoU alongwith other non-privatisation reforms can contribute substantially towards the success of privatisation.

the State Road Transport Undertakings (SRTUs) experienced impressive growth in terms of fleet strength, investment, effective kilometers operated, passengers carried, employees, etc. However, their financial performance is far from satisfactory. For example, 42 SRTUs with a fleet strength of 93,349 and a capital of Rs. 4048.68 crores incurred losses to the extent of Rs. 358.89 crores during 1989-90. Loss per bus works out to be Rs. 38,386. The financial net return on investment was negative (–8.86 percent, table 1).

Table 1: Financial performance of SRTUs (1989-90)

Indicator	Punjab Roadways	PRTC	All SRTUs (i.e. National Figures)
Average fleet strength (No.)	2380	1068	93476
Block Capital (Mid year value Rs. Crores)	37.70	103.61	4048.68
Gross Profit (Rs. Crores)	15.76	7.33	1004.24
Profit after Depreciation Reserve Fund (Rs. Crores)	9.27	4.64	537.72
Profit/Loss Before Tax (Rs. Crores)	6.39	–2.81	319.40
Profit/Loss After Tax (Rs. Crores)	–27.91	–18.61	–358.89
Profit/Loss Before Tax per bus (Rs.)	26807	–26310	34162
Profit/Loss after Tax per bus (Rs.)	–117269	–174251	–38386
Profit after DRF to Block Capital	24.59	4.48	13.28
Profit before Tax to Block Capital	16.92	–2.71	7.89
Net Profit/Loss to Block Capital	–74.03	–17.96	–8.86

In Punjab both public and private transport undertakings provide bus services to the passengers. On national highways the ratio between public transport routes and private routes is 70:30. On state highways/district roads, it is 50:50. In public sector, two undertakings viz. Punjab Roadways (a departmental undertaking) and Pepsu Road Transport Corporation (a Corporate body) are operating.

In a labour surplus economy like India, generation of employment has been one of the major objectives of public enterprises. Any move towards privatisation adversely affecting the existing employment would negate the dividends of earlier public policy and would be counterproductive.[2] This is particularly so in a situation where job prospects in the organised private sector are either stagnating or shrinking. Hence at the time of working out the scope of the modalities for privatisation in the cases of Punjab Roadways and PRTC, the employment objective should get adequate priority.

In a labour surplus economy like India, generation of employment has been one of the major objectives of public enterprises. Any move towards privatisation adversely affecting the existing employment would be counterproductive.

Employee-friendly privatization can easily be introduced in cases of SRTUs because units of operation are less costlier. In case of other undertakings, the units of operation are integrated involving huge investments and in many cases are beyond the purchasing capacity of workers. Government and financial institutions are also reluctant to extend loans for this purpose. However, in passenger transport undertakings, the units of operation involve less investments and if the government and financial institutions extend loan facilities, the operating units can easily be brought within the reach of employees.

Social and political consensus is one of the pre-requisites for privatisation. The move of privatisation in passenger road transport should be thoroughly debated in the Assembly and outside by experts, the management of the undertakings, employees, customers and the public. If consensus on privatisation emerges, then, Punjab Roadways and PRTC are recommended to adopt a phased privatisation programme.[3]

Employee-oriented privatisation initially may be inaugurated in PRTC. Non-privatisation reforms are recommended to be introduced with immediate effect in

[2]The cases of Scooters India Limited and U.P. State Cement Corporation are pointers to this direction.

[3]Privatisation is a gradual, complex and difficult process (Mankani, 1990). It involves political, legal and technical issues. These can be sorted out if proper phasing of privatisation programmes is designed.

PRTC.[4] These reforms would not come in the way of privatisation as they are not substitutes but rather, are complementary to each other (Trivedi, 1990b).

Phasing of Privatisation Programme (PRTC)

The privatisation programme may be phased in terms of four time-modules.

Module I

In first two years, when non-privatization reforms are implemented, PRTC should initiate discussion with employees about privatisation (table 2) covering issues such as readiness of the employees towards privatisation through ownership measure, namely, joint ventures and modalities to implement it. In this case willingness of employees to participate in equity capital must be sought. If the response is encouraging, the modalities can be worked out. Following the U.K. model, the following modalities can be considered by the government/management of PRTC (Ramanadham, 1991):

Table 2: Highlights of Phased Privatisation Programme in the case of PRTC

Module I (Years 1 to 2) Mode of Privatisation: Equity Participation	Module II (Years 3 to 4) Mode of Privatisation: Employee buy-out
1. In addition to the non-privatisation reforms implementation, initiate discussion with employees regarding partial privatisation. Seek their willingness about equity participation. Depending on the response work out modalities on the following lines: (a) Specified number of free shares per employee (b) A number of matching shares per employee (c) A number of shares to be sold to employees through open mechanism	1. Initiate discussion with employees regarding another mode of privatisation viz: employee buy-out. Seek employee willingness about: (a) Voluntary retirement (b) Buying of buses (c) Forming of co-operatives
2. The sum total of (a), (b) and (c) should not exceed 20 per cent equity of PRTC in the subsidiaries.	2. If the choices for (a) + (b) + (c) are overwhelming, then take necessary steps for: (a) Undertaking valuation studies (b) Institutional finance (c) A course on co-operatives covering their philosophy, merits, working, relevance to transport activities and limitations.
3. Utilise raised funds to purchase new buses to reduce the percentage of overaged buses.	3. The number of fleet to be privatised should not exceed 20 per cent of the existing fleet strength. 4. Utilise raised funds to purchase new buses to reduce bus-staff ratio.

Model III (Years 5 to 6) Monitoring period	Module IV (Years 7 to 8) New offer for Employee buy-out
1. Carefully monitor the functioning of owners' co-operatives particularly with the focus on: (a) Financial performance (b) Physical performance. (c) Customer satisfaction. 2. List the problems faced by the co-operatives.	1. If module III reveals encouraging results about the owners' co-operatives, revise the offer for 'employee buy-out'. 2. Limit the offer to a specified percentage 3. 'No' to privatisation after that limit. 4. Initiate necessary steps for (a) Undertaking valuation studies (b) Institutional finance (c) A course on Co-operatives. In addition to the areas covered in Module II, also find suitable solutions for the problems faced by the co-operatives (Module III).

[4]Under non-privatisation reforms, it is recommended that PRTC would be a holding company having three subsidiaries. The holding company is recommended to sign MoU with the government. In case of adoption of these reforms, the subsidiaries would be operating bus service. Employees of the subsidiaries would not be the employees of PRTC. However, decisions relating to workers' participation in equity and selling of buses to the employees would be taken by PRTC. For these decisions, PRTC, along with Boards of Management of subsidiaries, would hold discussion with employees. The Boards of Management are working under the overall supervision of PRTC, hence, in the next the reference of PRTC alone is retained.

- Free shares (upto a number) per employee[5]
- Matching shares (upto a number) per employee[6]

[5]In the case of Associated British Ports Holding Plc., British Aerospace Plc., British Airways Plc., British Gas Plc., and Rolls Royce, the employees were offered respectively 53, 33, 76, 52 and 41 free shares per employee (Ramanadham, 1991).

[6]In the above mentioned undertakings the matching shares per employee respectively were 225; 600; (two for one) upto 120; (two for one) upto 111; and (two for one) upto 88 (Ramanadham 1991).

- Open sale of shares to employees. The number of shares to be offered under this category may be decided by the government/management.

In the case of PRTC subsidiaries, more weightage should be given to matching shares and open sale of shares. The number of free shares, keeping in view the financial position of PRTC, is to be kept at minimum.[7] Taken together, the three measures should not exceed 20 per cent of the equity capital of PRTC in the subsidiaries and PRTC should continue to hold equity capital equal to or more than 51 per cent. These measures would provide additional resources to the PRTC. The exact amount depends upon the number of free shares, matching shares and open sale of shares offered by the undertaking. The raised funds can be utilised in loan form to replace the overaged buses of PRTC's subsidiaries which would result in bringing vehicle productivity to match the competitive standards of other leading SRTUs in the country.

Module II

Privatisation via 'employee buy-out' is recommended to be initiated during 3rd and 4th years. By this time the employees would be shareholders having knowledge of the working of the subsidiaries as owners. PRTC during this period should initiate discussion with employees about their taking over of buses. PRTC should seek their willingness about: voluntary retirement (subject to fulfillment of a particular length of service), purchasing of buses and adopting co-operative form of organisation after take over. In case, majority of employees have expressed their willingness about these choices simultaneously, then make necessary arrangements for:

- Undertaking valuation studies
- Institutional finance
- A course on co-operatives (philosophy, merits, relevance to transport activities and limitations).

The number of fleets to be privatised may not exceed 20 per cent of the fleet strength of PRTC's subsidiaries. Large scale privatisation may not be materialised because of limited resources — both institutional and personal (savings and provident fund). Large scale transfers may also jeopardise the existing level of services. This ownership measure designated as 'a path from worker to owner', would help maintain employment and improve vehicle, fuel, labour and capital productivities. It would also result in widespread ownership and wider choice to the consumers. It would help PRTC to raise substantial funds. The precise amount to be raised is difficult to quantify. However, tentatively, it works out to be:

This ownership measure designated as 'a path from worker to owner', would help maintain employment and improve vehicle, fuel, labour and capital productivities.

(i) **Revenue from Sale of Buses**

(A) Number of buses to be sold = 20% of the existing fleet strength of PRTC

$$= \frac{20 \times 1051}{100} = 210$$

(B) Price of bus (Assumed) = Rs. 3.0 Lakhs[8]
Hence revenue from the sale of Buses = (A × B) = (210 × Rs. 3.0 lakh)
= Rs. 6,30,00,000

(ii) **Saving from Voluntary Retirement**

(A) Number of employees to be retired under voluntary retirement scheme = Number of buses sold × 4 = 210 × 4 = 840[9]
(If the norm of 1 bus 4 employees is considered)[10]

(B) Staff cost per worker per year = Rs. 36099[11]

(C) Eligibility for Voluntary Retirement: Employees having 15 years or less to their retirement. The simple average length of service works out to be 7.5 years.[12] However (C) would be treated equal to 1 year to begin with.

[7]The number of free shares and matching shares referred in the cases of the U.K. undertakings are just illustrations. These numbers are not recommended to be adopted in PRTC case as a replica. These offers were parts of comprehensive programme of privatisation in which public also participated in the open sale of shares. The objective, thus, was to privatise the undertaking and to protect the interests of the workers. In the case of PRTC, participation of public in equity is not recommended and hence, PRTC has to manage these offers within its limited resources.

[8]This is a moderate assumption in the light of the high percentage of overaged buses and prices of new buses. For example, a new bus price is Rs. 6.2 lakhs in the case of Tata chassis and Rs. 6.6 lakhs in the case of Leyland chasis.

[9]These employees would constitute 14.66 per cent of the existing staff strength of PRTC.

[10]For details see discussion relating to Co-operative form of organisation.

[11]The figure relates to the year 1990-91.

[12]PRTC would save salary of voluntal retired persons upto 7.5 years. Instead of simple average, weighted average method should be applied in this case. However, due to non-availability of willingness data at this juncture, it is not possible to adopt weighted average method.

Saving from Voluntary Retirement = (A × B × C) = 840 × Rs. 36,099 × 1 year = Rs. 3,03,23,160
(This amount would be earned continuously for 7 years and half of this in the 8th year)

(iii) **Net of Operating Revenue and Expenses**

(A) Net of operating revenue and expenses per bus after adjusting economy of expenses per bus on account of voluntary retirement in PRTC. = (–) Rs. 1,43,199

(B) Buses to be sold = 210
Net of operating revenue and expenses = (A × B) = (–) Rs. 1,43,199 × 210= – Rs. 3,00,71,790
(Rs. 3,00,71,790 would act as savings to PRTC against the selling of 210 buses. Therefore in the accounting, the amount would enter as positive).

Total Amount Raised/Saved by PRTC in the First Year:

= (i) + (ii) + (iii) = Rs. 6,30,00,0000 + Rs. 3,03,23,160 + Rs. 3,00,71,790 = Rs. 12,33,94,950

Savings in the subsequent 6 years on yearly basis on account of voluntary retirement (840 × Rs. 36, 099) = Rs. 3,03,23,160

Savings in the 7th year on account of voluntary retirement $\frac{(840 \times \text{Rs. } 36{,}099)}{2}$ = Rs. 1,51,61,580

Thus total saving spread between 2nd year and 8th year = Rs. (6 × 3,03,23,160) + (1,51,61,580) = Rs. 19,17,00,540

During the first year of privatisation under Module II, PRTC has two options. First, PRTC may buy back the shares the PRTC from those employees who have sought voluntary retirement. Second, PRTC may allow them to retain the shares in the capacity of ex-employees. If PRTC opts for first option, undoubtedly out of the amount (Rs. 12,33,94,950) raised in the first year, some money would be spent to buy back the shares of PRTC from the outgoing employees. Even after adjusting this amount, ample funds would be at the disposal of PRTC. The tentative computations in this regard are as follows:

1. In the case of Module I, it is recommended that equity participation of employees should not exceed 20 per cent equity of the PRTC.
2. The equity capital of PRTC in 1990-91 was Rs. 80.97 crores.
3. Equity participation of workers = 20 per cent of Rs. 80.97 crores = Rs. 16.19 crores.
4. Number of total participants in the scheme (i.e. workers) = 5729
5. Number of workers adjusted under voluntary retirement = 840
6. (5) as percentage of (4) = 14.66
7. If shares among workers are evenly distributed, then share capital with outgoing workers is 14.66 per cent of Rs. 16.19 crores = Rs. 2,37,34,540
8. Thus funds to be spent to buy back shares = Rs. 2,37,34,540
9. In case of first option, the balance left with PRTC = Rs. 9,96,60,,410
(Rs. 12,33,94,950 – Rs. 2,37,34,540) = Rs. 9,96,60,410
10. Second option would yield revenue = Rs. 12,33,94,950

In the first year, under first option PRTC by spending Rs. 9,96,60,410[13] can purchase 161 new buses. Whereas under option second, 199 new buses can be purchased against Rs. 12,33,94,950. In the second year, 49 additional buses can be purchased (the revenue is equal to Rs. 3,03,23,160). With this, the fleet strength of PRTC would go to its pre-privatisation period. This measure, thus, would help to reduce bus-staff ratio. For example, the bus-staff ratio during the pre-privatisation period works out to be 5.48 (i.e. in 1991-92). In the post-privatisation period it would come down to 4.62. Under the second option the fleet strength goes to 1991 and thus further reduced the bus-staff ratio to 4.45. The revenue fetched in 3rd and subsequent years can be spent to purchase additional buses to bring the percentage of overaged buses to nil and clear loans, etc.

Only co-operative form of organisations is recommended for running bus services by the newly privatised fleet. The co-operative organisations has the following advantages over two-owner organisation:[14]

Economies of scale can be enjoyed:

- The financial institutions and government would be more liberal in extending credit facilities to co-operatives *vis-a-vis* two owners

[13]This has been worked out on the basis of price of a new bus equal to Rs. 6.2 lakhs. New buses can be utilised to the existing levels of vehicle utilisation keeping in view of the growing demand and overcrowding on some of the routes in the state.

[14]If one bus is sold to two employees, this is termed as two-owner organisation.

- Regularity and punctuality of bus service can be ensured
- Customer grievances redressal system can be introduced
- Co-operatives can sign MoU with PRTC and Punjab Roadways for repairing services. Financially sound Co-operatives can buy workshops from PRTC and Punjab Roadways
- Co-operatives are the only answer to absorb more employees per bus. If 'one-bus two-employee' norm is adopted, it will result in overstaffing in PRTC
- Co-operatives can provide inter-state bus services
- Co-operatives can promote healthy competition among themselves and with other agencies
- Co-operatives can ply buses on economically unviable routes provided the government compensates the quantified loss
- Co-operatives can extend concessional travelling facilities on the pattern adopted by PRTC and Punjab Roadways, provided the government reimburses the quantified loss
- Co-operatives can form an apex association viz. Association of Passenger Road Transport Co-operatives (APRTC) to protect their interests at the national level.

Module III

During the 5th and 6th years of the privatisation programme, critically examine the working of co-operative passenger transport undertakings (Module III).

The analysis must include:

- Their financial soundness
- Their physical performance and
- Quality of service (i.e. customers satisfaction).

Module IV

If results of Co-operatives are encouraging, revise the offer of sale of buses to the employees. The offer is to be made in 7th and 8th year of the programme (Module IV). However, this offer should not exceed a prescribed number of buses. A manageable fleet strength is recommended to be kept by the PRTC's subsidiaries. This is essential because total privatisation is not desirable from the point of view of the public in general and customers in particular.

During this phase also make necessary arrangements for:

- Undertaking valuation studies
- Institutional Finance
- A course on Co-operatives

Phasing of Privatisation (Punjab Roadways)

In Punjab Roadways the privatisation programme may be spread over six time-modules (For details see table 3). The funds raised through privatisation in the relevant phases should be invested in the form of new buses in the subsidiaries of the PSRTC to replace over-aged buses and to reduce bus-staff ratio. Bus-staff ratio in Punjab Roadways would not increase only because of privatisation. The decision of Punjab Government to take back the staff of Punjab Roadways on deputation with three Municipal Corporations Transport Undertakings, would also result in increase of bus-staff ratio. In these circumstances purchase of new buses is the only alternative to optimally utilise the existing manpower.

Table 3: Suggested Phased Privatization Programme (Punjab Roadways)

Module I (Years 1 to 2)	Module II (Years 3 to 4)	Module II (Years 5 to 6)	Module IV (Years 7 to 8)	Module V (Years 9 tp 10)	Module VI (Years 11 to 12)
Examine the results of non-privatisation reforms in PRTC	If results of non-privatisation reforms in PRTC are encouraging, convert Punjab Roadways into a corporation named Punjab State Road Transport Corpn. (PSRTC).	Implement non-privatisation reforms and initiate discussion with employees about privatisation on the lines proposed in case of PRTC (Module I)	Depending upon the response of employees, implement the privatisation programme.	Analyse the result of privatised buses on the pattern proposed in the case of PRTC.	If results are satisfactory, revise the offer subject to a particular limit. After that no privatisation.

[15]Undoubtedly, the employees working at workshops of PRTC and Punjab Roadways in this case should first be convinced for the switchover. After their agreement, they would be enrolled as new members of the co-operatives.

Funds raised through privatisation in the relevant phases should be invested in the form of new buses to replace overaged buses and to reduce bus-staff ratio.

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Think of the sequence. You create something. You grow it. You look for a competitive advantage. Then you really tie it down tight, making it as efficient as possible. Those are very different jobs.

ALAN ZAKON

Feature

Migration to Middle East: Priorities in Policy & Research

A. Ashokan

The impact of labour migration on the home country's economy is manifold. At one end of the spectrum are the shortage of manpower and skewed distribution of purchasing power. At the other end are the positive outcomes of the financial inflow. The author analyses the resultant scenario and presents his recommendations.

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During the colonial period the British recruited labourers on a contractual basis to work in the plantations of Afro-Asian countries including Ceylon, Malaya, Burma, Mauritius, South Africa and the West Indies. This process of migration was confined to labourers in particular and it came to an end with the outbreak of the First World War. In the post-independence period another migration stream opened new vistas for well educated professionals seeking administrative, technical and professional positions in the advanced countries of the West. This led to what is popularity known as Brain Drain. This process still continues though in small numbers.In recent years, an exodous of Asian workers has taken place to a new frontier — the old rich countries of the Middle East. In particular the direct pull was due to the oil embargo of 1973 and the consequent rapid rise in the price of crude oil. The Middle East has increasingly become a magnet for Asians who want to improve their economic situation. Massive scale migration started with the open door migration policies pursued by national governments and improvements occurred in communication and air travel. The changes in the Middle East that were brought by the oil price hikes led to a strong demand for Asian workers, which compensated in part for the adverse economic effects of the heavy oil bills that were shouldered by Asian countries. Thus the flow of oil from the Middle East to Asia has been paralleled by a flow of Asian workers to the Middle East — a labour migration pipeline. (Aronold & Shah, 1984; Nair,(1986). Estimates of the Indian Migrant population in the Middle East vary from source to source (table 1). The latest available source puts it as 1 million.

Impact on Economy

Emigration from a country influences its economic development in a variety of ways. It helps the economic development of the labour exporting country if it acts as

Table 1: Estimates of Indian Migrant Population in the Middle - East

Country	1975	1979	1983	1987
Bahrain	8943	26000	30000	77000
Iraq	5000	20000	50000	35000
Kuwait	21475	65000	115000	100000
Libya	500	10000	40000	25000
Oman	26000	60000	100000	184000
Qatar	16000	30000	40000	50000
Saudi Arabia	15000	100000	270000	240000
U.A.E	61500	152000	250000	225000
Others	—	28000	21000	21000
Total	154418	491000	916000	957000

Source: Rashid Amjad (1989)

an outlet for its unemployed, relaxes its capital shortage, leads to generation of additional employment and income at home and favourably affects the population structure and asset distribution (Ashokan, 1992). The emigration hampers economic development if it creates scarcity of manpower in, or results in brain drain from the home country and creates distortions in the distribution of purchasing power among social groups and spatial points (Adams, 1968). In economics where feudal ways of spending and investment are predominant, the increased income by way of remittances only reinforces such feudal tendencies, creating further distortions in the economy. Increased remittance income of the households may also lead to withdrawal of labour supply - the phenomenon of the backward sloping supply curve. Further a labour importing country may turn off the valve of labour migration when it so desires, the labour exporting country having no power to turn it back on. Emigration accentuates regional or intersectoral inequalities in the labour exporting country if the migration from the country has a spatial or communal concentration.

Another impact of emigration is on the demographic structure. The long absence of adult males from the family had led to a decline in the birth rate (Ashokan 1988). The remittance income improves the consumption profile of the emigrant and non-emigrant families by increasing their purchasing power. However the financial inflow effect depends not only on the rate and the magnitude of inward remittances but also on the pattern of utilisation. While the magnitude of remittances to a large extent is determined by the difference between the levels of earning and expenditure of the emigrants the latter depends mainly on the spending behaviour of the recipients at home. Eventhough financial inflow has improved the regional economic scene (of Kerala) in the form of higher standard of living, educational and social upliftment of the emigrant family, and generated employment activities particularly in the construction sector; it has created more imperfections and distortions in the economy in the form of regional and sectoral inflation. For instance, the connection between remittances and the level of investment in the economy of Kerala operates through effects on expenditure or on savings in the economy. On the expenditure side most of this is known to have gone into house improvements and construction or into the purchase of land. The financial multiplier effects of foreign remittances could be expected to induce investments through the operation of the acceleration principle (Amjad, 1989; Saith, 1992)

Eventhough financial inflow has improved the regional economic scene it has created more imperfections and distortions in the form of regional and sectoral inflation.

The other link between remittances and local investments (savings) exists through the activities of the banking sector. It has been argued, not always with convincing evidence, that the Kerala's banking credit-deposit ratio is exceptionally low implying that financial resources flow out from the state to the rest of the country. It would be more appropriate to regard a low credit deposit ratio more as a symptom than as a cause of a low rate of investment in Kerala's economy. Moreover, the developmental plans of the state are constrained by resource bottlenecks. Low tax base further deteriorates the situation. The substantial foreign exchange and rupee resources from the remittances have not been positively tapped. Moreover, Kerala's economy has been unable to capture the multiplier effects of boom in the construction sector, despite the much lower level of industrial complexity of the products and inputs for which additional demand is created. In other words there is a weak link between the income generated overseas and the local economy. The magnitude and rate of growth of the State Domestic product give a more correct picture of Kerala's economy. The annual growth rate of the SDP during the 1960s was 3.87 percent but declined to 2.37 percent and 1.82 percent during the 1970s and 1980s respectively. Moreover, the growth rates recorded by all the major sectors during the 1970s and 1980, were smaller than the 1960s (Table 2).

Table 2: Average Annual Growth Rates of NDP (Kerala) at constant Prices

Sector	1960-61 to 1970-71	1970-71 to 1980-81	1980-91 to 1985-86
Primary	3.07	0.20	0.95
Secondary	6.22	5.19	0.54
Manufacturing	6.51	4.03	0.26
Construction	3.11	5.67	0.47
Tertiary	5.47	4.15	3.86
Transport and Communication	9.60	7.19	9.98
Transport, Hotel and Restaurants	6.30	1.20	1.18
Banking & Insurance	6.91	4.39	6.66
Real Estate	2.67	1.96	3.74
Total	3.87	2.37	1.82

Source: Nair, P.R.G (1989)

The table indicates that the rate of growth of Kerala had been lower in the seventies and eighties compared to the sixties. Kerala's development strategy has failed to improve the productive base of the economy (Subramaniam 1990; Thampy 1990). In the light of acute unemployment, stagnating agricultural and industrial production and paradoxically thriving service sector, consistent and imaginative schemes are highly essential for their rehabilitation. A recent study reveals that 59 percent of the gulf returnees are unemployed and 50 percent of them belong to the age group of less than 35 years. (Nair, 1986; Ashokan, 1988).

Priorities in Policy & Research

The development strategy of the country has failed to incorporate labour migration (and returns) and remittances. There is no machinery to document these flows. Their macro economic implications are documented neither by the Central planning machinery nor by the Human Resource Development Ministry. This is mainly due to unscientific manpower planning strategy which has failed to correlate the growth of the education sector particularly at a higher plane to that of the manpower requirements. In some Asian countries development plans have started integrating migration into the overall plan framework. Pakistan's current Five Year Plan (1988-93) has integrated migration with the national economic planning. Thailand's Sixth Five Year Plan (1987-91) takes into account overseas migration as an objective in overall Human Resource Development Planning with emphasis on labour market policies. (Amjad, 1989).

A prime recommendation is that a group of research correspondents should be instituted at least in few selected heavy migration states or pockets to monitor flows and policy developments pertaining to migration. There is a necessity to explore the relationship between demographic and economic transition within the Indian sub-continent and their implications for population flows. Research studies are needed to correlate international labour flows and capital flows. Social and political implications of temporary labour immigration programmes should be brought in front of policy and research analysis.

Conclusion

Since Kerala accounts for more than 50 percent emigrants from India to the middle east, any programme pertaining to rehabilitation of the returnees must be analysed in line with the agro-industrial and socio-economic climate of the state. The crucial issue is whether we can introduce a policy of rehabilitation without allowing further distortions in the labour market. Rehabilitation and reemployment should be through the mobilised funds of the returnees or other voluntary organisations. However, the Union Government cannot sidestep its responsibility at a macro economic plane in re-employing, re-absorbing and rehabilitating the middle east re-immigrants to India.

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Feature

Techno-Economic Studies on Rotary Tillage

J. Prasad

A study was undertaken to evaluate tillage systems by tractor operated rotavator and other tillage equipment commonly used for seedbed preparation in Madhya Pradesh. The results reveal a saving in total operational time and diesel consumption per unit area basis with one operation of rotavator in comparison to tillage treatments by conventional tillage equipment. The effect of tillage treatments on yield was found to be non-significant. Although hourly cost of operation of tractor with rotavator was higher the cost of operation on area basis was minimum, advocating the feasibility of rotary tillage over conventional equipment.

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Tillage operations, defined as mechanical manipulations of soil, are performed to achieve the desired quality of seedbed and to provide optimum environment for plant growth. Optimum tillage achieves maximum crop yields with minimum time, energy consumption and cost of operations. Timeliness in seedbed preparation is important to ensure sowing of next crop after the harvest of the previous one. For instance, seedbed preparation for sowing rabi crops after the harvest of kharif crops, particularly under black soil conditions calls for expertise. Tillage implements commonly used include ploughs, disc harrows and cultivators. The completion of primary and secondary tillage operations with the conventional equipments involves multiple operations. The rotavator offers the advantage of preparing seedbed of uniform depth with soil aggregates of more uniform size as compared to other tillage equipment. It derives engine power through power take-off (pto) rather than tractive wheels and hence results in efficient utilization of the available tractor engine power. In addition, the rotavator has other advantages such as minimum number of tillage, shredding of stalks and mixing them with soil alongwith other residues, row crop cultivation etc.

Optimum tillage achieves maximum crop yields with minimum time, energy consumption and cost of operations.

Methodology

A study was undertaken to assess the comparative evaluation of tractor operated rotavator and other tillage equipment commonly used in Madhya Pradesh in seedbed preparation under soybean-wheat crop rotation and for sowing of gram after paddy harvesting. Four tillage treatments were carried out with five replications consisting operations as in table 1.

Table 1 : Tillage treatments

Designations	Soybean-wheat	Paddy-gram
T_1	Two operations of sweep type cultivator followed by one operation of disc harrow	Two operations of sweep type cultivator followed by two operations of disc harrow.
T_2	Mouldboard ploughing followed by two operations of disc harrow	Mould board ploughing followed by three operations of disc harrow
T_3	One operation of rotavator	One operation of rotavator
T_4	Two operations of rotavator	Two operations of rotavator

The experiments comprised single factor randomized block design in case of wheat and two factor randomized block design in case of soybean crop under soybean-wheat crop rotation. The sub-treatment in the case of soybean crop included application of basalin as chemical method of weed control with and without presowing. The study could not be conducted in statistically laid plots under paddy-gram crop rotation. Agronomical practices followed were the same for all the treatments. The field experiment was conducted with Punjab-1 variety of soybean during the monsoon season of 1987 and 1988 and with Sujata variety of wheat during the winter season of 1986-87, 1987-88 and 1988-89 as well as Ujjain-21 variety of Bengal gram during the winter seasons of 1987-88 and 1988-89. With a view to assess the total operational time and fuel consumption detailed observations on effective field capacity and hourly fuel consumption were recorded with various implements. Based on the observations of effective field capacity and hourly fuel consumption with individual implements for single and multiple operation, the total operational time and fuel consumption required to cultivate one hectare area were computed for the four tillage treatments. The sample for grain yield were drawn from various locations of the test plot selected randomly, and the yield was expressed in quintal/hectare. For calculating the cost of operation under various tillage treatments, assistance was drawn from Bureau of Industrial Standards (1979).

Operational Time Fuel Consumption

The results of the study with regard to total operational time and fuel (diesel) consumption required to cultivate one hectare area are reported in table 2. As evident, the operational time was higher by 147.2 and 247.2 per cent in the case of T_1 and T_2, respectively under soybean-wheat crop rotation. Likewise, the diesel consumption was higher in the case of T_1 and T_2, than T_3. In the seedbed preparation for gram after paddy harvesting, the level of the disc harrowing was increased to two and three in T_1 and T_3, respectively. The total operational time and diesel consumption were more in T_1 and T_2 than T_3. The savings in total operational time and diesel consumption, with the use of single rotavation (T_3) in relation to tillage treatments T_1 and T_2, were 59.6 to 71.2 per cent and 24.2 to 50.8 per cent, respectively. Thus, rotavator offers greater advantage over other tillage equipment in use both in terms of operational time and diesel consumption.

Table 2: Total fuel consumption and time for one hectare area during Kharif and rabi seasons

Crop rotation	Tillage treatments	Total time required to cultivate one hectare area (hour)	Total diesel consumption required to cultivate one hectare area, (litre)
Seedbed preparation for wheat under soybean-wheat crop rotation	(i) Two operations of cultivator followed by one operation of disc harrow (T_1)	8.9 (+147.2)	30.2 (+31.9)
	(ii) Mouldboard ploughing followed by two operations of disc harrow (T_2)	12.5 (+247.2)	46.5 (+103.1)
	(iii) One operation of rotavator (T_3)	3.6	22.9
	(iv) Two operations of rotavator	6.9 (+91.7)	46.5 (+103.1)
Seedbed preparation for gram under paddy gram crop rotation	(i) Two operations of cultivator followed by two operations of disc harrow (T_1)	14.0 (+154.5)	57.9 (115.2)
	(ii) Mouldboard ploughing followed by three operations of disc harrow (T_2)	20.1 (+265.5)	81.0 (+201.1)
	(iii) One operation of rotavator (T_3)	5.5	26.9
	(iv) Two operations of rotavator (T_4)	10.3 (+87.3)	53.2 (+97.8)

Note: Figures in parentheses indicate percentage increase over the values obtained under tillage treatment T_3.

The advantage of rotary cultivation was more significant in seedbed preparation for sowing rabi crops after harvesting of paddy crop. There was a saving of 60.7 to 72.6 per cent in operational time and 53.5 to 66.8 per cent in diesel consumption with single rotavation in comparison to other tillage treatments in preparing the seedbed for sowing gram crop after paddy harvesting. Two operations by rotavator also offered greater advantage as compared to other tillage treatments.

Yield

The results of the experimental study on the yield of wheat, soybean and gram under four tillage treatments are presented in Fig. 1. As evident from the yield data, variation in grain yield of wheat, soybean and gram due to different tillage treatments was non-significant. This indicated that it was possible to achieve almost the same level of yield with one operation of rotavator which could be obtained with other tillage treatments requiring more number of operations by other tillage equipment in use. In case of soybean, chemical methods followed by mechanical methods of weed control resulted in significant increase in grain yield in comparison to sub-treatment employing only mechanical methods of weed control.

Cost of Operation

With a view to ascertain the economics of using the rotavator, the cost of operation under various tillage treatments for soybean-wheat and paddy-gram crop rotations was computed (Table 3, Fig. 2). The hourly cost of operation of rotavator was higher than other tillage equipment primarily due to high initial cost of rotavator. However, the cost of operation expressed in terms of area basis was minimum for single rotavation (T_3), Under soybean-wheat corp rotation, the cost of operation for T_1, T_2, T_3 and T_4 worked out to be Rs. 766, Rs. 1184, Rs. 403 and Rs. 749, respectively.

Table 3 : Cost of Seedbed preparation

Crop rotation	Tillage treatments	Cost of operation	
		Rs./h	Rs./ha
Seedbed preparation for wheat under soybean-wheat crop rotation	(i) Two operations of cultivator followed by one operation of disc harrow (T_1)	86.11	766
	(ii) Mouldboard ploughing followed by two operations of disc harrow (T_2)	94.72	1184
	(iii) One operation of rotavator (T_3)	111.92	403
	(iv) Two operations of rotavator	108.59	749
Seedbed preparation for gram after paddy harvesting under paddy-gram crop rotation	(i) Two operations of cultivator followed by two operations of disc harrow (T_1)	88.13	1234
	(ii) Mouldboard ploughing followed by three operations of disc harrow (T_2)	96.06	1931
	(iii) One operation of rotavator (T_3)	119.84	659
	(iv) Two operations of rotavator (T_4)	120.16	1238

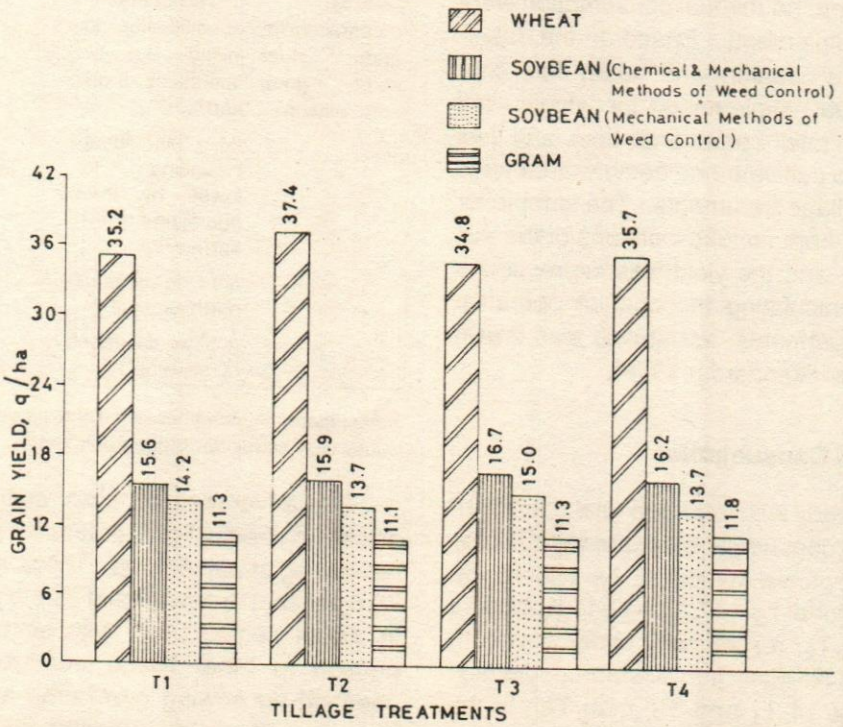

Fig. 1 Effect of tillage treatments on yield of wheat, soyabean and gram.

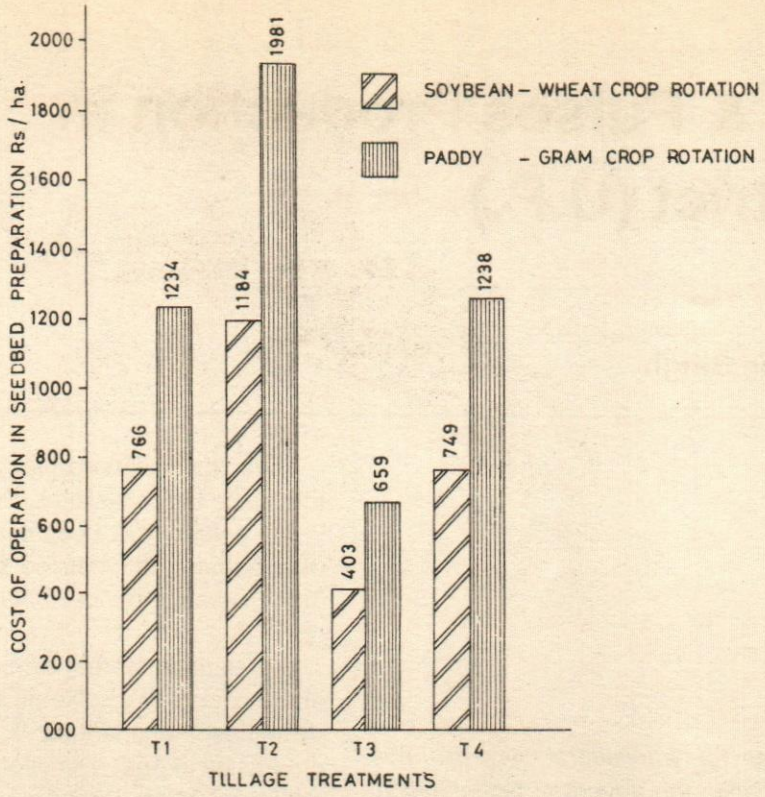

Fig. 2 Cost of operation in seedbed preparation with different tillage treatments

For sowing gram after paddy harvesting, the cost of operation on area basis was Rs. 1234, Rs. 1931, Rs. 659 and Rs. 1238 for T_1, T_2, T_3 and T_4, respectively. Although, the hourly cost of operation was higher for seedbed preparation by rotavator, the cost on area basis was mini-mum for single rotavation (T_3) both under soybean-wheat crop rotation and paddy-gram crop rotation. The cost of operation for seedbed preparation after paddy harvesting was higher than that for soybean-wheat crop rotation. The increase was primarily due to the complexities of seedbed preparation for sowing rabi crops after paddy harvesting. (The problem is more acute under black soil condition).

Conclusions

The use of rotavator is advantageous for seedbed preparation both in terms of saving in operational time and fuel (diesel) consumption on area basis. The total operational time and diesel consumption per unit area basis was minimum in the case of single rotavation of all the four tillage treatments. There was saving of 59.6 to 71.2 per cent in operational time and 24.2 to 50.8 per cent in diesel consumption for seedbed preparation with the use of one operation of rotavator as compared to tillage treatments T_1 and T_2 under soybean-wheat crop rotation. Likewise, there was saving of 60.7 to 72.6 per cent in operational time and 53.5 to 66.8 per cent in diesel consumption on area basis for seedbed preparation for sowing of gram after paddy harvesting with one operation of rotavator as compared to other tillage treatments.

The variation in grain yield of all the three crops of wheat, soybean and gram due to various tillage treatments was found to be non-significant. In other words, it was possible to achieve almost the same level of grain yield with one operation of rotavator which could be achieved in other tillage treatments T_1 and T_2 requiring more number of operations by conventional tillage equipment.

The hourly cost of operation of tractor and rotavator was comparatively higher than the other tillage equipment. However, the cost of operation on area basis was minimum for single rotavation of all the tillage treatments. The cost of operation of seedbed preparation for sowing gram after paddy harvesting was comparatively higher than that under soybean-wheat crop rotation.

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Oilseeds & Pulses Production in Agra District (U.P.)

Balishter & Roshan Singh

The pattern and pace of agricultural growth have changed considerably since the advent of technological upgradation in our country. The area under cereals, for instance, has expanded at the cost of pulses and oilseeds. To arrest this imbalance, this study explores the constraints faced by farmers cultivating oil seeds and pulses and presents its recommendations.

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With the initiation of technological changes in agriculture since the mid-sixties, the pace of agricultural growth in our country has been considerably accelerated. This development has induced shifts in the cropping pattern. The diverse cropping pattern of the early sixties has gravitated towards a few specialised crop enterprises. The area under cereal crops has, in particular, expanded at the cost of crops like pulses and oilseeds. This study examines the changes in cropping pattern and crop production in Agra district of western. U.P. at three points of time - 1962-63 (pre green revolution period), 1976-77 (Green revolution period) and 1988-89 (post green revolution period).

Since pulses and oilseeds constitute an important element in the food packet of the people, any decline in their production is bound to create a serious food problem.

Methodology

The study is based on the information collected from a sample of 64 farmers selected on a stratified random sample basis from the three villages of C.D. Block Bichpuri in Agra district (U.P.). The farmers were selected from small (below 2 hectares), medium (2-4 hectares) and large (above 4 hectares) farm size groups in proportion to their number in each size group in the three villages. This sample was selected for a study conducted in 1962-63. Similar samples were taken up for study from the same villages in the year 1976-77 and in 1988- 89 to examine the changes in the situation over time.

Results & Discussion

Table 1 shows that in the case of the small farm size group the average farm size increased during the green revolution period, from 1.22 hectares in 1962-63 to 1.41 hectares in 1976-77 but declined slowly during the post-green revolution period reaching 1.33 hectares in 1988-89. In the case of medium and large farm size groups, the average farm size shows a continuous decline from 3.17 hectares in 1962-63 to 2.86 hectares in 1988-89 for medium farms and from 6.34 hectares in 1962-63 to 5.14 hectares in 1988-89 for large farms. Only 64 per cent of the total cultivated area had irrigation facilities in 1962-63, which increased to about 86 per cent in 1976-77 and to almost cent per cent in 1988-89. Thus extension of irrigation facilities has received attention during this period.

Table 1: Average size of farm and extent of irrigated area (in hect)

Farm Size	No. of sample cases	1962-63		1976-77		1988-89	
		Av.size of farm	Net area irrigated	Av. size of farm	Net area irrigated	Av.size of farm	Net area irrigated
Small	30	1.22	0.87 (71.31)	1.41	1.29 (91.49)	1.33	1.33 (100)
Medium	12	3.17	2.09 (65.93)	2.94	2.51 (85.37)	2.86	2.86 (100)
Large	22	6.34	3.92 (61.83)	5.56	4.63 (83.27)	5.14	5.14 (100)
All	64	3.35	2.15 (64.18)	3.12	2.67 (85.58)	2.93	2.93 (100)

Note: Figures in parantheses give percentages.

Source of Irrigation

Canal and well (Persian wheel) were the main sources of irrigation in 1962-63 accounting respectively for about 52 per cent and 48 per cent of the total irrigated area. (table 2) there was a sharp decline in the area irrigated exclusively by canal from 52 per cent in 1962-63 to only about 8 per cent in 1976-77 and almost nil in 1988-89 and the well (persian wheel) was dispensed with completely by 1976-77. Private tubewells, either exclusively or as supplemental sources to canal irrigated area became the most important source with accounted for about 92 per cent (46 per cent each from tubewells exclusively and tubewells as supplement to canal irrigation) of the total irrigated area in 1976-77. In 1988-89 the entire cultivated area was under private tubewells either exclusively (57 per cent) or as supplemental sources to canal (43 per cent). It indicates that assured irrigation has provided the basic input for the introduction of new farm technology.

Assured irrigation has provided the basic input for the introduction of new farm technology.

Cropping Pattern

Table 3 shows that the percentage of cropped area under kharif crops on the whole has declined from about 43 per cent of the total area in 1962-63 to about 38 per cent in 1976-77 and further to about 34 per cent in 1988-89, while area under Rabi crops in the corresponding period has increased from about 57 per cent in 1962-63 to 60 per cent in 1976-77 and further to 62 per cent in 1988-89. In 1962-63 there was no area under Zaid crops but in 1976-77 and in 1988-89 these accounted for about 2 and 4 per cent of the total, respectively. This shows a clear shift in cropped area from kharif to Rabi and Zaid crops.

Table 2: Area irrigated by different sources (per cent)

Size group	1962-63			1976-77				1988-89			
	Canal	Well (persian wheel)	Total	Canal	Private tubewell	Canal+private tubewell	Total	Canal	Private rubewell	Canal+private tubewell	Total
Small	51.63	48.37	100.00	10.84	38.73	50.43	100.00	—	49.81	50.19	100.00
Medium	48.66	51.34	100.00	7.92	49.22	42.86	100.00	—	57.44	42.56	100.00
Large	63.59	36.41	100.00	5.26	53.77	40.97	100.00	—	66.34	33.66	100.00

Table 3: Area under various crops (per cent)

Crop	1962-63	1976-77	1988-89
Kharif			
Bajra	8.82	14.58	12.98
Jowar	15.70	16.54	13.76
Arhar	3.16	1.22	2.13
Urad and moong	1.31	0.30	0.11
Pulses as mixed crop	11.26	2.32	1.29
Paddy	0.17	1.83	1.90
Kharif vegetables	0.26	1.39	1.63
Others	1.59	—	—
Total Kharif	42.71	38.18	33.80
Rabi			
Wheat	28.35	44.23	45.57
Pea	7.08	4.53	1.04
Gram	7.67	0.95	—
Other Rabi grains	13.94	2.56	1.67
Mustard	0.11	2.76	9.58
Potato	0.04	2.67	2.71
Rabi vegetables	0.10	1.82	1.90
Total Rabi	57.29	59.52	62.47
Zaid			
Moong	—	1.23	2.11
Zaid vegetables	—	0.97	1.62
Total zaid	—	2.30	3.73
G. Total (A+B+C)	100.00	100.00	100.00

As regards the shift in particular crops among the kharif crops, area under Bajra increased from about 9 per cent in 1962-63 to about 15 per cent in 1976-77 and declined slightly to about 13 per cent in 1988-89. The area under kharif pulses (grown alone or as mixed crops) declined. The area under paddy and kharif vegetables shows a continuous increase over the period. No oilseed crop is grown in the kharif season. On the whole there has been a marked decline in the area under kharif pulses which largely explains the decline in the extent of kharif cropping. The little area remaining under kharif pulses is more for self-consumption of the farm family than for the market.

Among the Rabi crops there is not only a marked increase in the area under wheat during the green revolution period, but also a substitution of desi varieties with HYV almost completely. The area under wheat increased from 28 per cent (all desi) in 1962-63 to about 44 per cent (all HYV) in 1976-77 and 46 per cent (all HYV) in 1988-89. The area under mustard also has shown a marked increase from almost nil (0.1 per cent only) in 1962-63 to about 4 per cent in 1988-89. The area under potato and other rabi vegetables also increased from about 1 per cent in 1962-63 to about 4 per cent in 1988-89. The area under pea and gram as also other rabi grain has shown a sharp decline in 1976-77 and 1988-89 over 1962-63. Area under other rabi grains declined from about 14 per cent in 1962-63 to only about 2 per cent in 1988-89. It shows that rabi cropping which was quite diversified in 1962-63 is now mainly centred around two crops, viz. wheat and mustard. There is a clear trend of a shift from low income crops to high income crops in this season. Though the decline in area under gram and pea, which are used both as grain as well as pulse, is not a welcome change, increase in area under mustard, an important oilseed crop is certainly most welcome.

Moong and vegetables are the only zaid crops grown on the farms presently. No zaid crop was grown in 1962-63; these crops accounted for about 2 per cent of the total cropped area in 1976-77 and about 4 per cent in 1988-89. The introduction of moong, an important pulse crop, as Zaid crop is very desirable but it should cover a much larger area than at present in order to boost pulse production in this area.

The share of cereal crops in the cropping pattern increased from about two thirds in 1962-63 to about three fourths in the subsequent period, mainly because of increase in wheat area (table 4). The share of pulses in cropped area markedly declined from about 16 per cent in 1962-63 to about 3 per cent in 1988-89. The share of oilseeds increased from 0.11 per cent to about 10 per cent. Area under vegetables has also shown a marked increase with the introduction of new input intensive farm technology there is a clear shift in cropping pattern towards fewer crops with high income potential.

Table 4: Area under broader groups of crops (per cent)

Crop	1962-63	1976-77	1988-89
Food Grains			
Wheat	28.35	44.23	45.57
Other cereals	36.11	33.31	28.13
Pulses	17.77	7.21	2.88
Other foodgrains	1.38	1.83	1.94
Total food grains	83.61	86.58	78.52
Non foodgrains			
Oilseeds (mustard)	0.11	2.76	9.58
Vegetables	0.40	6.85	7.86
Fodder crops	6.24	3.57	2.90
Others	9.64	0.24	1.14
Total non foodgrains	16.39	13.42	21.48
Total (A + B)	100.00	100.00	100.00

In 1988-89 only two crops, viz. wheat and mustard (both rabi crops) accounted for over 70 per cent of the gross farm output, wheat for about 58 per cent and mus-

tard for about 13 per cent (table 5). In 1962-63, wheat accounted for about 31 per cent of the gross output. The wheat revolution in a way has changed the diversified farming of the tract into specialised farming around wheat crops, affecting adversely the area under cereal and pulse crops. The share of other cereals declined from about 37 per cent in 1962-63 to less than 20 per cent in 1988-89, while the share of pulses sharply declined from about 18 per cent in 1962-63 to about 1 per cent in 1988-89. This clearly indicates a shift in cropping pattern in favour of wheat and mustard, and against other cereals and pulses including pea and gram.

Table 5: Contribution to gross output by major group of crops (per cent)

Crop	1962-63	1976-77	1988-89
Food grains			
Wheat	31.35	55.81	57.62
Other cereals	36.88	19.71	19.69
Pulses	18.21	3.68	1.04
Other foodgrains	6.17	5.93	3.27
Total foodgrains	92.61	85.13	81.62
Non foodgrains			
Oilseeds (mustard)	0.08	5.58	12.99
Vegetables	0.40	3.45	4.11
Fodder crops	3.77	3.09	0.63
Others	3.14	2.75	0.65
Total non-foodgrains	7.39	14.87	18.38
Total (A + B)	100	100	100

Crop Yield

The average per hectare yield of only three crops, viz. wheat and mustard and bajra has shown a marked increase during the period under reference (table 6). The yield of wheat and mustard more than doubled itself, while that of bajra increased almost by 50 per cent. The yield of all other crops has shown a decline or remained static.

Constraints in Pulse Production

Table 7 shows that all 64 sample farmers reported that they had to use underground tubewell water for irrigating pulses due to non-availability of canal water in time. The underground water is quite saline which is not suitable for growing pulses as these are highly sensitive to salinity. About 64 per cent of the farmers reported that there is high yield uncertainty due to attack of insect-pests and diseases; about 45 per cent farmers reported that non-availability of stable new high yielding varieties of pulse crops was a major constraint to pulse production; about 42 per cent farmers reported that there is no improved technology for pulses camparable to those available for other crops like wheat and paddy.

Table 6: Average yield of selected crops at three points of time

(Quintals per hect)

Crop	1962-63	1976-77	1988-89	Percent change in 1976-77 over 1962-63	Percent change in 1988-89 over 1976-77
Bajra	5.98	8.67	8.93	44.98	3.00
Wheat	15.23	30.82	31.42	102.36	0.89
Pea	14.01	6.77	3.51	–51.68	–48.15
Gram	14.97	3.21	—	–78.56	—
Arhar	4.13	3.24	4.39	–21.55	35.49
Moong	6.77	4.80	4.96	–29.10	3.33
Mustard	2.97	6.24	8.48	110.10	35.90

Table 7: Constraints in pulses production (1988-89).

Constraints	No. of farmers	per cent to total 64 farmers
Scarcity of canal water	64	100.00
High yield uncertainty in pulse production due to severe attack of insect, pest and disease	41	64.06
Non-availability of stable new high yielding varieties of pulse crops	29	45.31
Absence of improved technology for pulses as available to wheat	27	42.19

Recommendations

The area under kharif crops has registered a marked decline in the wake of opportunity offered by the new farm technology to increase farm production and farm income through emphasis on rabi crops, mainly wheat and mustard. This decline in the area under kharif crops offers the farmer an opportunity to increase the area under kharif pulsed and oilseeds. Saline irrigation water does not pose a serious problem for the production of kharif pulses like urad, moong and arhar as these crops depend more on rains than on irrigation water. Quality seeds of suitable varieties and a proper technology, are the need of the hour. Likewise, there is a possibility of growing kharif oilseeds like sunflower, soybean and toria integrated properly into the cropping system with proper production and marketing facilities. There is also an avenue for increasing production of rabi oilseeds through improving the yield of mustard by use of suitable varieties and effective plant protection measures. Area under Zaid moong can also be increased in places where canal water is available at least at the time of sowing. After germination the crop withstands the occasional use of tubewell saline water. Evolving location-specific suitable varieties of pulses and oilseed crops for the region together with proper production technology and motivating the farmers to adopt the same through measures for proper marketing, and remunerative price will go a long way in increasing the production of pulses and oilseeds in the country. □

Feature

Coping with Shortening Fallows: A Case Study From Nigeria

E.C. Eboh & C.O.B. Obiechina

This paper assesses the farm-level technologies to cope with shortening fallows in Enugu State of Nigeria. The economic benefits from these technologies as well as the factors impeding their use were specifically examined. Four communities in Udi and Igbo-Eze local government areas were surveyed. It was found that farmers are using many technologies including mulching, household manuring, farmyard manuring and chemical fertilizing to offset the soil depletion effects of shortening fallows. The optimum use of the technologies was constrained by lack of access to organic manures, poor manure manufacture skills and related resource (labour) shortages.

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Under forest fallow and bush fallow cultivation, soil fertility is restored when the land is allowed to revert to its natural vegetation for some years. Today, however, the period during which this natural regeneration is allowed has reduced considerably, principally because of population pressures on the land. So, the system of ensuring fertility through long fallow period is increasingly being constrained by land-use pressure; with the variation in fallow clustering around one to three years (Okafor, 1991).

Over-exploitation of the land and abandonment of traditional long fallows have resulted in high rates of deforestation, soil erosion and structural destabilisation and impoverishment of the soil.

Empirical indications point to the sordid fact that the overexploitation of the land and abandonment of traditional long fallows have resulted in high rates of deforestation, soil erosion and structural destabilisation and impoverishment of the soil (Lagemann, 1977; Okafor, 1987; Eboy, et al, 1990). Shortening fallows diminish the nitrogen and organic matter contents of the soil and erode the soil productivity. These deleterious consequences, if unabated, will eventually cause the total collapse of the land productive base and the entire agro-ecological system in parts of Southeastern Nigeria. And, because of the restricted prospects of bringing new areas under cultivation, shortening of the fallow period on cultivated land, no matter how devastating it could be, remains a favoured option among small farmers.

Operating short fallow periods without endangering the soil resource base requires greater skill in soil fertility

management and better agro-ecological practices. Ameliorating the soil deterioration and soil degradation effects of shortening fallows is the central challenge facing smallholder farmers in parts of Enugu State, especially in areas where population pressures and land related ecological hazards are more prominent. To cope with this challenge, farmers can adopt soil-replenishing and soil-building technologies that will slow the process of diminishing yields and avert ecological collapse. Okafor (1991) found that the rural population in southeastern Nigeria handicapped by limited and poor arable land adopt various strategies to alleviate food shortages and poverty.

Farmers can adopt soil-replenishing and soil-building technologies that will slow the process of diminishing yields and avert ecological collapse.

Efforts by small farmers at slowing soil decline and yield diminution involve a mixed variety of organic and inorganic fertilization techniques and materials. They include the use of household wastes, green manuring, mulching, composting, farmyard manuring and chemical fertilizers. The extent to which these technologies are being used by the farmers has not been verified. Worse still, the economic benefits from the use of these technologies (especially the organic manures) have not been adequately demonstrated. Furthermore, the different obstacles to the optimum use of these technologies are yet to be empirically diagnosed. Therefore a study was undertaken to ascertain the strategies which smallholder farmers are using to cope with shortening fallows; and the economic efficacies/benefits as well as the operational limitations of these strategies.

Methodology of the Study

Two local government areas of Enugu State were purposively selected to capture differing population pressure zones. Udi Local Government Area (LGA) with a population density projection of 243 persons per sq. km in 1991 was selected to represent low population pressure while Igbo-Eze LGA with a density projection of 722 persons per sq. km represented relative high population pressure. In Udi LGA, Ngwo and Eke communities were randomly chosen while in Igbo-Eze LGA, Enugu-Ezike and Ibagwa-Anil communities were also randomly selected. In each community, forty five farming households were again randomly chosen, thus giving a total sample size of one hundred and eighty farming households. An interview schedule was used to obtain information from farmers. Data obtained relate to individual farmer survival and coping techniques, extent and origins of practice, patterns economic benefits and costs of usage, access to needed materials and skills, perceived rationale for used technologies and the operational obstacles encountered.

Analysis of data was done using simple descriptive and inductive statistics such as means, percentages, and t-tests of significance. Economic analysis tools such as partial budgeting and crop (enterprise) budgeting procedures were used to compare the incremental costs and benefits associated with the manuring technologies.

Soil Manuring Technologies

Several experiments on the maintenance of soil fertility have proved that the use of various technologies of manuring increases fertility levels and crop yields. Growing annual legumes as green manure for incorporation in the soil in rotation with other crops can have several beneficial effects. The most important effect is an increase in the available nitrogen content of the soil resulting from the rapid decomposition of buried plant material with a relatively low carbon: nitrogen ratio (Webster & Wilson 1980). It also results in an increase in soil organic matter and water infiltration rate as well as water holding capacity. Experiments carried out in Ibadan, Nigeria show that the incorporation of green manure crops in the soil maintains yields not only due to organic matter and nitrogen but also other available nutrients it contributed (Webster, 1938; Vine, 1953).

Green manure is particularly noted for the stimulating effect it has on soil bacterial activity; if the green manure does not contain leguminous plants, it is assumed merely to be returning to the soil those nitrates which it previously removed from it, but if a legume obtains nitrogen from the air fixed by the symbiotic nodule bacterial, then additional nitrogen is being added to the system. On the other hand, fresh or partially humified plant residues exert some deleterious effect on plant growth. This is observed after ploughing in or tillage and it is attributed to the conversion of mineral nitrogen to the nitrogen of the plasma of micro-organism. As a result of numerous investigations, Konova (1961) assumed that this deleterious effect is determined by the interrelationship between the plant and the microflora participating in the decomposition of these residues, namely their competition both for nutrients and for oxygen of the soil. On account of the requirements for successful development

of a green manuring crop, Webster & Wilson., (1980) affirm that green manuring is usually ineffective in drier areas and that it does not produce any lasting increase in humus and total nitrogen.

Growing annual legumes as green manure for incorporation in the soil in rotation with other crops can have several beneficial effects.

The importance of farmyard manure for increasing soil fertility has been demonstrated over many centuries of agricultural practice. Konova (1961) reports that farmyard manure contributes in maintaining the reserve of active humus in the soil, together with root residues. In addition, the stimulation of the biological activity of the soil is attributed to the presence in farmyard manure of an enormous number of micro-organisms which the soil microflora can utilize rapidly as a source of energy and thereby preserving the soil humus.

Numerous experiments on farm yard manure used in the tropics revealed that majority of the crops showed a high positive response. However Webster & Wilson (1980) say that the rates and frequencies of application required to maintain yields vary with soil, climate, crops and the manure quality. Fertilizer dressings of equivalent NPK content are as effective as farmyard manure for short term tests. However, in long term experiments as in Northern Nigeria, farmyard manure proves better than equivalent amount of NPK in inorganic fertilizer (Denninson, 1961). In Ghana, Djokoto & Stephens (1961) found out that farmyard manure nearly always gave better results than inorganic fertilizers on long term continuous cropping systems.

Application of nutrient elements in inorganic form as fertilizers has resulted in tremendous crop yield increases. The Food & Agriculture Organisation (FAO) conducted widespread fertilizer trials in countries in and outside West Africa between 1962 and 1965. In Nigeria, demonstrations in 1964 to 1965 by FAO confined to south eastern regions and mostly in maize, yam and rice yielded moderate results on maize. In Eastern Nigeria, responses and economic returns on rice and yam were generally good with high value/cost ratios. Most of the trials proved fertilizer use to be profitable except where selling prices of outputs/produce supplied were very low(FAO,1968). In using mulches as sources of plant nutrients, it has been reported that crop responses to continuous use of residue mulches indicated that residues can be substituted to meet the fertilizer shortage (Greenland & Lal, 1979). Mulching by use of vegetable and plant materials protects the soil from rainfall and sunshine without adverse competition for water and nutrients which is always prevalent in the use of cover plants (Webstar & Wilson,1980).

Mulching contributes organic matter to the soil through the breakdown of the mulch materials. Soil structure is improved and nutrients are released gradually. The yields of many tropical crops have improved as a result of extensive use of mulching in those crops. The influence of various mulching materials on maize yield as reported by Greenland & Lal (1979) indicates that mulch materials from leguminous plants can produce high crop yields without supplemental fertilizers. Whereas mulch protects the soil against raindrop impact and preserves soil structure, it also optimizes soil temperature and moisture regimes and improves the biological activity of earthworms.

Even though mulching has been shown to improve the yields of annual crops, it is of little use in arable forming. As several tonnes of vegetable material per hectare are required for effective mulching, crop residues are often insufficient, especially as they may also be required for animal feed or domestic fuel, and small farmers without wheeled transport are commonly unwilling to undertake the considerable effort of importing mulching materials on to their farms (Webster & Wilson , 1980).

Mulching by use of vegetable and plant materials protects the soil from rainfall and sunshine without adverse competition for water and nutrients which is always prevalent in the use of cover plants.

Crops usually respond to dressings of good compost very much in the same way as they do to farmyard manure. According to Seifert (1962), the value of compost does not lie solely in its rich contribution of bacterial to soils of every kind. Because of its high content of growth and energizing elements of both vegetable and animal organ, it is a remarkable improver of sick soils whether the sickness is in the form of utter exhaustion, tendency to be easily washed away or general poverty of both earth and plants.

Technologies & Practices in Use: Empirical Results

Many methods/techniques were used by the small farmers to maintain and/or improve soil fertility. All the farmers interviewed used more than one method. The techniques are grouped under organic manure, inorganic manure, and other cultural methods.

Table 1: Distribution of farmers according to soil fertility technique used

Method used	Number/Percentage
Kitchen refuse	99
Poultry manure	98
Crop Rotation	19.5
Bush Fallow	63.7
Goat/sheep dung	15.6
Mulching	7.5
Pig dung	1.6
Inorganic fertilizer	31.4

Organic manure is composed of wastes and residues from plant and animal life. Kitchen refuse, poultry manure, goat/sheep dung, and pit dung were used by the farmers in maintenance of soil fertility. Poultry manure and kitchen refuse were commonly used. 99 per cent of the farmers applied kitchen refuse while 98 per cent applied poultry manure. Inorganic fertilizers are simple chemical compounds made in a factory or obtained by mining which supply plant nutrients. Out of the 180 farmers interviewed, 31.4 per cent applied inorganic fertilizer to improve soil fertility. An average of 189.7 kg/ha (about 4 bags/ha) were used by farmers (Each bag is 50 kg).

Table 2: Distribution of farmers according to quantity of Inorganic fertilizer used

Quantity used in kg/ha	percentage
1 - 150	35
150 - 300	53
300 - 450	12
Total	100

Table 2 shows that 53 per cent of the farmers applied fertilizer quantity between 3 to 6 bags.

Analysis of Costs & Returns

Based on the different categories of manuring technologies adopted and considering the fact that fixed costs of production are held constant, the items of variation are only the cost of the manure, its transportation, movement of additional produce resulting from manuring and other costs associated with manuring directly or indirectly. The costs to be considered here however include the variable costs only and these cover those of seeds and planting materials; manure; labour cost comprising clearing and cultivation, weeding and application of manure, planting of seeds and harvesting of produce; cost of transport, chemicals and sprays and then miscellaneous. The sum of total of these variable costs for the different crops are got on a hectare basis per farmer and the mean variable cost calculated. Table 3 summarises this information.

Table 3: Average Variable Costs (N per hectare) associated with crop production using different manure types

Crop	Organic and inorganic manure mixed	Inorganic manure only	Organic manure only	No manure
Yam	6,400.00	6,250.00	6,200.00	6,050.00
Cassava	1,600.00	1,450.00	1,400.00	1,250.00
Maize	1,450.00	1,250.00	1,250.00	1,050.00
Rice	2,200.00	2,000.00	1,900.00	1,700.00
Cocoyam	1,450.00	1,300.00	1,250.00	1,100.00

From table 3 we can deduce the changes in the variable costs per hectare using the 'No manure' enterprise as a reference.

Table 4: Incremental costs (N per hectare) of production arising from manure use

Crop	Organic and In-organic manure mixed	Inorganic manure only	Organic manure only
Yam	350.00	200.00	200.00
Cassava	350.00	200.00	150.00
Maize	400.00	200.00	200.00
Rice	500.00	300.00	200.00
Cocoyam	350.00	200.00	150.00

Table 4 shows the different increases in the cost of production per hectare as a result of the adoption of one form of manuring or another. As can be seen, the combination of organic and inorganic manure added highest to the total variable cost, followed by the use of inorganic manure only except in the maize enterprise where the cost of using organic manure equals that of inorganic manure. The least addition to total variable cost is obtained in the use of organic manure only and this may be attributed to the fact that organic manure are usually underpriced.

From price and quantity values the total revenue from the average yields, following the function ($TR = P_x.X$)

where TR = Total Revenue

P_x = Unit price of produce

X = Average yield/produce,

is shown in table 5.

Table 5: Total Revenue (N per ha.) from Average Crop Yields Under Different Manure Use

Crop	Organic and inorganic manure mixed	Inorganic manure only	Organic manure only	No manure
Yam	13,860.00	13,216.00	12,600.00	11,956.00
Cassava	2,528.00	2,442.00	2,240.00	2,000.00
Maize	6,740.00	6,300.00	6,000.00	5,600.00
Rice	17,280.00	16,560.00	15,744.00	15,360.00
Cocoyam	2,640.00	2,3180.00	2,112.00	1,980.00

From table 5, we can deduce the changes in the total revenue per hectare using the "No Manure" enterprise as a reference.

Table 6: Incremental Revenue (N per hectare) arising from Manure Use

Crop	Organic and inorganic manure mixed	Inorganic manure only	Organic manure only
Yam	1,904.00	1,260.00	644.00
Cassava	528.00	442.00	240.00
Maize	1,140.00	700.00	400.00
Rice	1,920.00	1,200.00	384.00
Cocoyam	660.00	330.00	132.00

The values in table 6 represent the additional increases in revenue as a result of adoption of one form of soil manuring method on another. Similarly the adoption of a combination or organic and inorganic manures adds highest to the total revenue followed by the adoption of inorganic manure only. The least addition to total revenue occurred in the use of organic manuring method.

The profitability of cultivation of crops using different manure types can be deduced through the comparison of costs and returns associated with the different manuring methods. This is done on the basis of gross margins and net returns from manuring. Combining tables 3 and 4, that is average variable costs and total revenue, the gross margins of different crops under different manuring methods can be computed. Gross margin is the surplus (or deficit) remaining after the total variable costs incurred in the production of a commodity have been deducted from the gross income earned on the value of production, that is Total Revenue less Total Variable costs. Table 7 summarises these information.

The highest gross margin came from the use of a combination of organic and inorganic manures for all the crops except for cassava where the use of inorganic manure only gave the highest gross margin. Also the least gross margin resulted from the non-usage of any type of manuring for all the crops except cocoyam in which case its least gross margin resulted from the use of organic manure only.

Table 7: Gross margin (N per hectare) of crops under different manure types

Crop	Gross margin values			
	Organic and inorganic manure mixed	Inorganic manure only	Organic manure only	No manure
Yam	7,460.00	6,966.00	6,400.00	5,906.00
Cassava	928.00	992.00	840.00	750.00
Maize	5,290.00	5,050.00	4,750.00	4,550.00
Rice	15,080.00	14,560.00	13,844.00	13,660.00
Cocoyam	1,190.00	1,010.00	862.00	880.00

Furthermore from table 7, the increases in gross margins associated with the decision to use manure can be computed. Using the gross margin of the 'No manure' enterprise as a reference, a change in the gross margin as a result of manuring is calculated. Likewise the incremental in cost associated with manuring can be deducted from the incremental in revenue. Whichever is adopted, the same value of increase in net returns as a result of manuring is got. Table 8 gives these incremental.

Table 8: Incremental Net returns (N per hectare) as a result of Manuring

Crop	Organic and inorganic manure mixed	Inorganic manure only	Organic manure only
Yam	1,554.00	1,060.00	494.00
Cassava	178.00	242.00	90.00
Maize	740.00	500.00	200.00
Rice	1,420.00	900.00	184.00
Cocoyam	310.00	130.00	–18.00

The highest increase in net returns resulted from the use of a combination or organic and inorganic manure for all the crops except for cassava where the use of inorganic manure only gave the highest incremental net returns. The least increase in net returns came from the use of organic manure only. However it is important to note that in cocoyam the incremental variable cost for organic manure exceeded the incremental revenue realized from it. It is therefore best to combine the use of organic and inorganic manures for cocoyam, then better to use inorganic manure only than to use organic manure only. Also because of the loss involved in using organic manure only, it should even be better not to use any manure than to accrue losses in using organic manure only for cocoyam.

There is a significant increase in the net returns from the use of one form of manuring technology or another especially a combination of organic and inorganic manures.

Soil Manuring Constraints

Many factors hinder the ability of the farmers to optimise the use of soil manuring technologies.

- Lack of continuous availability of organic materials
- Bulkiness and heavy conveyance burden for organic materials
- Very high labour requirement for organic wastes accumulation;
- Lack of wheeled transport for organic materials movement
- Poor organic materials build-up skills
- Lack of appropriate skills for compost manufacture
- Insufficient crop residues for mulching
- Unavailability of water to prepare composts
- Poor access to inorganic fertilizers
- Unpopularity of mixed farming systems that could guarantee organic materials supply
- Low awareness of green manuring techniques

Of these constraints, the majority (80 per cent) of the farmers pointed "lack of continuous supply of organic materials" as the most potent reason for the low usage of organic manuring techniques. Even though, farmers displayed high awareness of the economic and ecological benefits from manuring, they could not optimise their usage because of these operational obstacles.

Conclusion

Strategies adopted by smallholder farmers to cope with shortening fallows and soil depletion are economically beneficial. Crop yields and farm incomes were saved through the farmer-generated techniques such as household manure, mulching and farmyard manure. Sustaining farmers' strategies would require increasing their access to organic materials; enhancing their manure accumulation and preparation skills and the provision of loans to employ more farm labour for difficult manuring tasks. Agricultural extension agencies must as a matter of necessity, emphasize and teach farmers better skills and methods of preparing and utilizing organic manures. Timely delivery of chemical fertilizers at affordable costs to farmers is also imperative for yield sustainability.

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Feature

Impact of Farmers Education, Age & Experience on Fertiliser Use & Yield

A. Narayanamoorthy

Human resource related variables like education, age and experience play an important role on the use of inputs and the quantum of yield. This study analyses the impact of these factors and concludes that experience and education have a positive relationship with productivity.

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Recently attention has been devoted to the study of human resource variables like education, experience and age, and their impact on yield in agriculture. Education plays a crucial role since the introduction of new seed-fertiliser-water technology in Indian agriculture as educated farmers have the advantage of access to information from agricultural officials and can be first adopters. Many studies are available in this regard. However, the results of the existing studies are not similar. One set of studies shows that there is a positive relationship between education and the use of new technology components and the yield of the crop. Some other studies have found that there is no direct relationship between education and the yield of the crop.

Chaudhri (1979) in his study on "Education, innovation and agricultural development" in North Indian Agriculture found that general education upto secondary level has a significant impact on diffusion of technology and agricultural productivity. Mann (1989) found that education plays a positive role in modern agriculture, because more educated farmers are able to collect more information about new seeds. Lockheed et al., (1980) and Dasgupta (1989) also support this view. Azar (1991) came out with the conclusion that education ensures positive impact on productivity. However, elementary education (upto four years of schooling) is not sufficient for increasing the productivity. A more recent study by Duraisamy (1992) found that education, especially above middle school level has a positive and significant impact on agricultural productivity in Tamil Nadu.

But some others proved that education is not a barrier to modern agriculture and the use of modern inputs (Pandey 1989). Rao (1980) showed that proximity to urban area or urban contact plays a major role than education in agriculture. Kalirajan et al., (1985) carried out a study in Tamil Nadu rice farming areas to know the impact of

education on crop yield. They found that the new technology was well adapted to local conditions. Observations of neighbours and receptivity to advice were found to be more important than education — the experience gained was better than formal education.

Education plays a crucial role since the introduction of new seed-fertiliser-water technology in Indian agriculture as educated farmers have the advantage of access to information.

Narayanamoorthy, (1990) found while studying the record yield farmer of Pudukkottai district in Tamil Nadu that low education in no way affects the farmer in adopting the modern inputs and producing record yield. Experience and active involvement in agriculture were more important factors than education.

The existing studies have some limitations. First a study on the effect of education on yield should specify the variety of the crop, since the yield producing genetic capacity varies according to variety. Second, the mode of irrigation (canal/tank/well/bore-well etc) must be indicated, since yield variation may be because of differential use mode of irrigation. Many studies in Indian agriculture corroborate that yield rate is higher in the case of farmers with own borewell than those with canal or tank irrigation [Dhawan (1988); Kaul et al., 1991]. Third, adoption of yield increasing inputs (especially fertiliser) also increases the yield. So the amount of fertiliser — all NPK, must be considered for the study. Importantly, most of the reviewed studies have taken the education of the head of the household or that of the respondent for analysis. This may not give clear picture because any decision relating to agriculture is taken on the basis of the collective decision of the family members who are working in agriculture. So the education of the farmers who are involved in agriculture (irrespective of gender) and its average or total education are more reliable.

Taking into consideration the limitations of these studies, the present paper focuses on the relationship of human resource variables (education, age and experience) and its impact on fertiliser use and yield. The study is a micro-level analysis conducted in the highly bore well concentrated area of Pudukkottai district of Tamil Nadu. The study covered the bore well owing farmers alone with the following objectives:

- To analyse the impact of education on fertiliser use and yield of paddy.
- To analyse the relationship between the farmers' experience and use of fertiliser and productivity of the crop.
- To know the relationship of the age of the farmer with fertiliser use and yield of the crop.

Methodology

A sample of hundred borewell farmers was randomly selected from a total of 178 . The list of bore well owners and their land holdings including crop pattern was collected from the respective village administrative officer's; (VAO) record. The revenue villages for the study are Vallathirakottai, Kalangudi, Vandakottai and Maniyambalam. These villages are completely irrigated by bore well since late 1970s. Before that they used tank water. The important crops of the study areas are paddy, sugarcane, plantain and groundnut. Other crops are very few or nil in some villages (especially in Vallathirakottai and Kalangudi). Paddy occupies more than 60 per cent (except Vallathirakottai where it accounts for more than 50 per cent) of the total cropped area against the district average of 47 per cent in 1990-91. Sugarcane is the second major crop in all study villages accounting more than 25 per cent of the total net sown area, while it accounts only 0.76 and 1.05 per cent in taluk and district respectively. These villages are under the Special Rice Production Area Programme (SRPAP).

Results & Discussion

Selection of a uniform variety is one of the important conditions to measure the impact of education on fertiliser use and yield. In the sample of 100 bore well owners, only 61 of them had cultivated CR-1009 paddy variety during the samba season in 1990-91. The remaining 39 cultivated different varieties like CO-43, ADT-39, Ponni, etc. Only a small percentage of farmers had cultivated IRRI varieties in the study area. CR-1009 variety gives more yield comparatively than any other variety in the study area. It is well adapted to the local conditions, of that area. The study selected only the farmers who had cultivated CR-1009 paddy variety for analysis.

Education, Fertiliser Use & Yield

Education is divided into three groups — low (upto 5 years), medium (5.00 to 10 years) and high (above 10 years). The average years of schooling of farmers actively involved in agriculture is considered as education for this study. To know the impact of education on yield

the yield between low and medium group of farmers. However, the yield rate is significantly higher for medium aged farmers than the higher aged group. So one can not clearly say that the age of the farmers plays a crucial role in fertiliser use and yield, since the results show a mixed trend among the groups.

Table 3: Average age, fertiliser use and yield in Paddy cultivation.
(*fertiliser and yield/acre*)

Average age in years	No. of samples	Average age	Average acres	NPK in Kgs.	Yield in Kgs.
Low (upto 30)	9	25.18 (2.34)	3.86 (4.34)	88.95 (17.00)	2280.00 (289.82)
Medium (30.00 — 40)	28	35.46 (2.91)	6.66 (9.26)	84.12 (24.44)	2245.71 (490.71)
High (above 40.00)	24	47.91 (6.81)	5.55 (4.24)	96.06 (25.82)	2195.00 (427.05)
Total	61	41.40 (26.66)	5.81 (7.14)	88.49 (23.94)	2230.81 (445.98)

Note: Figures in parentheses are standard deviation.

Correlation & Regression Results

We have also calculated correlation to understand the degree of associationship of the study related variables. Table 4 shows that farming experience is significantly but negatively related with education and land, while the association is very weak and negative with yield. The correlation value of average age of the farmer is very weak with all study related variables. Surprisingly, eduction is significantly but negatively related with the use of fertiliser. The relationship between education and yield is also very weak. However, it is significantly and positively related with the total area. The results of the regression exercise (table 6) also confirm that the human resource variables like education, age and experience of the farmer in no way explain the use of fertiliser and yield of the crop. It is also confirmed by the R^2 value which is very weak in both the models.

Table 4: Correlation matrix for study related variables.

Variables	X_1	X_2	X_3	X_4	X_5	X_6
Farming experience (X_1)	1	.05 (.39)	−.44a (.3.87)	.06 (.51)	−.08 (−.64)	−.22[c] (−1.78)
Average age (X_2)		1	.17 (1.33)	.17 (1.35)	.03 (.23)	.12 (.95)
Average education (X_3)			1	−.19 (−1.55)	−.04 (−.37)	.29[b] (2.38)
NPK (X_4)				1	.24[c] (1.92)	.18 (1.47)
Yield (X_5)					1	.11 (.87)
Land (X_6)						1

Note: Figures in parentheses are 't' values
a — significant at 1 per cent level
b — significant at 5 per cent level
c — significant at 10 per cent level.

Table 5: Significant position of the study related variables

Variable	Difference between low and medium	Difference between low and high	Difference between medium and high
Based on Education:			
Education	sig. at 1% level	Sig. at 1% level	Sig. at 1% level
Total acres	no. sig. difference	sig. at 10% level	sig. at 5% level
Fertiliser	no. sig. difference	no. sig. difference	sig. at 10% level
Yield	no. sig. difference	no. sig. difference	no. sig. difference
Based on Farming Experience:			
Farming experience	no. sig. difference	sig. at 5% level	sig. at 5% level
Total acres	no. sig. difference	sig. at 5% level	sig. at 1% level
Fertiliser	sig. at 10% level	no. sig. difference	no. sig. difference
Yield	no. sig. difference	no. sig. difference	no. sig. difference
Based on Average Age:			
Average age	sig. at 1% level	sig. at 1% level	sig. at 1% level
Total acre	no. sig. difference	no. sig. difference	no. sig. difference
Fertiliser	sig. at 10% level	no. sig. difference	sig. at 1% level
Yield	no. sig. difference	no. sig. difference	sig. at 1% level

Note: Significant rate is calculated by using 't' test.

Table 6: Regression results.

Independent variables	'b' co-efficients	
	Dependent variable (*fertiliser*)	Dependent variable (*yield*)
constant	89.07	2072.32
X1 — Farming experience	−0.08	−4.84
X2 — Average age	0.21**	0.05
X3 — Average education	−2.56*	−9.58
X4 — Fertiliser use	—	3.45
X5 — Total acres owned	1.00*	4.19**
R^2	0.14	0.07

Note: * — significant at 5 per cent level
** — significant at 15 per cent level.

Conclusion

From the analysis we can conclude that education alone can never be a crucial factor to determine the fertiliser use and yield of the crop. Infact the farmers with less education are using more fertiliser than the more educated ones. The correlation result also shows that the yield is significantly related with fertiliser and not with education. Farming experience of the respondent is also in no way related with yield, but less experienced farmers are using significantly more fertiliser than the medium group. Both young (low age) as well as the higher aged groups of farmer are using significantly more fertiliser than the medium aged group. But it does not reflect on the yield of the crop. Regression results also corroborate that human resource factors alone can not explain the yield and fertiliser use. Hence, one can say that agricultural productivity is determined not by the education of the farmer but by the intensity of physical inputs and the involvement of the farmer in agriculture. However, one cannot completely ignore the usefulness of education in modern agriculture. Educated farmers can change the cropping pattern favourably based on the existing market condition as well as the forecast of the future market demand than the low or uneducated farmers.

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In developing managerial competency, we must do more than 'drive through the rearview mirror'. It is not enough to look at what excellent organizations and managers are already doing. It is also necessary to be proactive in relation to the future; to anticipate some of the changes that are likely to occur and position organizations and their members to address these challenges effectively.

GARETH MORGAN, Riding the waves of change
(San Francisco:Jossey-Bass)

Indian Electronics: Technology, Trade & Liberalisation

K.J. Joseph & K.K. Subrahmanian

The Indian economy is currently undergoing a process of structural change in response to policy reforms favouring liberalisation and globalization in all economic spheres. The authors attempt to analyse the effects of liberalisation on the nature of changes in technology, product structure and foreign trade. The study is confined to capture the experience of Indian electronics industry which has been enjoying substantial dose of liberalization in terms of industrial licensing, import of capital goods and components and technology since the early 1980s.

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Indian economy is currently undergoing a process of structural change in response to policy reforms favouring liberalisation and globalization in a number of spheres including the import of foreign technology. The reform measures in different spheres will inter-act with each other and the combined effect, it is assumed, will lead to technological progress and augmentation of competitiveness, of Indian industries as well as their integration with the world economy. It is expected that the resulting changes in the structure of foreign trade will lead to increased exports and acceleration in economic growth. It is but not clear whether or not the increase in exports net of imports i.e. net trade effect will be advantageous? For, it can be argued that the "free" play of MNCs (Multinational Corporations) in the investment flows, (finance, technology and management) and trade under liberalisation has the potential danger of inhibiting the development of domestic technological efforts and domestic lines of production, which otherwise would have reduced its import dependence or expanded export earning on the basis of the dynamic comparative advantage acquired through the process of internal learning. Thus viewed, liberalisation could have conflicting effects on the pattern of technological change, product structure and international trade and finally the rate of economic growth. This paper is an attempt towards understanding the effects of liberalisation on the nature of changes in technology, product structure and foreign trade.

Liberalisation could have conflicting effects on the pattern of technological change, product structure and international trade and finally economic growth.

A detailed empirical study of the effect of liberalization on technological change and foreign trade in Indian industries is not a practical proposition at this juncture as the introduction of comprehensive policy reforms with transparency started only in 1991. The attempt here is, therefore, confined to capture the experience of Indian Electronics Industry, which has been enjoying substantial dose of liberalization in terms of industrial licensing, import of capital goods and components, foreign capital and technology since the early 1980s. Hence, its experience can be guidepost to the subject matter of our discussion.

The Conceptual frame

To begin with, we need a conceptual frame for analyzing the impact of liberalisation on technology and trade. This we can attempt on the logic implied in the new technology-gap theories of international trade[1]. We recognize the importance assigned to technological-lead in explaining the pattern of trade in these models but we also note some of their limitations. For instance, these models consider technology as a freely available information, which could be transferred across different countries without any difficulty. In fact, technology cannot be reduced to freely available information or to a set of blueprints. It must be viewed as embodying specific, local, often tacit and only partially appropriable knowledge. Hence, the purchaser of technology always receives a less complete information set than what is possessed by the seller (Nelson, 1978). This necessitates technology importing countries to strengthen their technological capability by supplementary domestic R & D efforts howsoever free the firms are to import technology from the international market. Moreover, the effective use of the technology transferred from developed countries will call for adaptations to suit local conditions of both factor and product markets. These adaptations, which invariably call for local R & D, in turn can lead to incremental improvements. The cumulative effect of these incremental improvements could be manifested in still further innovations of altogether new products/processes and even in the export of the new products and the technology. Thus, we assume that the direction of technological transformation (change) or what can be called, the technological trajectory, lies at the heart of structural transformation, the change in the composition of imports and exports, and thus on the net trade-effect of a developing country.

[1] The early contribution to the new theories of international trade may be traced back to the technology gap theory of Posner (1961) and Product Cycle theory of Vernon (1966). For a recent review of the new theories see Bain. (1991).

Needless to say, the trajectory will depend on the technological strategies adopted by the micro economic entities say the firms, in terms of technology import, local R & D and the combination there of. The firms' strategies rest on the differences in industrial structure, social organization and the relative role of government in the economy. Technological trajectories would also differ across sectors. For, at any moment of time technological opportunities vary across different industries in terms of the knowledge base on which they would draw, the strength of their linkages with other sectors/industries, degree of embodiment of technical advances in the capital equipment and the forms of private appropriation of the economic benefits from innovation.

The firms' strategies rest on the differences in industrial structure, social organization and the relative role of government in the economy.

It follows from the above discussion that the technological trajectory influences the nation's current specialization in production, its product structure, and hence, the pattern of its imports and exports. Also the given product structure influences the potential for its technological dynamism and trade performance. A central issue then is concerned with the type of technological strategies being followed by the micro economic agents, say the firms and their effect on the technological trajectory of the country. The question in the Indian context today is whether the liberalisation will lead to such a technology-behaviour of economic entities that ensures the sustained growth in exports net of imports? Although the types of protectionist policies hitherto followed had their adverse effects, there are arguments for some protection based on the principle of strategic profit sharing[2]. In particular, the government policy to strengthen the technological dynamism and the competitive position of domestic producers in the world market may generate higher levels of national welfare than would result from free trade.

There are two different types of conditions that give rise to this result (Dosi et al., 1990). First, industries that are imperfectly competitive tend to generate high returns (excess profits or quasi rents) and the resources employed by these sectors earn higher returns than the

[2] see Brander & Spencer (1985)

other sectors of the economy. Under these conditions, national welfare may be improved by a government policy to win larger share of world profits for the domestic population. For example, if the world computer industry is a high profit, high wage industry, then national protectionist and promotional policies that capture a large share of the world computer industry for domestic producers may improve national welfare at the expense of competitors abroad. Second, government intervention to improving industrial welfare can be justified by a second set of conditions set by the standard notions of externalities and spill over effects. The argument runs as follows: certain industries may be more important than the others because they generate benefits for the rest of the economy and the government policies to promote or protect them can improve welfare by fostering these spillover effects.

The Japanese policy gives empirical support to the above lines of arguments. The Japanese policy makers were aware that optimal allocation of resources from a long term dynamic view point cannot be accomplished by the market mechanism alone (Freeman, 1988; 1987). Hence, the government acted as a gate keeper to break apart the multinational package of "money, technology and management". Japanese policy also produced intense competition in which pursuit of market share was the best way to pursue profits. Hence it could be argued that government policies can, to the benefit of national welfare, determine the outcome of competition in international markets (Zyasman et al, 1990).

The Japanese policy makers were aware that optimal allocation of resources from a long term dynamic view point cannot be accomplished by the market mechanism alone.

Reverting to the type of strategies being followed by economic agents say, the firms, one could draw analytically a distinction between the strategy which maximizes what Dosi et al.(1990) calls 'Ricardian' efficiency (allocative efficiency) on the one hand and 'Schumpeterian' efficiency (growth efficiency) on the other. The allocation of resources amongst industries and activities in response to current economic measures of social profitability is 'Ricardian Efficient' in the sense that it maximizes short run (current) economic welfare. The allocation of resources amongst industries can be evaluated not only according to its Ricardian efficiency but also according to its effects on the pace and direction of technological change and hence on the long term rates of growth of economic activity (Schumpeterian efficiency). Here it may be noted that the strategy, which maximizes the short run allocative efficiency need not necessarily be the one that maximises the long term rates of growth. Similarly, the product structure that maximizes Ricardian efficiency need not be the one that maximize the schumpeterian efficiency. Further the technology behaviour of firms in terms of local R & D and technology import towards maximising Ricardian efficiency will be different from the firms attempting to achieve Schumpeterian efficiency.

The strategy, which maximizes the short run allocative efficiency need not necessarily be the one that maximizes the long term rates of growth.

In the light of the above discussions, our conceptual framework for empirical evaluation of the Indian situation has to address itself to an analytical question: whether the firms' behaviour in response to market-oriented and free trade policies is to achieve the short run Ricardian efficiency or to maximize the long run Schumpeterian growth efficiency? On *a priori* grounds if the objective function of the firms were to maximize the short run Ricardian efficiency, then the emerging product structure of the industry would be the one based on imported technologies and inputs. Similarly, as the firms are not concerned with the macro objective of minimizing the outflow of foreign exchange, the products which are dominant in the product structure need not necessarily be the one that has export potential or the one that minimizes the import content. On the contrary, if the firms were to maximize the Schumpeterian growth efficiency, the resultant technological trajectories and product structure would be taking different forms. To put it differently, the analytical question is whether the product structure of the industry is technologically myopic or technologically dynamic? The latter case recognizes the cumulative, irreversible and uncertain nature of technological activities whereas, the former doesn't. Moreover, the latter takes into account the spill overs and externalities whereas, the former considers only the short run profits.

The conceptual frame outlined here examines the technology strategy (behaviour) of the firms, the changes

in the product-structure of the industry and finally, the pattern and net effect of trade in terms of the relative rates of growth of imports and exports. In what follows we examine the technology and trade effects of the policy of liberalisation by making a study of Indian Electronics.

The analytical question is whether the product structure of the industry is technologically myopic or technologically dynamic?

Indian Electronics: A Case Study[3]

During the early years of the development of this industry, the thrust was on self-reliant growth in tune with the then general industrial/technology policy framework. In pursuit of the above strategy, priorities were worked out, production capacities and investments were licensed and imports progressively controlled by a wide array of policy measures, which were predominantly regulatory and protectionist in character. That strategy remained more or less same in essence for a decade or so but was changed towards a more open and market oriented one in the eighties through a series of policy changes (Appendix 1). The policy changes initiated in the eighties sought a liberal climate, both internally and externally through dilution of the industrial licensing, relaxations of MRTPA and FERA provisions, liberalization of imports and greater access to the import of foreign capital and technology. Moreover, considerable relaxations were effected in the fiscal regime including reduction in direct taxes and import duties to provide a more propitious economic climate for private sector in the Indian industrial economy. The first step in our study of Indian electronics industry is to examine the technology behaviour of the electronics firms under the relatively liberal policies of the eighties.

Technology Behaviour of Firms[4]

Ideally, one should examine the technology behaviour of firms by analyzing the firm's expenditure in terms of technology import and the in-house R & D effort towards adapting and assimilating the imported technology. In the absence of relevant firm-wise time series data on technology payments, we cannot attempt such an analysis. As an alternative, we may adopt the following method. We ask whether the annual R & D expenditure incurred by the technology-importers in electronics industry is higher than non-importers in a sample of firms undertaking R & D during the eighties. Since the R & D intensity is generally hypothesized to vary with the size of firms, we also examine the influence of the firm-size on R & D expenditure. These propositions are empirically tested by using a multiple regression equation of the following type:

$$\log R_t = a + b_1 \log TM_t + b_2 \log SV_t + e_t$$

where, R is the level of R & D expenditure., TM is a dummy variable taking values 0 and 1 respectively for firms that are non-importers and importers of technology respectively, and SV is the value of sales used here as a measure of the size.

In applying the statistical model outlined above we need information of R & D expenditure of firms. The Ministry of Science & Technology (DISR) surveys the firms registered with it and publishes a Compendium of In-house R & D Centres, which gives information on sales-turnover, foreign collaboration, R & D expenditure etc. of the firms. On the basis of above information it is possible to separate out technology-importers and non-importers undertaking R & D and to carry out the empirical test outlined above. We obtained the required data relating to electronics industry for four years (1985-86 to 1988-89) of the eighties from this compendium. The sample covered in each year being not identical, the statistical testing was carried out for each year separately. The sample firms were classified into two groups viz., non-importers of technology and importers of technology. The results of the estimated multiple regression equation is given in table 1.

Table 1: Estimates of Regression Coefficients

Year	1985-86	1986-87	1987-88	1988-89
No. of Sample Firms	24	64	20	
Constant	– 0.829 (–1.139)	– 0.783 (–1.753)	– 0.726 (–0.853)	– 0.401 (0.633)
Dummy (TM)	0.112 (0.629)	0.023 (0.226)	0.050 (0.256)	0.548 (1.351)
Size (SV)	0.559 (3.145)*	0.639 (6.219)*	0.574 (2.969)*	(0.302) (2.739)*
R^2	0.301	0.419	0.339	0.418

Figures in the parenthesis show the t values
* significant at 1 per cent level.

[3] For a detailed study on the structural characteristics and the growth of Indian electronics industry see Joseph (1991).

[4] For a detailed analysis of the technology behaviour of firms under liberalization see Subrahmanian (1991).

Two interesting findings emerge from the statistical testing of the data though the explanatory power of the model is not high. First, the co-efficient of SV (proxy for size) is positive and significant but less than unity. This would imply that the increase in R & D intensity is in direct relation, but not proportionate, to the size of the firm. In other words, larger firms do not undertake proportionately more R & D than smaller ones. Second, the coefficient of dummy variable has positive sign but is not significantly greater than zero. In other words, the annual R & D expenditure incurred by technology-importers is not significantly higher than non-technology importers. The regression coefficients showed a consistent pattern in all the four years. We may interpret that the greater play of market forces has not encouraged the firms to strengthen their technological capability through a process of internal R & D activity in Indian electronics industry. Perhaps, the incentive structure of the market under policy liberalization is biased in favour of importing technology continuously for maximizing the short-run gains (Ricardian efficiency) rather than developing internal technological capability for achieving sustainable growth and dynamic comparative advantage in the long run.

The incentive structure of the market under policy liberalization is biased in favour of importing technology continuously for maximizing the short-run gains (Ricardian efficiency) rather than developing internal technological capability for achieving sustainable growth and dynamic comparative advantage in the long run.

Product Structure

As the second step, we analyze the product structure of the industry. We have estimated the share of different sub-sectors in electronics output and traced the changes overtime. For this purpose we have divided the electronics output into three broad categories via., (a) electronic consumer goods, (b) electronic capital goods, and (c) electronic intermediates.

It is evident from table 2 that during the controlled regime of the seventies, electronics production in India was dominated by the electronic capital goods contributing more than 50 per cent of the total output. The respective share of electronic consumer goods and electronic intermediate goods were 27 per cent and 21 per cent respectively. Given the fact that electronic capital goods could be viewed as being technology-intensive, and having higher spill-overs and externalities some studies[5] even attributed the dominance of this sector to represent the then higher domestic technological capability of Indian electronics industry.

Table 2: Changes in the Production Structure of Indian Electronics (at current prices)

Year	Electronic consumer goods	Electronic Capital goods	Electronic Intermediary goods	Total Output
1971	53 (30)	81 (47)	40 (23)	173
1972	63 (31)	94 (47)	44 (22)	200
1973	64 (28)	113 (50)	51 (22)	228
1974	78 (26)	151 (50)	72 (24)	301
1975	85 (23)	205 (56)	75 (21)	365
1976	103 (25)	224 (55)	80 (20)	410
1977	131 (26)	284 (56)	91 (18)	509
1978	159 (27)	308 (52)	117 (20)	591
1979	179 (28)	320 (49)	136 (21)	647
1980	214 (27)	422 (52)	163 (20)	806
1981	246 (29)	412 (48)	173 (20)	856
1982	337 (28)	606 (50)	214 (18)	1205
1983	330 (24)	725 (53)	230 (17)	1360
1984	587 (31)	897 (47)	303 (16)	1890
1985	1060 (40)	1135 (43)	410 (15)	2660
1986	1312 (38)	1531 (44)	510 (15)	3460
1987	1835 (39)	2070 (44)	700 (15)	4720
1988	2400 (38)	2712 (43)	1023 (16)	6299
1989	2799 (34)	3839 (46)	1440 (17)	8313
1990	2938 (32)	4420 (48)	1520 (17)	9201
1991	3000 (31)	4694 (48)	1750 (18)	9725

Note: Figures in parentheses indicate percentage share in total. They may not add up to 100 because the total output includes production in the export processing zones.
Source : Department of Electronics, *Annual Report*, Different Years.

The product mix, however, witnessed substantial changes when the policy regime was shifted in favour of market forces. There was considerable increase in the share of electronic consumer goods especially since 1984. The share of this sub-sector increased by more than 10 percentage points during 1985-88 as compared to the seventies. While there was a shift in favour of the low technology products with less spillover effects like electronic consumer goods there was a significant

[5] See for details, UNCTAD (1978).

decline in the share of electronic capital goods and intermediate goods. Such a shift in the product structure of the industry could be viewed as a direct outcome of the change in the objective function and the consequent behavioural pattern of entrepreneurs in terms of their investment under different policy regime. It appears that the play of market forces in the eighties has had its impact on the entrepreneurial behaviour in such a way as to maximise short run allocative (Ricardian) efficiency.

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Pattern of Foreign Trade

Now let us examine how the propensity to export and import changed along with the changes in the domestic production structure. In the absence of any reliable time series estimates of imports, we worked out the components requirements in electronics equipment production on the basis of the equipment component ratios given by the Bureau of Industrial Costs and Prices (BICP, 1987). We first obtained the components requirements for each product group and then added these up to obtain the total components required for the electronics industry. To estimate imports we subtracted from the total requirements, domestic output net of exports. Estimates of imports thus obtained are reported in table 3. The figures, in fact, are underestimates to the extent that they do not take into account equipments imports. Table 3 also reports data on electronics exports. It is evident from the table that there has been an increase in the export performance of the industry. However, the size of the export share remained marginal as compared to imports share. While the export picked up the import intensity also increased more than proportionately. It appears that changes in the technology behaviour of the firms along the shift in the product structure resulted into proportionately larger imports under liberalisation. Presumably, the "liberal" import of technology without adequate complementary domestic R & D did not enable the firms to achieve dynamic comparative advantage through a process of learning by doing and to raise the export trade adequate to pay even the imports. The net effect on the external sector was thus not very favourable to India under the relatively liberal policies of the eighties.

Table 3: Trend in Exports and Imports of Electronics

Year	Exports (Rs. Crores)	Export as a % Production	Imports (Rs. Crores)	Import content in Equipment Production
1981	56.3	6.5	162.7	23.8
1982	89.6	7.4	249.7	25.2
1983	116.2	8.5	289.7	25.6
1984	155.8	8.2	507.2	31.9
1985	154.5	5.8	754.1	33.5
1986	240.0	6.9	989.6	34.2
1987	312.1	6.6	1374.2	34.8
1988	475.0	7.5	1837.4	33.9
1989	784.1	9.4	2329.2	33.5
1990	930.2	10.1	2603.5	33.2

Concluding Observations

If the experience of electronics industry in the eighties is any indication, the pattern of technology behaviour of the firms of Indian industry under the ongoing liberalisation may have the tendency of inducing the firms to maximise the "Ricardian efficiency" rather than to achieve the "Schumpeterian efficiency". This tendency in turn has the potential danger of rendering the Indian industry externally more dependent on, and internally less dynamic in technological progress. Such a technology behaviour of firms also has its adverse implications on the product structure that render them more dependent on imports and proportionately less dynamic in exports.

Indian industry under the ongoing liberalisation may have the tendency of inducing the firms to maximise the "Ricardian efficiency" rather than to achieve the "Schumpeterian efficiency". This tendency in turn has the potential danger of rendering the Indian industry externally more dependent on, and internally less dynamic in technological progress.

To generalise, in a developing country like India the play of market forces may have the tendency to mould entrepreneurial behaviour in such a way as to maximise short run allocative (Ricardian) efficiency. The consequent product structure and the technology behaviour

Appendix 1

Milestones in Electronics Policy

Milestones	Year	Remarks
1. Bhabha Committee	1966	Recommended development of an integrated electronics sector with a view to achieve self reliance with minimal recourse to foreign capital and dominant role to public sector and small scale.
2. Sondhi Committee	1979	Recommended dismantling of controls in general and MRTP and FERA Cos. in particular.
3. Menon Committee	1979	Recommended liberalization of import of foreign capital and technology and duty free import of capital and equipment.
4. Components Policy	1981	De-licensing of component manufacture except for MRTP and FERA companies. Provision of 40 percent equity to FERA companies in high tech areas. No MRTP clearance required under sections 21 and 22 of MRTP Act except for LSI and VLSI. General reduction in duty on components and liberal import of capital goods for component manufacture.
5. Colour TV policy	1983	Ceiling on capacity was removed. All sectors of industry excluding foreign companies were allowed to participate.
6. Telecommunication Policy	1984	Telecommunication was opened to private sector.
7. Computer Policy	1984	All Indian companies (excluding FERA) were allowed to enter the computer industry with no restriction on capacity. Most of the components needed were put under OGL. to facilitate import.
8. Integrated Policy	1985	De-reserved certain components of small scale sector. Introduced broad-banding and liberal approach towards foreign companies even with more than 40 per cent equity in high tech. areas.
9. Computer Software Policy	1987	Reduction in the import duty on all imports meant for software exports and no duty for hundred per cent export. Provision of special financing schemes and permission for foreign companies (with more than 40 per cent equity) in the hundred percent export projects.
10 New Industrial Policy	1991	A step forward in terms of all the aspects mentioned above.

inter alia tend to inhibit the industry from achieving the dynamic comparative advantage in the international market. This does not imply that market-oriented reforms as such are irrelevant for technological progress and for export promotion. As a testable proposition, if not a settled conclusion, we may say that the market has a clear role to play in allocating resources, but it is doubtful whether it can bring about a technological transformation that an economy like India requires. The role of government will, therefore, continue to be crucial, if not decisive, in achieving a type of technological transformation that *inter alia*, helps increase India's exports net of imports, and bring about favourable net trade effect.

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Labour Productivity & Labour Intensity in Indian Manufacturing (1973-89)

NPC Research Division

In a previous study [*Productivity*, **34**(3)], we updated our time-series data on energy productivity in Indian manufacturing industries upto the year 1973-89. This study presents updated information on labour productivity in the manufacturing industries upto 1989-90. The methodology of computing the productivity ratios remains the same as in our earlier study [*Productivity*, **32**(4)] on labour productivity. Labour productivity is defined as the net value added per employee per year. The 'net value added' figures have been taken from the Annual Survey of Industries (ASI), from which data upto the year 1989-90 is available now. These values have been deflated to 1981-82 constant prices, based on the relevant wholesale price indices. Labour intensity is defined as the share of 'emolument' in the value of 'total inputs', both being measured at current prices.

The present study covers 44 industry groups based on National Industrial Classification (NIC). These industry groups have been chosen, keeping in mind their significance in terms of contributions in the 'total value of output' in the manufacturing sector.

Table 1: Labour Intensity and Labour Productivity in Indian Manufacturing Industries

Years	Food Products			Refining of Sugar			Hydrogenated Vanaspati			Beverages, Tobacco Products		
	20-21			206			210			22		
	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories
1973-74	5.1	*	13509	9.3	3.36	261	2.0	*	65	9.4	*	2357
1974-75	4.6	7.53	13454	9.2	8.05	251	2.0	19.31	71	9.7	13.37	2080
1975-76	5.2	7.17	14126	9.7	8.86	243	1.9	21.76	75	10.3	8.70	2880
1976-77	5.1	7.74	15306	11.4	7.75	261	2.1	29.01	79	10.4	9.59	6398
1977-78	4.9	8.52	15783	10.8	7.85	288	1.6	38.14	69	10.3	6.17	7307
1978-79	5.1	10.58	16310	10.1	11.31	286	2.0	37.65	69	11.7	7.63	8204
1979-80	5.1	8.56	16840	12.2	8.42	293	2.0	40.96	83	13.8	6.52	9629
1980-81	5.4	*	17067	13.1	4.46	304	2.0	44.09	82	12.6	6.02	8901
1981-82	5.1	7.17	18351	9.9	8.42	296	1.7	35.74	76	11.3	5.85	9568
1982-83	5.3	9.88	17111	9.5	17.66	308	1.8	36.88	90	18.3	5.89	8486
1983-84	5.7	14.97	17523	11.2	31.69	318	2.1	26.22	109	13.5	11.39	8188
1984-85	5.8	14.50	17459	15.9	29.44	318	2.2	24.34	102	11.7	11.75	7093
1985-86	5.6	15.83	17725	13.0	28.96	323	2.2	53.52	88	12.8	10.36	8457
1986-87	5.4	16.21	17299	12.0	33.17	328	2.3	43.64	97	12.0	11.36	7163
1987-88	5.4	15.50	18333	12.0	25.11	349	2.1	34.34	99	12.9	10.07	7951
1988-89	5.2	19.46	18581	10.7	38.31	336	1.8	36.08	104	12.4	11.50	7723
1989-90	4.9	22.18	19342	11.5	36.02	361	2.1	37.15	123	12.6	9.68	9088

Years	Cotton Textiles			Wool,, Silk, Synthetic Fibre Textiles			Jute, Heap & Mesta Textiles			Textiles Products		
	23			24			25			26		
	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories
1973-74	25.0	12.55	5719	13.9	11.88	2413	41.0	6.18	429	9.6	14.28	1642
1974-75	23.7	11.18	5560	13.4	15.14	2368	47.1	6.87	322	9.9	13.35	1652
1975-76	24.0	9.81	5968	12.0	14.20	2743	43.9	8.07	184	9.4	17.07	1979
1976-77	20.0	10.04	6213	11.6	12.81	3090	38.9	7.73	201	9.2	15.52	2192
1977-78	19.6	10.73	6508	13.1	14.20	3112	38.8	7.21	223	9.2	15.52	2347
1978-79	19.7	12.78	6701	10.8	16.30	3216	36.6	6.87	247	9.0	19.24	2577
1979-80	22.4	13.24	7207	11.3	16.07	3455	38.5	8.07	257	8.7	15.21	2907
1980-81	21.8	13.24	7189	11.6	17.46	3743	38.8	9.62	265	7.9	17.38	2889
1981-82	20.1	11.87	7141	10.6	19.79	4100	40.2	8.93	297	7.4	20.49	2943
1982-83	19.9	10.56	6569	10.9	18.87	3267	42.3	7.68	219	7.4	21.80	2491
1983-84	22.2	13.28	6731	12.3	22.16	3532	39.1	6.50	236	9.7	20.39	2621
1984-85	20.8	11.85	6760	11.9	24.18	2955	31.5	5.19	215	8.9	28.85	3063
1985-86	19.5	13.77	7073	10.3	28.43	3236	27.1	6.25	204	8.1	27.48	2835
1986-87	22.0	15.91	6981	10.6	32.27	2986	50.6	10.57	184	7.7	37.88	2821
1987-88	20.2	14.60	6844	11.2	25.75	3142	52.0	9.42	236	8.0	18.46	3141
1988-89	17.3	16.29	6801	10.6	28.79	3250	46.3	9.22	187	8.2	22.67	3159
1989-90	16.2	18.88	7021	8.8	40.86	3325	38.2	7.95	327	7.2	24.91	3186

Years	Wood & Wood Products Furniture & Fixtures			Paper, Paper Products & Printing			Pulp, Paper & Boards			Leather & Fur Products		
	27			28			280			29		
	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories
1973-74	17.4	10.19	2932	28.8	16.93	3779	20.2	27.38	560	11.4	12.51	594
1974-75	15.8	9.29	3158	24.9	18.91	3820	17.6	38.53	490	12.8	15.82	667
1975-76	16.1	9.29	3431	25.0	18.34	3936	18.9	33.12	424	7.4	13.62	670
1976-77	15.3	10.49	3573	23.2	17.78	4506	18.4	27.70	449	8.7	15.09	727
1977-78	14.8	10.79	3676	23.5	18.34	4439	18.9	26.75	538	9.7	14.72	762
1978-79	14.2	10.79	3788	23.1	17.78	4901	18.7	27.38	500	8.1	11.78	797
1979-80	14.1	10.19	3978	21.0	17.50	4743	16.8	25.47	587	7.1	12.51	862
1980-81	12.3	8.99	4033	19.4	17.21	4798	15.8	23.24	585	9.2	11.41	886
1981-82	13.0	9.59	4094	20.2	18.63	4890	14.6	24.52	672	8.5	12.14	899
1982-83	14.2	8.86	3618	19.7	14.92	4571	14.3	13.17	637	9.2	13.67	880
1983-84	15.2	11.37	3591	19.9	15.71	4710	13.6	14.86	734	10.8	16.75	942
1984-85	15.3	10.04	3847	17.9	19.09	4808	11.8	22.75	696	9.9	17.56	929
1985-86	14.1	9.21	3580	16.9	16.21	4870	11.5	16.49	802	9.1	14.20	999
1986-87	12.8	10.09	3873	16.1	18.83	4921	11.3	21.92	779	9.1	14.54	976
1987-88	13.1	11.16	3407	17.3	17.47	5096	12.0	19.70	899	8.2	17.27	1074
1988-89	11.6	12.64	3355	15.0	19.27	4960	10.2	27.64	808	7.4	12.90	1195
1989-90	11.5	11.98	3521	14.0	23.42	5098	10.2	35.79	842	7.6	16.20	1238

Years	Rubber & Plastics			Chemicals & Products			Basic & Industrial Gases			Fertiliser & Pesticides		
	30			31			310			311		
	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories
1973-74	n.a	n.a	n.a	12.7	38.77	3043	15.7	55.57	389	12.2	36.99	335
1974-75	4.9	42.62	1952	10.2	37.21	3221	11.8	49.76	543	9.3	38.67	344
1975-76	5.1	36.93	2496	10.3	33.05	3732	12.3	37.05	639	9.0	31.67	378
1976-77	4.4	50.57	2831	9.7	35.91	4152	12.8	38.50	701	7.8	36.43	440
1977-78	4.2	50.85	2881	9.4	36.69	4674	12.7	51.57	764	7.5	38.11	469
1978-79	4.0	40.91	2350	10.0	44.49	4881	13.5	52.30	874	7.8	59.41	493
1979-80	3.6	34.09	3302	9.4	36.69	5328	11.5	45.76	883	7.3	43.44	503
1980-81	3.2	35.23	3498	9.0	32.00	5479	10.2	34.50	917	7.0	32.51	447
1981-82	2.6	34.09	3864	8.2	35.91	6834	8.8	50.12	1223	5.4	51.28	618
1982-83	2.6	44.33	3514	8.5	39.79	5350	10.9	50.05	934	5.0	68.19	442
1983-84	2.9	30.88	3778	9.2	46.98	5824	11.3	43.52	978	6.1	64.04	495
1984-85	3.0	47.86	3900	9.1	44.60	6032	10.4	41.09	1320	6.0	100.86	469
1985-86	2.6	78.95	3958	8.8	45.73	6402	10.1	48.39	1040	6.6	75.97	546
1986-87	3.0	73.56	4097	*	47.00	6335	9.5	66.86	1017	5.7	75.54	474
1987-88	3.1	74.28	4412	8.9	51.54	6578	10.4	69.85	1049	6.6	79.46	515
1988-89	3.0	76.52	4660	8.3	57.50	6946	8.8	94.69	1119	6.5	101.37	594
1989-90	3.2	78.95	5047	7.7	66.43	6631	7.3	64.58	361	7.2	95.0	426

Years	Paints & Varnish 312			Drug & Medicine 313			Non-metallic Mineral Products 32			Structural Clay Products 320		
	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories
1973-74	11.5	45.36	338	18.5	26.87	674	22.0	12.78	3757	41.7	9.67	1182
1974-75	9.8	42.49	372	16.0	27.79	682	20.8	11.84	3890	36.6	8.18	1223
1975-76	9.9	39.62	368	15.8	32.42	800	18.9	12.47	4820	36.1	8.93	1533
1976-77	8.8	41.63	403	14.9	38.29	865	17.3	13.40	5309	30.8	8.93	1641
1977-78	9.7	39.62	496	15.2	29.49	918	17.3	15.59	5558	29.8	10.04	1666
1978-79	8.7	44.21	498	15.5	31.81	958	17.9	12.78	5639	31.2	10.42	1727
1979-80	9.0	50.53	551	15.4	32.89	1070	17.1	12.47	6083	28.2	8.93	1899
1980-81	9.8	38.18	568	15.4	35.51	1121	17.5	13.09	6440	27.6	9.67	2159
1981-82	8.7	36.46	773	14.8	33.35	1434	15.7	13.09	7694	27.3	8.56	3048
1982-83	10.6	36.73	476	15.1	40.55	1131	16.5	15.67	6667	40.8	6.98	2495
1983-84	11.0	44.92	547	16.3	49.19	1187	15.7	15.20	7618	30.3	5.15	3117
1984-85	11.7	43.13	515	15.9	41.26	1265	14.1	17.40	7841	28.7	6.15	3146
1985-86	10.4	38.08	555	14.8	45.09	1358	13.5	18.53	8515	27.6	6.43	3421
1986-87	10.0	54.39	592	15.0	48.30	1374	13.2	16.97	8267	26.7	5.93	3247
1987-88	9.3	50.07	739	15.5	50.21	1497	13.5	17.81	8706	25.3	7.95	3445
1988-89	9.5	41.66	722	13.8	55.21	1554	12.0	19.69	9025	20.2	8.17	3486
1989-90	10.5	24.23	1121	5.8	33.90	2550	11.9	22.40	9038	22.2	7.44	3515

Years	Glass & Glass Products 321			Cement, Lime & Plaster Industry 324			Basic Metal & Alloy Industry 33			Iron & Steel Industry 330		
	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories
1973-74	28.5	11.71	391	14.7	16.98	126	19.8	22.50	4132	*	20.68	942
1974-75	24.8	9.70	392	14.4	17.52	126	18.4	28.70	4215	19.7	23.27	1114
1975-76	25.2	8.37	414	13.0	26.95	205	16.8	25.76	4562	18.7	20.31	1150
1976-77	23.6	9.37	448	11.7	26.95	226	15.7	28.37	4988	17.5	20.68	1143
1977-78	22.9	12.38	483	12.0	33.69	247	15.0	24.13	5054	17.1	19.57	1299
1978-79	23.1	11.38	560	12.2	27.49	232	13.2	26.74	5259	13.7	21.42	1332
1979-80	23.4	9.70	573	12.5	23.45	271	12.5	23.81	5538	13.0	19.57	1471
1980-81	20.6	9.37	590	12.2	20.48	261	11.5	25.44	5779	11.6	21.79	1546
1981-82	19.0	10.71	674	11.5	19.67	276	10.2	30.65	6013	10.2	22.53	1714
1982-83	19.0	10.43	607	10.3	44.97	276	10.0	29.42	5509	9.8	21.81	1474
1983-84	19.6	10.37	601	10.3	43.17	328	11.9	30.37	5888	12.1	42.49	1686
1984-85	19.4	13.59	567	9.2	48.34	366	12.3	23.73	5901	13.0	31.21	1657
1985-86	18.2	19.64	571	8.7	49.58	468	10.1	28.54	6077	7.1	36.72	1764
1986-87	16.7	16.37	556	8.7	42.49	448	9.7	25.85	6191	10.2	31.10	1822
1987-88	17.4	16.06	570	8.9	42.98	517	9.8	27.51	6184	10.4	29.78	1754
1988-89	17.8	18.03	596	7.4	48.00	558	8.7	38.18	6203	9.8	45.65	1829
1989-90	15.0	23.68	626	7.6	54.13	551	7.6	37.44	5853	8.8	39.81	1597

Years	Foundry for Casting 331			Ferrous Alloys 332			Copper Manufacturing 333			Aluminium Manufacturing 335		
	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories
1973-74	18.9	18.22	2440	10.0	37.14	49	10.7	29.88	92	13.8	28.85	161
1974-75	18.6	20.50	2519	8.1	45.32	21	9.9	34.86	74	21.2	31.01	141
1975-76	17.3	17.90	2737	7.7	39.52	42	8.4	14.69	111	11.1	36.06	200
1976-77	16.9	18.22	3094	7.2	41.23	70	9.5	53.54	116	8.9	54.09	183
1977-78	15.5	17.24	2973	6.5	34.07	43	9.8	29.88	117	9.8	37.50	232
1978-79	14.9	18.87	3121	6.7	40.89	49	9.5	25.40	96	9.6	40.75	253
1979-80	13.8	17.24	3173	6.6	31.35	49	7.8	33.62	119	9.2	12.26	280
1980-81	12.8	19.20	3293	6.8	52.13	53	9.8	18.92	141	8.6	*	308
1981-82	11.6	19.85	3307	6.3	46.00	60	7.4	16.68	164	8.3	12.62	317
1982-83	11.7	17.65	3126	7.7	22.32	35	6.8	39.43	149	8.0	25.53	318
1983-84	13.4	18.80	3208	7.8	*	65	7.0	41.81	143	8.5	18.35	364
1984-85	13.3	14.71	3313	7.4	17.53	53	7.6	17.40	129	7.6	27.95	335
1985-86	11.2	18.89	3337	6.9	38.57	54	8.8	13.56	144	7.3	21.11	331
1986-87	9.9	18.62	3365	6.0	42.09	64	7.7	*	167	7.5	17.13	328
1987-88	9.6	20.21	3313	6.8	49.16	80	8.8	20.31	175	7.8	46.69	335
1988-89	8.1	21.54	3236	5.8	49.10	76	6.0	13.39	193	5.9	79.00	395
1989-90	4.1	27.01	1442	5.2	44.78	77	6.2	32.55	187	5.4	104.48	342

Years	Zinc Manufacturing 336			Metal Products & Parts 34			Machine tools & Parts 35			Agriculture Machinery 350		
	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories
1973-74	9.4	*	29	18.3	17.42	4434	24.4	21.18	4713	12.4	*	799
1974-75	9.3	149.08	11	17.2	16.56	4412	20.7	22.28	4808	10.5	21.18	707
1975-76	9.6	79.30	11	17.4	15.99	5260	19.8	21.73	5449	10.7	22.16	673
1976-77	9.8	76.13	12	16.2	17.42	5590	18.5	26.40	5881	11.4	28.02	621
1977-78	5.5	136.40	19	16.1	16.85	5657	19.5	25.03	6203	12.2	22.16	718
1978-79	7.7	57.73	20	15.4	17.71	5818	18.4	25.85	6387	10.5	24.44	703
1979-80	8.5	68.83	23	15.0	19.14	6230	17.3	23.38	6826	9.9	22.81	789
1980-81	8.8	61.22	24	15.1	18.85	6457	15.8	26.13	7011	9.4	27.70	786
1981-82	7.4	48.21	25	13.7	19.14	6563	15.4	27.23	7876	8.7	30.63	797
1982-83	9.0	37.30	21	13.5	18.66	5884	16.0	27.73	7207	10.2	29.50	717
1983-84	8.1	85.08	22	16.4	21.86	6054	18.0	31.38	7138	11.1	28.39	794
1984-85	8.2	*	21	16.5	20.18	6078	18.2	33.80	7168	11.5	31.47	734
1985-86	7.6	*	46	14.8	21.47	6307	17.5	37.14	7648	11.6	36.09	802
1986-87	7.5	39.02	33	15.3	22.36	5978	16.3	36.49	7254	11.8	38.55	700
1987-88	8.1	37.31	43	15.0	24.89	6390	15.9	32.94	7584	11.7	42.75	830
1988-89	6.6	41.51	45	14.4	27.05	6335	14.8	31.44	7711	9.6	35.73	775
1989-90	5.9	61.44	29	10.9	21.76	6683	13.7	37.35	7753	8.5	46.93	859

Years	Prime Movers & Boilers			Industrial Machinery for Food & Textiles			Industrial Machinery other than for Food			Refrigeration & AC		
	352			353			354			355		
	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories
1973-74	20.1	*	623	25.2	20.45	1003	34.1	*	402	23.4	18.41	128
1974-75	19.3	32.59	689	19.2	21.52	977	29.5	15.41	541	19.0	17.98	161
1975-76	14.7	33.72	732	19.2	20.45	1028	23.2	18.17	437	21.4	13.43	121
1976-77	15.5	43.46	776	20.2	24.39	1130	20.9	20.34	499	13.8	17.76	130
1977-78	14.0	42.71	757	14.4	25.11	1250	27.2	10.67	642	14.0	29.02	151
1978-79	13.1	31.84	719	30.3	27.62	1289	26.7	14.22	656	14.3	24.91	155
1979-80	12.0	28.10	782	18.8	23.32	1375	25.0	15.21	740	16.8	21.22	162
1980-81	11.5	26.97	800	17.3	36.95	1359	22.6	16.59	737	11.9	23.61	200
1981-82	11.3	29.22	1097	16.3	21.52	1565	22.0	15.21	768	12.2	25.99	259
1982-83	11.3	28.97	822	19.0	20.79	1250	20.9	15.64	718	11.8	32.63	164
1983-84	13.9	26.23	838	18.8	22.70	1448	22.8	22.44	725	16.6	31.49	167
1984-85	14.4	40.23	942	19.5	25.01	1226	21.9	22.77	715	16.8	29.03	165
1985-86	13.3	44.61	940	19.9	23.92	1296	17.0	21.40	829	16.6	40.15	159
1986-87	12.0	28.52	871	15.1	28.23	1240	18.6	23.06	835	13.9	35.51	173
1987-88	11.0	29.98	956	17.2	28.84	1206	19.1	31.62	940	13.6	36.30	199
1988-89	13.3	32.58	902	13.2	29.34	1272	17.0	31.47	995	14.0	40.60	190
1989-90	12.1	34.59	770	11.5	41.92	1271	13.5	36.70	1158	15.9	59.45	155

Years	Machine tools & Parts			Electrical Machinery			Electrical Industrial Machinery			Transport Equipment		
	357			36			360			37		
	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories
1973-74	40.1	14.60	590	19.9	23.22	2380	21.4	27.82	1141	28.5	22.35	1600
1974-75	37.4	17.87	586	20.0	21.23	2340	24.3	25.32	998	28.8	19.07	1680
1975-76	34.7	15.86	827	18.2	22.55	2390	18.6	28.74	843	27.5	19.67	2752
1976-77	31.8	16.36	847	16.1	24.10	2596	16.2	30.33	837	24.1	24.14	2204
1977-78	34.5	14.35	934	16.7	25.65	2740	17.6	31.24	915	26.1	23.84	2348
1978-79	32.6	15.10	910	15.8	25.87	2882	16.4	30.10	955	25.8	24.14	2528
1979-80	30.2	16.36	949	14.7	24.32	3277	15.9	28.05	1036	24.4	19.37	2867
1980-81	26.7	14.85	1009	13.7	27.64	3406	15.5	33.30	1046	22.9	19.97	2815
1981-82	25.1	21.14	1011	13.1	28.74	4229	15.1	33.75	1062	21.9	22.05	3339
1982-83	27.7	20.32	1166	14.6	35.32	3641	16.2	42.27	1138	22.5	24.73	2816
1983-84	32.5	24.47	1075	17.3	36.91	3661	19.4	42.19	1105	24.1	26.20	2815
1984-85	23.4	21.52	1027	18.5	42.23	3831	23.7	60.05	1148	23.6	26.53	3041
1985-86	32.3	22.99	1076	15.5	35.99	4066	19.5	41.02	1129	21.2	26.00	3267
1986-87	29.2	22.69	1032	15.0	39.86	3888	19.8	44.65	1071	20.4	30.07	3120
1987-88	29.8	28.95	975	14.4	45.02	4241	18.7	47.72	1304	19.4	28.83	3318
1988-89	26.4	25.05	1051	12.1	48.05	4496	16.1	47.76	1378	16.8	30.82	3345
1989-90	24.5	25.98	1039	11.2	54.13	4790	15.5	56.30	1556	14.9	34.83	3637

Years	Motor Vehicles 374			Motorcycle, Scooter 375			Bicycle, Parts 376			Other Manufacturing Industry 38		
	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories	Labour Intensity Ratio (%)	Labour Productivity (Rs 000)	Number of Factories
1973-74	20.1	*	523	16.2	*	114	12.7	*	464	30.6	12.55	1662
1974-75	19.6	29.12	569	18.0	15.88	147	12.5	10.75	498	29.7	11.89	1566
1975-76	18.5	28.49	990	18.1	18.96	110	12.9	10.75	581	25.4	13.21	1473
1976-77	17.5	35.45	1021	16.9	15.88	146	11.0	11.74	600	23.4	17.62	1871
1977-78	19.2	36.08	1023	15.1	20.15	201	12.5	11.54	598	21.7	15.63	1897
1978-79	17.7	36.40	1113	17.2	21.57	215	11.0	9.95	643	18.2	15.41	1799
1979-80	16.0	27.85	1205	16.3	23.47	270	10.4	12.74	694	18.4	15.85	2047
1980-81	15.0	28.49	1297	15.8	20.15	235	7.8	13.53	676	18.7	18.72	1956
1981-82	14.8	35.45	1565	15.0	22.99	293	8.0	17.12	748	18.3	18.72	2383
1982-83	15.9	38.38	1334	15.5	28.24	255	9.0	16.87	638	18.7	23.45	1475
1983-84	17.9	41.14	1302	15.4	25.57	257	9.4	17.84	669	19.9	28.46	1871
1984-85	18.9	42.05	1529	14.2	29.61	287	8.7	15.84	658	19.8	35.61	1509
1985-86	16.5	42.76	1594	13.2	38.87	295	8.1	12.04	673	19.0	54.78	1725
1986-87	15.7	47.80	1567	29.1	33.46	348	8.3	15.58	627	20.8	38.16	1573
1987-88	15.0	43.31	1463	10.6	28.71	432	8.7	17.77	687	17.1	38.66	1742
1988-89	13.4	48.72	1498	10.0	29.84	460	7.6	18.35	691	17.5	35.90	1792
1989-90	12.2	44.27	1008	10.3	24.96	550	7.5	17.27	693	12.9	45.29	1795

n.a : Data not available

* : Extremely high or low value not conforming to the pattern

Note: According to the recent reclassification of NIC, industry groups 30 (Rubber & Plastics) and 31 (Chemicals & Products) have been interchanged. But we use the same codes as in the earlier study to maintain comparability.

Compiled by

K. Suryanarayanan

Pollution from Viscose Filament Yarn Industries

NPC Pollution Control Division

The Viscose Filament Yarn Units are typical sub-sectors of man-made fibre industry in India. There are seven viscose filament yarn units in India. The production of filament yarn stands at 0.015 million tonnes/annum (1990 production data) against an installed capacity of 0.0135 million tonnes/annum.

The Process and Sources of Pollution

The viscose filament yarn production comprises three steps:

- Viscose preparation/formation
- Cellulose re-generation (spinning machines, spin bath return and salt recovery)
- After treatment

Viscose Preparation/Formation

The pulp (cellulose) is hydrolysed using 18% caustic soda and other proprietary chemicals and passed through a slurry press. The press lye is allowed to settle. A portion of clear alkali is continuously recycled, while the remaining is reprocessed in dialysers. The rejects from dialyser is reused or discharged as waste water. Alkali cellulose is then dried, shredded and matured. Viscose solution is prepared in batches in xanthator. Two types of xanthators are prevalent in filament rayon industries, dry churn and wet churn. In xanthators, CS_2 under vacuum reacts with alkali to form Cellulose Xanthate. After completion of xanthation, unreacted or excess CS_2 is discharged into the atmosphere. The viscose solution is thereafter processed successively in dissolver (dry churn), disintegrator and blender for assuring uniform composition. In case of wet churn, after every batch of xanthation and viscose transfer, the empty xanthator is washed and washed water is either discharged or flushed to dissolver.

After the Xanthation process, the viscose solution is filtered in three stages filter system. Periodic cleaning of filter presses and filter cloths generates waste water. The filtered Viscose solution is finally deaerated using vacuum flash deaerator. The exhaust from the final stage containing residual CS_2 is discharged as process emission continuously.

Cellulose Re-generation

Spinning Machine

The viscose solution is then pumped through spinnerettes continuously in a Spin Bath solution containing principally sulfuric acid. Cellulose is regenerated as cellulosic fibre and CS_2 & H_2S are released. Although, the CS_2 & H_2S gases are continuously extracted from the entire machine area through appropriate suction hood and duct assembly and discharged into the atmosphere as process emission, still significant amount of CS_2 & H_2S gases are dispersed in shop floor causing fugitive emissions. In order to avoid the built up of gases in working area fresh air is continuously supplied into the spinning hall. In filament yarn spinning machine the regeneration of cellulose is complete in spinning area. The regenerated cellulose from each spinning position is continuously drawn as filament yarn and spun in the form of cake in a central pot. The yarn while being spun discharges residual spin bath rich in salts in central pot which tend to deposit the salts in the pot. Hence continuous/intermittent water spray is given to wash out the deposited salt. In case of continuous water spray the salt recovery is not feasible and entire pot discharge is discharged as waste water. Due to frequent maintenance requirement of spinnerettes and replacement of cakes, continuous flow of fresh water is maintained in the lower channel of spinning machine for hand washing and it is discharged as waste water. Further, viscose leakages

from spinnerette gear pump, spillages from machine, periodic cleaning of entire machine during change over of product mix and floor washing activities generate waste water.

Return Bath & Salt Recovery

The dilute spin bath is stored in bottom tank from where a portion after evaporating excess water and addition of requisite quantities of acid and proprietary chemicals, is pumped to top tank for recycling to spin machine, and another portion is pumped for salt recovery. The top and bottom tanks are covered and the residual CS_2 & H_2S are extracted and discharged into atmosphere as process emissions. In salt recovery operations periodic cleaning of evaporator tubes & filters, vapor condensate, spillages and floor washing generates waste water.

After Treatment

The cakes are manually loaded on washing stations and are subjected to washing and finishing operations. The sequence of operations are hot water wash, alkali wash, desulfurisation with Na_2S, hypo treatment for bleaching, antichlor to remove excess chlorine and finally soft finish with speciality chemicals. Desulfurisation and bleaching operations cause process/fugitive emission but levels are insignificant. All treatment and washing operations generate waste water. The waste water from these activities is taken to sump zone and discharged. This discharge which is rich in Zinc, TDS, SO_4 and other pollutants is called sump zone discharge.

It may be noted that though CS_2 is an important raw-material for Viscose Filament Yarn Industry. However, it does not get consumed in the process and the entire quantity used, reappears as CS_2/H_2S during the Cellulosic regeneration process. The CS_2 consumption per ton of production for filament yarn is 295 kg with +5% variations.

Most of the units have their own CS_2 manufacturing plants. The CS_2 is produced by reaction of calcined charcoal and molten sulfur in the absence of air at a temperature of 800-900°C.

Air Pollution

The major sources of air pollution in filament yarn units are:

- Xanathator
- Deaerator
- Spinning Machine
- Spin Return Bath
- Fugitive emissions from spinning machine.

The emissions and pollution load depend on capacity of plant, number of machines in a hall and operating conditions and therefore, emission factors have been worked out per Tonne. Fibre production for Xanthator, Deaerator and Spinning Machine and Spin Bath Return. The values are given in Table 1. The fugitive emissions data are given in Table 2.

Table 1: Emission Factors for various sources of filament yarn units

Sources & Parameter	Concentration Nm^3/hr, mg/Nm^3	Specific Load Nm^3/T, kg/T
Xanthator, Flow	235-286	8.2
Exhaust CS_2	129438	1.3
Deaerator, Flow	193 Nm^3/hr	102
Exhaust CS_2	22920-70194	1.32-5.2
Spinning Machine		
Flow	344962-857032	587679-626255
CS_2	272-291	170-171
H_2S	39-75	24.4-44
Spin bath, Flow	28515-72690	49845-51767
return CS_2	157-192	8.1-9.6
H_2S	166-231	8.6-11.5
Unaccounted (%)	—	7.4-21.2

Table 2: Fugitive Emissions from spinning machine

Location	CS_2 mg/Nm^3	H_2S mg/Nm^3
Machines with closed shutters	20-57	8.5-23
Machines with open shutters	215-342	13-34
Machines with higher denier & closed shutters	101	14

Water Pollution

The major sources of water pollution in this sector are:

- Production activities
- Auxiliary Plants
- Utilities

The waste water is categorised in three categories (based on pollutants and their load) as follows:

- Combined viscose preparation area discharge (VPA)
- Zinc bearing streams
- Total factory waste water discharge

The waste water characteristics and pollution load depend upon plant capacity, operational practices and efficacy of treatment system. In Table 3 waste water

Table 3: Characteristics of waste water from different sources filament yarn units

Parameter	Source							
	Viscose Pre. Area		Zinc Bearing Streams		Total Factory Raw		Discharge Treated	
	Conc. mg/L	Load Kg/T	Conc mg/L	Load Kg/T	Conc. mg/L	Load Kg/T	Conc. mg/L	Load Kg/T
Flow*	77	1.9	547	14.6	975.0	624.0	975	624.0
pH*	—	—	—	—	6.0	—	7.4	—
COD	802	39.5	—	—	176.0	110.0	136.0	87.0
BOD	—	—	—	—	61.0	38.0	26.0	16.0
TSS	—	—	—	—	24.0	15.6	20.0	12.5
TDS	—	—	—	—	1606.0	1000.0	1458	910.0
Zn	—	—	208	8.9	13.2	8.2	2.3	1.5
SO_4	—	—	—	—	1303.0	813.0	1160	724.0

* - Units for Flow Rate are m^3/hr and m^3/T
- Unit for pH is absolute number

characteristics in terms of per ton of fibre production for a typical filament yarn plant.

Compiled by :
M.J. PERVEZ

It is the unique privilege of the leader to strengthen men. Nowhere else in contemporary industrial society does that privilege come to grips with opportunity so directly as in the organizations in which men work. To exercise the privilege demands sensitivity to subtlety and forthrightness of action, that creative fusion of aggression and affection which summons forth the highest human talents. The man whose leadership is the product of such fusion in the service of an ideal in aptly called the exceptional executive.

HARRY LEVINSON

News & Notes

Uncertainty Analysis in IRP

The only constant facing today's utility executive is uncertainty: load growth is uncertain, inflation rates and fuel prices are uncertain, competitive markets are uncertain, and the regulatory environment is uncertain. Utilities and regulatory commissions frequently face decisions that have to be made while an IRP (Integrated Resource Planning) framework is evolving. If the decisions are postponed until the IRP framework and procedures are established, opportunities may be lost on both the supply side and the demand side, costs may increase. or shortages may occur. This is true in jurisdictions where IRP rules have already been adopted but are still evolving, as well as those that are still in the process of establishing IRP rules.

How does one plan in such a changing environment? One answer is by incorporating uncertainty analysis into (IRP) process. Uncertainty is a major area in which practitioners are working to extend the IRP framework. Uncertainty analysis in IRP may seem daunting, but several techniques can simplify the process. They focus the analysis on critical issues facing utility management and regulatory commissions, taking a *decision analysis* approach. Decision analysis is a comprehensive framework for making decisions under uncertainty. It provides a way of combining different types and quality of information from different sources. A decision analysis process can address IRP issues to the extent that they have a significant effect on the decision at hand but do not remain paralyzed until a comprehensive IRP has been completed.

A utility planner can use decision analysis in a six-step procedure:

1. Construct a spreadsheet that performs an economic analysis of the resource options being considered.
2. Conduct sensitivity analyses with a detailed production simulation model and construct a response surface model summarizing the sensitivity results, to be embedded within the spreadsheet model.
3. Conduct a sensitivity analysis with the spreadsheet constructed in Step 1.
4. Conduct a probabilistic analysis of project risks with the spreadsheet.
5. Conduct a sensitivity analysis of the probabilistic results obtained in Step 4 to determine the sensitivity of the results to the probability assumptions and other assumptions.
6. Refine elements of the analysis in Steps 1 through 4 if indicated by the probabilistic sensitivity analysis in Step 5.

The decision analysis process described above has proven an effective and efficient method for performing decision analysis of resource options. It incorporates the elements of IRP that have a significant effect on decisions about specific resource options, and it accounts for uncertainty in the underlying assumptions. Hagler Bailly has used this process in evaluating specific options for such clients as Bangor Hydro-Electric and Black Hills Power and Light. Both studies accounted for additional DSM potential beyond the utilities' plans at that time as well as for environmental externalities. They also used this process in evaluating non-utility generation options for two other U.S. utilities.

Efforts to merge IRP and decision analysis will continue. Existing models that merge them will be further enhanced to increase sophistication in both areas. New models merging IRP and decision analysis will also be developed. These development efforts will be motivated both by known shortcomings and by the need to accommodate new issues into the IRP paradigm, such as transmission and distribution effects. For the foreseeable

future, however, decision-making for specific resource commitments will continue to be best served by a decision analysis approach that seeks to be comprehensive in covering issues that have a significant effect on the immediate decision, but not necessarily on all IRP issues.

Source: Hagler Bailey, Jan. 1994.

What is 'empowerment'?

The particular complex of changes being undertaken by our industrial and commercial clients significantly affects three aspects of organisational life: decision-making structures, managerial roles, and operational jobs and their rewards. Executives and senior managers increasingly use the word empowerment to describe both a highly selective devolution of some decisions and also a redrawing of the boundaries of authority, functions, and jobs. The underlying philosophy emphasises that managers now give a power to employees which they did not previously have; employees become authorised to act in ways which would have been considered undermining of the chain of command. We frequently hear statements like, 'it is all about empowerment isn't it' and 'empowerment is at the core of everything we are trying do'.

Executives and senior managers would like to achieve a leaner decision-making structure with fewer levels of middle management and greater communication and co-operation across functional boundaries. By flattening hierarchies and knocking down departmental barriers, leaders of organisations hope to decrease both overhead costs and the time it takes their employees to respond to changes in customer demands. The belief is that delays of a certain type are eliminated: those delays which are due to communications having to travel up the hierarchy, over to and back from another function, with decisions then moving back down the hierarchy. By integrating same functions into the some organisational units and eliminating others, it is hoped that territories guarded jealously by technical specialists will disappear.

Middle and line managers who are implementing moves to create this leaner organisation need to be capable both of carrying out strategies determined from above and also of inspiring quality and productivity from below. In addition, they must be able to share responsibilities and to co-operate in decision-making across traditional boundaries between jobs, occupations, departments, and levels of hierarchical authority. Simultaneously, recession economics often leads to significant redundancies within white-collar ranks. To many middle managers, lean manufacturing and flatter hierarchies means more work with fewer people.

Further, senior managers expect middle managers to carry out more project work involving increased co-operation between operational departments and service departments. The introduction of new technologies, quality assurance systems, legislative demands, and corporate-wide restructuring are just a few examples of changes which require project management. Those at the top expect that these changes to middle and line managers' work can be accomplished through internal restructuring, for example business process re-engineering, product based structures, and other approaches to integrating routine operational and service functions while creating new units to handle non-routine projects.

In efforts being made to change decision-making structures and managerial roles a main emphasis is currently being placed on empowering the workforce. Line managers, middle managers, and technical specialists are being required to devolve responsibilities, historically reserved for their jobs, to operational and office personnel. We have observed many an interaction between senior and middle managers in which complaints about an increasing workload in the context of decreasing staff are met with admonitions to pass on power and authority to those below.

By implementing new and changed operational job and reward systems, managers hope to motivate their workforce better. Typically, some form of agreement needs to be reached with employees to achieve much greater flexibility in work practices where and when the changing needs require. Flexibility, both of job duties and of attitude towards being moved from job to job, forms a core aspect of UK and Irish managers' notions of empowerment. The passing on of power and authority tends to be defined practically as the passing on to operational and office personnel some responsibilities historically reserved for line and middle managers, for example: scheduling and allocating workloads, contacting service personnel to repair equipment, and administering attendance records. Another common feature of the definition is that employees will demonstrate the ability and willingness to be self-directed in achieving productivity and quality objectives. Group-based work, or some version of teamwork, is a popular outcome of this managerial philosophy.

Source: Jean Newman in The Tavistock Institute Review 1992/93.

New Model for Technology Transfer

The Japan Productivity Centre (JPC) recently compiled and published a proposal entitled "In Pursuit of an Attainable-Ideal Model for International Technology Transfer".

The proposal was prepared by the JPC's Standing Committee for the International Exchange of Productivity Research and Experience based on the results of a questionnaire survey entitled "Feasibility Study on the Transfer of Management Practices from Japan to Other Countries".

For this survey, which was conducted Japanwide by the committee in March 1993, respondents were asked to fill out a questionnaire concerning their evaluation of Japanese business customs and management techniques and beneficial ways that these could be transferred to foreign countries. Valid responses were received from 135 Japanese businesspeople who had worked in foreign countries and 122 foreign businesspeople working in Japan.

The JPC committee's proposal concedes that the Japanese government and private businesses have not earned the praise and respect of the world on a level commensurate with the volume and quality of technical cooperation they have extended to overseas countries. It stresses the need for promoting technology transfers consistent with basic, clear-cut principles and objectives in order for Japan to assume responsibility in this field in the international community. To this end, it proposes the basic principle that "technology be shared on a global scale, with due respect for the disparate identities of the different regions of the world", and sets forth a basic objective of "chieving equitable distribution and narrowing the gaps between different parts of the globe through the sharing of technology".

The proposal suggests the following five technology transfer guidelines, which embody these basic principles and objectives:

- Technology must not be transferred without the participation, cooperation and consent of the nation's people.
- Technology transfer must contribute to improving productivity and to enhancing the quality of life.
- Technology transfer must protect jobs and increase employment opportunities.
- The benefits of technology transfer must be fairly distributed.
- Technology transfer must contribute to the harmony of the world community by promoting mutual respect and exchange among different cultures.

The proposal also sets up seven criteria for technology transfer:

- Will the technology increase social equity?
- Will it aim to reduce interregional disparities?
- Will it lead to a fairer distribution of wealth?
- Will it contribute to a more peaceful and democratic society?
- Will it contribute to an improvement in the standard of living, social conditions and the natural environment?
- Will it promote participation and consensus?
- Will it meet the recipient nation's requirements and enhance that nation's ability to help itself?

The JPC committee believes it is necessary to actively transfer the merits of Japanese-style management based on these principles and criteria and, in so doing, provide "packaged technology transfer" by integrating multiple technologies into a unified package, taking into account the inclusion of measures to handle any possible negative ripple effect brought about by technology transfer from Japan.

The committee stresses the need to maintain two-way technology transfer so that "we can both strive to actively share what is good about Japanese techniques and, in the process, look to our partners as models against which we can more accurately judge our own progress and seek ways to improve and enrich our owr lives".

The JPC committee proposal suggests that the attainable-ideal model for international technology transfer is to transfer technologies in such a way as to assume international responsibility (the buildup of intellectual property, the sharing of benefits and profits, self-help assistance and international contribution), while taking into consideration the actual state of the recipient countries (social environments, customs and practices, managerial climate, national sentiment and citizenry) and the effects of technology transfer on recipient countries (beneficial effects: upgraded technological levels, modernized management and increased employment; adverse effects: intensified labor, layoffs and environmental destruction).

Source: JPC News, Autumn 1993.

Young Workers Lose Drive

From March to April 1993, the Japan Productivity Center and Japan Economic Youth Conference conducted a joint survey on attitudes toward work and life among 4244 newly employed and 1073 employees with 2-5 years of working experience at their companies.

According to the survey results, 12.6% of the newly employed were "highly" motivated regarding their jobs and 39.0% were "moderately" motivated, while only 8.9% of those with two to five years of experience were "highly motivated and 36.2% were "moderately" motivated. The finding indicated that new employees are generally more motivated about their jobs than are employees with two to five years of experience. The percentages of respondents who had "only modest" or "no" motivation were 6.7% and 39.8%, respectively, for new employees, and 11.2% and 43.7%, respectively for experienced employees.

In response to the question "When you work harder, are you rewarded more?, 19.2% of the newly employed replied "definitely yes". This response, however, was gathered from only 5.5% of those with two to five years of experience in their companies.

Noteworthy here is the fact that newcomers have higher expectations of being rewarded by their companies for their achievements compared to employees with two to five years of experience. Asked if they want to work for the company until retirement, 41.7% and 32.2% of the newcomers replied "not so much" and "don't want to" respectively, compared with 39.6% and 17.8% of the experienced employees.

Tamotsu Sengoku, director general of the Japan Youth Institute, performed a cluster analysis of the survey results, and found that the ratio of those with no or little motivation was only 13% among the newly employed, but rose to 55.1% after two to five years of company service. He warns that this may become a serious issue in the future.

Source : JPC news Autumn 1993.

The Founders of Total Quality Management

There are some key names of people who have pioneered various concepts in TQM which are being widely applied nowadays. They are:

(i) W. Edwards Deming:

Deming's philosophy advocates that total quality programs need to be management led and have to involve everybody in the organisation. His ideas are always referred to and the 14 points which he suggests are key elements to the implementation of quality improvement programs in any context or any organisation regardless of type of activities and size. Besides the use of statistics for identifying tangible problems and solving them, Deming points refer to the long term need of dealing with people by involving them, encouraging them, developing them and relying on their contributions.

(ii) Joseph, M. Juran:

Juran argues that at least 80% of quality defects are management controllable. He therefore advocates that the task lies in the hands of management in what he calls 'management breakthrough'. It is basically managers who have to lead the battle of reducing waste and improving quality through their commitment and belief. Traditionally, of course, managers were the major obstacles to the breakthroughs by setting rigid standards based on linear performance. Juran refers to quality management in terms of quality planning, quality control and quality improvement.

(iii) Armand V. Feigenbaum:

Originator of the concept of Total Quality Control (TQC). He believes that control must start and finish with the customer. The customer must set the standard and be the judge of the achieved standard. TQC according to Feigenbaum must seek to coordinate all the various activities within a business whether it is machinery, processes, information systems or people. In other words, the whole effort needs to be geared towards the achievement of a common organisational objective.

(iv) Philip B. Crosby:

Perhaps best known for his book entitled 'Quality is free'. He is also the developer of the concept of 'Zero Defects' (ZD). Crosby argues that the problems associated with quality are very much people related. He thinks that Acceptable Quality Levels (AQL) are definitely a bad thing from the point of view of the customer. He argues that quality is free, and certainly is not a gift, and that continuous programs should aim at completely eliminating defects. He thinks that defects generally occur because of lack of knowledge and lack of attention, which are both people related.

(v) Kaorn Ishikawa:

Considered by many as the leading authority in Total Quality Management in Japan. He is the originator of

Quality Circles and 'cause-effect' diagrams which are widely used in continuous improvement programs worldwide. He also believes that it is impossible to control quality without the use of statistical techniques. He has developed some statistical techniques, often referred to as 'Ishikawa techniques', which are extensively used in problem-solving activities.

Source : M. Zairi, Management of Advanced Manufacturing Technology, Sigma Press, Wilmstone 1992.

The GATT & Developing Countries

The General Agreement on Tariffs and Trade (GATT) is a 'contract' calling for non-discriminatory treatment of trading partners and setting rules intended to counter protectionism and the "law of the jungle" in international trade. A total of 117 countries at present subscribe to GATT. Eight rounds of negotiations to free international trade have been held, the latest being the Uruguay Round which started in 1986.

The Uruguay Round propounds a sweeping package intended to liberalise and boost world trade by lowering customs duties, opening foreign markets and revamping outdated global trade rules. This would lead to increased trade, greater investment, creation of more jobs and faster income growth. With the implementation of the GATT Accord, world trade is expected to expand by more than US$ 200 billion per year.

The Agreement may turn out to be a key gain for developing countries, especially in the area of settlement of trade disputes with developed countries. With a strengthened multilateral trade dispute settlement mechanism in areas of anti-dumping and countervailing investigations, unilateral action like 'Super 301' by the economically stronger countries is expected to decrease. Also, member nations will receive 'most-favoured nation' status.

With the phased reduction in agricultural export subsidies now agreed upon, the huge market for agricultural products in developed countries would now be thrown open for developing countries, particularly for products like cereals, dairy products and oil-seeds.

To the detriment of the developing countries are issues relating to patents, pipeline protection clause (providing for exclusive marketing rights for five years for a new product patented in another country) and opening up of their market to textile imports. In the Uruguay Round of trade talks, attempts were made to ease out the Multifibre Agreement (MFA) by integrating it into the GATT system, based on tariffs. MFA effectively restricts the developing countries' exports of textiles to industrialised nations through imposition of quotas. The developed countries fear that removal of quotas would flood their domestic markets with imported textiles and cause largescale unemployment. A ten year time period has been fixed for dismantling MFA.

India would now be required to amend its 1970 patent legislation regarding drugs, pharmaceuticals and agrochemicals and move from the present 'process-patent' towards a 'product patent' regime. On all other issues in Trade Related Intellectual Property Rights (TRIPS), like copyrights and trade marks, the Indian law is already in consonance with the international system since the mid 1980s.

The vast and profitable film and television industry in the country may also have lost an opportunity to enter the world market in a bigger way, due to the audio-visual sector being kept out of GATT. As regards services, access of skilled service personnel into the markets of member countries would now be possible on a non-discriminatory basis, subject to an overall ceiling, which would be evolved by each country.

On the whole, with GATT, developed country markets will now be accessible to the developing countries. That is distinctly a gain which will considerably boost the share of developing countries in the world trade.

Source : Export Advantage Dec, 1993.

Personnel Policy of Public Administrations

Public administrations often rely on a "personnel statute" to outline their personnel policy. Such a statute defined the terms and conditions of the employment relations. As it is, one could describe it as a legally defined and enforced personnel policy.

The legal nature of a personnel statute might restrain public administrations from experimenting with their personnel management. On the other hand, some may regard this as a long-term advantage, offering stability and forcing the organisation into a consistent policy. As such, the question could be raised as to whether the statute can be seen as the precursor of the modern cry for long-term strategic personnel management? How do innovative public administrations cope with this personnel statute?

Like their private counterparts, public administrations juggle with concepts like decentralisation, delegation and mission-driven organisations. All over Europe, policy execution becomes more customer-oriented as more emphasis is put on the local level. Especially North European countries break with the classic principles of public administration. Government or public interference becomes less imperative. Denmark, Great Britain, Sweden and the Netherlands even strengthened the collaboration between administrations and private companies.

Obviously, such evolution will have profound repercussions on the personnel statute. Researchers found inspiration in the direction of those changes in British and Swedish public services, as both may be considered as being very innovative. It turned out that both the administrations adapted their personnel statute when it became imminent that certain regulations were dysfunctional in relation with the decentralisation and the deregulation policy. The personnel statute "old style" emerges as being too static and at odds with innovation processes.

Does that mean that these organisations turn their back on the idea of a personnel statute? Not at all. They conceptualise their "new" personnel statutes differently and see them now as a framework and a point of reference. The statute "new style" provides basic rules and guidelines on the position and the working conditions of the individual civil servant. The statute is less extensive and detailed, as it no longer aims to control the organisational processes.

Clearly, public administrations are influenced by innovative management concepts. To their credit, they opt to continue on their own road to a better personnel policy.

Source : European Centre for Works and Society, Oct 1993.

Real Reforms

Labour Policy

The aim should be to replace legal protection of employment by contractual obligation to make separation payments. (a) All laws preventing closure should be repealed, and replaced by a law creating a prior charge on bankrupt firms' assets for a minimum level of workers' compensation. (b) The law should be applicable to viable firms as well. For them, a contributory insurance service should be set up which would assume the liability for workers' compensation in the event of bankruptcy and free their assets of the statutory obligation. It would clearly not be in lenders' interest to lend to an uninsured firm; thus all firms depending on external funds would be induced to insure themselves. (c) The protection against dismissal embodied in the Industrial Disputes Act should be replaced by a contractual obligation to make separation payments. This obligation should also be covered by contributory insurance.

Fiscal Policy

The keynotes should be concentration on the provision of public goods, moderation in redistributive policies and nondiscrimination between producers. (a) The present excise duties and corporation tax should be replaced by a flat-rate tax on value added with the broadest coverage, and the fewest rebated and exceptions. (b) The present income tax should be levied at much lower rates with much fewer rebates and concessions, and should be subject to set-off of value added tax paid by an employer, (c) Customs duties should be used on a limited scale for protection of new industries, but should cease to be a source of revenue (d) The present constitutional division of powers of taxation as well as division of revenue should be abandoned. Instead, there should be a single system of tax administration. State and local governments should be able to piggyback on central taxes, and vice versa. (e) The government should be subject to a hard budget constraint in the form of a public sector borrowing requirement, and ministries should have a hard budget constraint as well as performance criteria to fulfil. (f) All government capital investment should be routed through mutual funds which would invest it on the basis of financial return (g) All marketed government goods and services should be sold at economically determined prices. Cross-subsidies should be prohibited. All subsidies should be made explicit and paid out of government budget.

Trade Policy

The aim should be to debureaucratize trade, and to level the field in both exports and imports. (a) Eximscrips should be used initially as a trade balancing device, and should be given on all current account earnings, from goods as well as services. They should be freely tradeable, and should be sold off the counter by banks, post offices and any other institutions who wish to trade in them. The only payments that would not be financed from eximscrips are government obligations for debt and expenses abroad. (b) But as the balance of payments

improves and the premium on eximscrips declines, the eximscrip entitlement of wage goods and major exports should be cut and they should be placed on OGL. (c) Tariffs should be low on all inputs, capital goods and goods that are easy to smuggle. The present dual price structure should be dismantled by a combination of tariff reduction, devaluation, temporary subsidy to high-cost industries and temporary differential allocation of eximscrips. (d) The tax on value added proposed above should be rebatable on exports at a flat rate. (e) Price and distribution controls on agricultural goods should be abandoned together with export controls.

Foreign Investment Policy

The point of bringing in foreign direct investment is not to relieve the balance of payments or to bring in technology, but to bring in new forms of management. (a) To guard against foreign enterprises achieving strategic control of the economy, there should be a negative list of 300 biggest firms in the country and firms in sensitive industries which would not be allowed to accept foreign direct investment over 10% of their equity; there would be no limit on foreign portfolio investment. (b) Dividends or interest on foreign investment should be payable out of eximscrips either earned on exports or purchased in the open market. (c) All regulations other than the above two should be replaced.

Public Enterprise Policy

Separation payments for labour in public enterprises should be governed by the same policies as those we earlier set out for all enterprises. The distinction between the public and the private sector should fade out through closures and public share issues. (a) Once, as said above, the government channels all its investment through mutual funds on economic criteria, public enterprises will have to compete for funds on equal terms with the private sector. They should be free to issue equity or to borrow. If their issue of equity leads them to be privatized, there should be nothing to prevent it. (b) Terminally sick enterprises should be sold and their workers compensated as described under labour policy. Loss-making enterprises would not be able to get closure insurance and hence be unable to borrow unless they cease to make losses. The government should hire professional managers for them as its own cost, and should fund economic assessments liberally, but not finance their losses. (c) Where possible, public enterprises should be divided into a number of competing enterprises. Where it is not possible, they should be subjected to regulation of price and quality of product if necessary. Apart from this, all government controls on public enterprises should be removed.

Monetary Policy

The aim should be to create a capital market which would stimulate savings and offer savers a much broader choice of investments. (a) All government investment and investment in public enterprises must also pass through mutual funds, so that it is channelled on the basis of economic prospects rather than plan targets. (b) Stock exchanges should be allowed to be set up subject only to a minimum of stipulations, including a high level of computerization and electronic communication in every stock exchange; and interlinking of stock exchanges should be insisted on. Share transfers should be simplified, and paperless financial instruments should be provided for. (c) Income tax law should allow the spreading out of capital gains over a fairly long period. (d) The provision for compulsory government purchase of property suspected to be undervalued should be repealed, but much more extensive provision should be made for compulsory auctioning. (e) Competition in the mutual fund market should be promoted with full rigour, subject only to rigorous disclosure requirements on investments and costs. (f) Interest rates should be deregulated. (g) Banking should be deregulated: private banks should be allowed, bankrupt public sector banks should be closed down and their deposits transferred to other banks, sale or closure of branches should be allowed, fuller disclosure should be required of banks, and banks should be allowed to go into long-term lending on their own or through subsidiaries.

These are not the only reforms that are necessary; for instance, we have left out agriculture. But their basic theme is clear enough.

If these reforms are carried out, what effect would we expect on output and employment? With the current savings rate, the economy should really be able to achieve and maintain a growth rate of 6-7% if the capital-output ratio came down to a reasonable 3-3.5. The aim of the monetary reforms is to make industrial investment more attractive, and to broaden the choice available to investors. If, as a result, the savings rate went up to say, 30%, there is no reason to expect a growth rate below 8-10%. That would raise the per capita growth rate from the recent 2-3% to 6-7%; the effect on the growth of employment would be equally dramatic. The physical bottlenecks, for instance of agricultural goods or energy,

which have constrained growth would be much less serious once foreign trade is opened up.

These are the long-run maintainable growth rates. In the initial years, higher growth rates would be attainable as the inefficiencies into which the economy has got encrusted break up. The magnitude of this initial effect cannot be guessed. An acceleration in growth rate introduces flexibility into the economy which makes structural changes easier.

Basic structural reforms must be based on an analysis of what is wrong with the economy. No such explicit analysis has preceded the current set of reforms. Till July this year the government admitted % I Reforms—strategy nothing wrong with its policies; then it began to turn them upside down. It is in the nature of politics that policies change quickly and abruptly; if changes are slowed down to await thorough analysis, they will never be undertaken. Thus speed is all-important; but that is all the more reason why the driver must have a sense of direction and a good eye. Whilst the government has not done too badly in this respect, its perspective reflects a combination of the old style of heavy-handed but ineffective economic management and a new style of less interfering, more sophisticated guidance. The Ministry of Commerce shows a flair for innovation and a sense of purpose, the Ministry of Industry still lives in the old world, whilst the Ministry of Finance has hitherto failed to match its revolutionary rhetoric with action. Greater consistency and coherence are required, and in principle, they are not difficult to achieve.

Source : Ashok V. Desai,
My Economic Affair,
Wiley Eastern Ltd, 1993.

Putting JIT into perspective

The advantages of JIT have been exaggerated while its disadvantages have been neglected.

Who pays for JIT? JIT transfers stocks from plant sites to suppliers' warehouses, their trucks and the streets. However, on an industry-wide basis, stocks are not eliminated. Further more warehousing costs are converted into transport costs. This means in fact that a part (albeit small in some cases) of the manufacturing costs are transferred to the economy at large, because in practically every country the transport costs do not reflect the full costs of transport to society (i.e. including costs of: additional road infrastructure, congestion and pollution clean up). In most cases, this transfer is a boon to JIT using plants, but an extra burden to small suppliers which have to make more frequent deliveries and keep larger stocks. Other sectors are also burdened in terms of congestion-related costs (e.g., delays, decreased shopping activity) and/or taxes to build more roads and to clean up. As governments wake up to this subtle problem, transport changes may climb to levels close to or above the costs of warehousing.

Why not take the JIT underground in large cities? At least in some large cities, one plausible alternative which could well reduce the long-term costs of JIT to society, suppliers and individual JIT using firms, would be to move intermediate inputs in existing underground facilities either in trains and/or in conveyor belts; these could perhaps be built along underground tunnel walls. In either case, there would be additional demand for products of the metal trades industries, namely train wagons, elevators, conveyors belts and computers.

Can JIT survive tough times? The timely arrival and departure of intermediate inputs and products can only be effective if production runs smoothly; it becomes unviable if production stoppages occur as a result of strikes. Its recent popularity in Japan has resulted from cooperative management-labour relations. Elsewhere, the risks of JIT are significant and its costs too heavy. For example, a strike by 2,300 workers at a GM metal-stamping plant in Lordstown, Ohio, in early September 1992, led to the closure of GM's successful Saturn plant and five other plants leaving 30,000 workers idle. As the strikes in Germany in May 1993 suggested a deep recession can make JIT too risky.

Source : International Labour Organization; Recent Developments in Metal Trades, Geneva, 1994. □

Book Review

Problems of Sugar Industry in India by D.K. Grover & S.S. Grewal, Vohra Publishers and Distributors, Allahabad, 1992, pp 128, Rs. 150/-

Like the rest of its counterparts sugar industry in India has its share of problems and difficulties— a little more than others perhaps. The permit-license raj prevalent in the country until recently has been largely responsible for most of the ills of the Indian industry in general and of the sugar industry in particular. Being one of the important agro-based industries it has been subject to both the vagaries of nature and frequent government interventions. To some extent however the controls imposed on the sugar industry were of its own making. The sugar barons exploited the cultivators of sugarcane when rightly speaking the profits ought to have come through managerial efficiency of sugar factory operations. In the wake of blatant exploitation like withholding payment for cane supplies on fictitious grounds or not paying the right price - government controls were unavoidable. The industrialists cannot therefore blame anyone except themselves for the plethora of controls which came to be foisted on the sugar industry over the years.

Labour productivity has been the lowest in this industry so much so that the total factor productivity has remained negative(around-1) over the past several decades. No doubt, sugar industry being the producer of an essential article of general consumption could have been a major contributor to the national economy but it has all along remained a drag instead. Sugar which was sold at less than a rupee per kg. in pre-independence days is not being retailed at an exorbitant price of over Rs. 12 per kg. Despite this its consumption has been increasing every year though a larger chunk of the country's population remains deprived.

Of its use the book is an academic study of the problems of sugar industry. Being based on a statistical analysis of a mass of data, the book is likely to provoke a debate on the question of the industry's viability and its future status. Coming as it does at a time when the entire Indian industry is on the threshold of changes stimulated by the recent economic reforms the book may be welcomed by some sections of the industry.

The authors may do well to supplement the study with another one focused on the problems the sugar industry is likely to be faced with when the new government and industrial policies come into full play.

The study has been well set out. It has eight chapters of which the first one contains an introduction and the second gives a review of the literature, both of which adequately highlighting the problem and its context. However, the authors' comments at the end of the chapter appear to be somewhat presumptuous as neither the review of literature is complete nor can it be claimed that the authors' own model is superior. The authors go on to explain the data base of their study and the methodology followed by them for its analysis which shows both its limitations and advantages. The next concentrates on the primary causes of the main problem of the industry— the irregular and inadequate supplies of cane to the sugar mills, its main raw material. The authors make a fairly comprehensive comparison of different variables in some of the primary sugarcane producing states of UP, Punjab, Tamil Nadu, Andhra and Maharashtra. All this, to establish that the fluctuation in different variables such as area, cane production, cane supplies, sugar production etc. exhibit a uniformity of pattern all over the country. The authors try to show with the help of a graphic presentation of data that there is a broadly cycle of periodicity in the fluctuations of different variables. While these conclusions drawn after a laborious analysis are already well known, the advantage of fresh assertion of these facts is that this may help draw the attention of the authorities so that interventional strategies can be planned according to the specific needs of each state.

The book also presents a brief description of the various distinctive features of the sugar industry. Other

than the seasonability of sugar production, all other characteristics like fixation of cane prices, sugar cycle, dual pricing system etc. are regulated by government procedures and policies. The examples illustrating the operational efficiency of some selected sugar units in Punjab hardly contribute anything substantial to the study of the problem of the sugar industry as such. The authors also describe their model of sugarcane supplies and arrive at some broad conclusions regarding various factors influencing the supply of cane, price of sugarcane, price of gur and sugar and the area under sugarcane production. The problems of sugar industry in Punjab as well as those faced by cane producers are discussed. These are claimed to be based on field observations and interviews. This is followed by a summary of the authors finding, emerging from the study with some suggestions of how cane supplies can be improved.

The authors' presumption and claim on the basis of various statistical tables that the pattern and magnitude of the problem of fluctuations in cane supplies is similar all over the country and the results of their study are equally applicable to the rest of the country may not be accepted at face value. To what extent the authors' contention will hold good for all states is a matter of conjecture as even physical variations between different states are so many that it would be risky to accept this postulation without making a more comprehensive study of the entire sugar industry preferably on a state-by-state basis.

The book is fairly well brought out. The printing is passe. There are several spelling errors which could have been eliminated by more intensive proof reading. The price of book at Rs. 150/- appears to be somewhat excessive considering its size and quality of its contents.

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Managerial Transformation by Values: A Corporate Pilgrimage by S.K. Chakravarty, Sage Publications, New Delhi, 1993, 216 p, Rs. 195/-.

"Transformation" is a word that nowadays, every organization talks about as a response to the ongoing changes taking place in our country. Though everyone understands the concept, how to translate it into actions is what is a mystery to every institution. Strategic Planning, Employee Involvement, Total Quality Management, etc. are some of the popular means to implement transformation but a big question remains - unless the all-embarrasing overriding value system that prevails in any typical Indian organization alters, is it feasible to make any change on objective plane on a permanent basis? However, organizational values cannot be tackled unless the socio-cultural basis of individuals' thinking processes is probed. Every part of our cognitive behaviour is implemented by our values. Any change in the value system will essentially center around transformation in our innerself.

Prof. Chakravarty has been one of the strong advocates of such an inner transformation for today's professionals. It is quite sometime that he has been speaking on this very subject on many a platform. He has also been carrying out experiments on this delicate subject in several organizations. The book in reference narrates one such experiment performed in one of the well known Indian organizations - Godrej & Boyce (Pvt.) Ltd. located at Bombay.

The book is essentially divided into three parts. The first part, consisting of 3 chapters introduces the concept of the changes to be brought out in our thinking and actions. The second part, covering 3 chapters (4 to 6) basically describes responses made by participants to the change process initiated by Dr. Chakravarty. The last part comprising chapters (7-9) is essentially an analytical exercise describing both qualitative and quantitative assessment of the experiment made in the company.

The author has presented briefly the rationale and the methodology of initiation to the new basis of thinking which is proposed to be developed within each of the participants. The thinking is based on cultivation of our hidden "Higherself" resting in each of our minds, which is free from ups and downs of normal life. The new thinking emphasizes development of "Duties - Obligations" orientation amongst people against the existing "Rights - Claims" thrust. It is the inculcation of true love and self-discipline which germinates leadership. The new thinking further stresses that unless we strive towards "Bliss" based on "Higherself", we cannot be free from all kinds of vagaries of life. All the aspects of this new thinking were presented to the participants through three separate modules. Each of the modules was taken up by Dr. Chakravarty in a manner so that each participant is induced to carry out the related exercise repeatedly. A long practice could only induce changes in our thinking mode. Only when there is a persistent effort put by us towards "SELF - centered" (not "self centered") transformation, we would then be capable of providing true leadership in a society.

In the correspondence between the participants and the author, some of the queries and doubts expressed by

the participants are so common. Many of the answers given by Dr. Chakravarty are highly illuminating, adding real value to the book.

As per the qualitative and quantitative assessment presented in the book it appears that it is the comparatively younger group which has been found to be most receptive to the new thinking of Dr. Chakravarty. Similarly, there has been clear identification of some of the elements of the new thinking which have been found to be lasting in the memory of the individuals. There have been several visible indications that some of the talents of the new thinking could be transferred through a cognitive process in a group environment. It is made clear that the new thinking based on Indian spiritual ethos when presented with coherence and conviction can bring about considerable changes in the mental horizon among the individuals in an organized setting.

In conclusion this book is one of those which belongs to a rare category of dealing with Indian spiritual ethos not in a detached plane but in the most practical and apparently highly materialistic context. This book rightly proclaims that real leadership and team work could emerge only when we practise the said Indian ethos in a genuine manner. This book is, therefore, not only to be read but also be used as a plank for developing ourselves. It is a book which will go a long way to reaffirm our faith in our own ethos.

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Taming Commodity Markets, The Integrated Programme and the Common Fund in UNCTAD by Gamini Corea, Sage Publications Ltd., New Delhi 1992, 272 p , Rs. 225.

The book gives a historical account of the interaction of circumstances or forces in the meetings of UNCTAD and the participation absence of Governments of countries led to the establishment of the Integrated Programme for Commodities and the Common Fund. It contains eleven well articulated Chapters and four Appendix Chapters.

The author introduces the subject by presenting the problem centering around "the long-term trend of prices and short-term fluctuations in prices and earnings" related to the dependence of the developing countries on commodity production and trade. Though the author does not make it clear, by 'commodity' here he means 'primary commodity'. Then he deals with the rationale of market regulation. He argues that "Corrective intervention by governments" is required to 'improve' rather than 'replace' the price mechanism and the play of market forces.

In delineating 'The evolution of international commodity policy' Corea reminds us of the role of UNCTAD II and III in presenting the case for a Common Fund. He then mentions the motive behind the necessity of a Common Fund, theoretically supported by the thesis offered by Prebisch. The author reminds us that the developed countries were averse to the proposal for a Common Fund. In any case, as informed by Corea, before the meeting of UNCTAD IV in Nairobi in 1976 " the concept of the Fund had not in fact matured to the point at which governments could be asked to take a firm decision" (pp. 50). The book also presents the initial failure of UNCTAD IV in Nairobi in taking a decision for the establishment of a Common Fund. The author portrays the concept of the Common Fund as an innovative idea, in the sense of its being the first international financial institution, that could be established on the initiative of the developing countries. In fact, argues the author, many of the central concepts of the Fund took shape in the course of the negotiations after the Nairobi Conference.

In addition to offering the rationale, an appraisal on the formation of the Common Fund as a powerful instrument, endowed with resources controlled by the developing countries has been made in the book. The author reminds us of some developments and setbacks, particularly the attitude of the U.S. and (formerly) U.S.S.R., following the agreement of UNCTAD in 1979. Finally, the role of the Common Fund is told in brief. The author elaborates on the hesitations and the difficulties, the strengths and the weaknesses, of the negotiating partners in the process of attempting to set up the Common Fund. As observed by him the absence of the Common, Fund, the shortcomings of the developing countries, the attitude of the powerful consuming countries were all responsible for the failure in the process of commodity negotiations. In the concluding Chapter, the author speculates on what the Common Fund could have ensured particularly for the African and Latin American countries on issues like price stabilisation etc.. The very functioning of the fund, opines the author, provides an opportunity and a challenge, particularly for the developing commodity producing countries to establish their case.

To be brief, the book by Corea is a very valuable document on the history of UNCTAD, and participating

countries in general, that elaborates the series of negotiations that led to the establishment of the Common Fund. The importance of the book for students, researchers and decision-makers cannot be exaggerated.

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Cross-Functional Management: Principles and practical applications, Kenji Kurogane (Editor-in chief); Asian Productivity Organization Tokyo, 1993, 254 p.

This edited book is contributed by eleven authors and has seven chapters. The entire contents are organized into two major parts. The first part contains three chapters and deals with the principles and history of quality control, promotion of TQC and meaning of cross-functional management followed by the history of cross functional management at Toyota Motor corporation and Komatsu Ltd. in addition to the administrative aspects and key points for cross functional management. The second part deals with practical applications of cross-functional management in Japanese companies. There are four chapters in this part and each chapter reports two practical applications pertaining to each of key features of cross-functional management viz. Development of new products, quality assurance, cost management and delivery control.

The concept of cross-functional management is very vital to the successful implementation of TQM in manner tailored to contingencies of specific circumstances of an organization as it facilitates interdepartmental cooperation.

Cross-functional management is differentiated from departmental management in the beginning of the book and its importance for interdepartmental cooperation in quality improvement and cost reduction is stressed. Major functions of cross-functional management identified are quality assurance, cost management, delivery control and new products. In the administrative structure of cross-functional management various management committee structures are proposed and illustrated through charts and diagrams. Table 3.7 of the book shows the relationship between departmental management, cross functional management, management by product line, policy management and day-to-day management which provides very useful insights into the theme of the book. Another useful information is the comparison of cross-functional management strategies with other types of TQC structures. The Concept of cost function target tree is also very valuable tool for cost management.

The second part of the book dealing with eight applications is very heavily illustrated with diagrams and charts. This can be gauged by the fact that there are 124 figures in 253 pages of the book. These illustrations provide a very clear insight and perception of issues and techniques involved in cross-functional management paradigm.

The entire book elaborates on the conceptual level of the management philosophy involved but in terms of quantitative treatment the book does not offer much. Even the practical applications are not case studies in the sense that they do not provide any data or quantitative basis of presentation. Secondly, whether the large number of committees proposed will be very effective in their functioning in an environment of work different from Japan is a key issue. The management philosophy outlined in the book needs to be the adapted to suit the situational parameters of other countries. This flexibility to suit a situation however is identified as a strength of cross-functional management. On the whole, this book is a very valuable addition to the management library and its publication is very timely since 'TQM fever' is at the peak in present times and the concept outlined in the book will enable its effective implementation.

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"Development Economics: A New Paradigm" by Syed Nawab Haider Naqvi, Sage Publications India Ltd., New Delhi, 1993, 208 p, Rs. 200

The book consists of revised and updated versions of the Presidential Addresses given by the writer every year since 1984 at the Annual General Meetings of the Pakistan Society of Development Economists and later published in the Pakistan Development Review. As evident from the long list of references given at the end of each chapter, the revisions made have been quite extensive. The book seems to be a reply to neo-classical economists and their followers who believe that market forces are capable enough in resolving all the problems of developing countries. The book is an advice to development economists to devote their energy and time for evolving a new economic theory for achieving growth through social/distributive justice. The subject matter has

been lucidly presented with the style and language used in the book being of very high order.

The objectives and operational mechanism of the free market doctrine have been evaluated on the basis of distributive justice which is the main objective of economic planning in developing countries. In case of free market doctrine, inequality in income and wealth is the pre-condition for maximising the profit, savings, investment and rate of growth. In support of this observation, the author refers the view points of a number of eminent economists, and states that extreme inequality in income and wealth is against the social, moral and ethical values. He concludes that from the objectives angle, free market doctrine does not suit to the developing countries.

In case of extreme inequality in income and wealth, the capacity of the poor persons to influence the marketing forces is very low. Therefore, resources are allocated according to the needs of the richer sections of the society. According to the author, in respect of flow of information, free market system is not as efficient as claimed by its advocates. The poor always remain non-participants in the economic decisions of the country. "In the early stages of development growing inequalities of income are tolerated by the poor only in the hope that they too will ultimately receive a due share in the wealth of the nation, and this tolerance of inequality diminishes sharply once the poor realise that their expectations will not be fulfilled." The author successfully proves that operationally also free market doctrine does not suit developing countries. As a remedial measure, the author accepts the concept of Mixed Economy. For the success of Mixed-Economy, the development economists are to evolve a new economic philosophy, the author argues. The document fulfills its objectives i.e. establishment of the superiority of Mixed Economy over the free market doctrine advocated by the neoclassical economists.

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"Industrialism & Employment Systems in India" by C.K. Johri, Oxford University Press, New Delhi, 1992, 253 p.

In the preface of the book the author declares that the question he kept in mind while writing the book is "what the country would need to do if it seriously wanted to industrialize". It is to be seen if, and to what extent, the author has justified his analysis on the pledge he made.

The author describes the idea of industrialism as " the cultural counterpart of market-oriented, profit centred, economic activity based on entrepreneurship and risk taking' (p. 6). The concluding section of this Chapter deals with industrial growth where the author observes retardation in industrial expansion during 1956-66 (p. 24). Assuming absence of printing error, the empirical data base of this observation is absent.

The author analyses the non-feasibility of "Mahalanobis strategy of building a strong industrial base through steel and heavy capital goods industries..." (p. 27). The views expressed by the author here on the "disadvantages in planning for development" in India are provocative and controversial. Often the analysis conceals more than it reveals of the real nature of the problem, e.g., the incremental capital-to-output ratio (ICOR) (p. 34). Often the hypotheses offered are not properly explained e.g. why, the author concludes that " the main reasons for India falling behind other industrializing nations are the Indian standards of inefficiency and corruption" (p. 36). As a unique model of development of India's political economy, it needs further elaboration, though some vital issues like the problems associated with electoral politics in an apparently open democracy have been discussed by the author (p. 41). The view of the author is not very clear on the question of conditioning " the Indian economy to function within the international framework" (p. 44). There is a strong opinion of the author on the low rate of industrial growth in India encompassing the problems associated with the practised inward-looking import-substituting industrialization strategy (pp. 47-48), the "politics of public sector investment" (p. 52) etc., though one may differ from his ideas.

The author argues that "Indian society expects people to be given priority over productivity and to control market forces for the sake of jobs even if this means sacrificing growth" (p. 65). However, it is really difficult to be sure about the author's judgement on this question. Also, some speculations have been offered by the author regarding entry of new firms and labour employment possibilities at a low rate (p. 73). The data base for labour market information has also been pointed out by the author here (pp. 92-93). In brief, in view of the author, "this chapter shows that corresponding to dualisms in urban labour markets the data base too ranges from the rich to the scanty "(p. 95). There is nothing to differ seriously from this view.

The author points at the undeveloped market information system and skill-specific unusual labour shortages as a problem (p.100). Here the author lucidly

discusses the aspects on labour-migration and mobility, particularly the problems of labour-market segmentation (p.108, 116).

The author opines that "the dilemma of productivity versus jobs on the policy agenda" (p.128) "remains unresolved because it is not seen as logically intertwined with industrialization" (p. 129). He tries to correlate economic progress, industrial harmony and productivity (p.135) and opines that the focus of labour policy in India is relevant only with respect to large-scale industries (p.150). This analysis covering several aspects including the role of trade unions, labour-management socio-economic differential etc. reflects the author's command over this area. The author asserts industrial relations as a system of conflict of interests between workers represented by trade unions on the one hand and the organized bodies of employers on the other (p. 155-157). He tries to cover in a short span several aspects, e.g., 'badly splintered' trade union movement in India (p.166), "workers' dependence on outside leaders" (p.169), "cause-effect relationship between inflation and degree of unionization" (p.172) etc. However he has not done full justice to this analysis in the short span.

In view of the author, "The Indian people have found it easier to embrace poverty and economic degradation than the technology and the socio-economic processes which offer the harder and surer path of escape from this condition "(p. 203). This view is highly questionable. He tries to cover many aspects regarding earnings, productivity, bargaining, job satisfaction and employment generation etc. However, the conclusive statements are often absent or confusing. The author covers the problems faced by Indian planners "to retain industrial development as the primary focus" (p. 231) and mentions "the increased vulnerability of the planning process to politics" (p. 235).

In conclusion, it can be said that since the purpose of the book is not prescriptive but one of identifying the problems as declared by the author in the preface, he seems to have succeeded in his efforts. The book brings into focus several problems worth studying for students, researchers and socio-political activists, revealing the author's insight into the problems, although a more detailed analysis and a stronger data base would have made the book more worthwhile.

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Executive recruiters, asked what qualities their client companies are seeking in a candidate for a top job, report that they're hearing our old friend "charisma" a great deal more than they used to. "Vision" also seems in increasing demand; while the headhunters aren't sure precisely what the term means, they sense that it has to do with new and much sought-after skills in motivating people.

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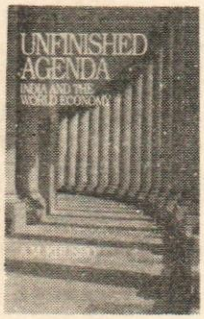

UNFINISHED AGENDA : INDIA AND THE WORLD ECONOMY

Khusro A.M.

An analysis of the crises and problems of world economies, with particular reference to India, could not have appeared at a more opportune time than the present work. Part I deals with the crisis period in the Indian economy in the early 1990s and highlights the critical politico-economic issues during three governments—those of Prime Ministers V.P. Singh, Chandrashekhar and P.V. Narasimha Rao. Part II deals, among other things, with the manner in which the various political parties proposed to tackle the politico-economic crisis on the eve of the national election in mid-1991, as evidenced by the various party manifestos; Part III deals with the sea-change in economic policies which was brought about in the post-June 1991 period by the Narasimha Rao government under the financial and economic leadership of Dr. Manmohan Singh.. In Part IV, the discussion moves to the international arena and themes ranging from the Gulf War to the recession in the West, from President Gorbachev to President Clinton and from the European Community to Indo-Pak trade relations are made the subject of attention.

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81-224-0605-X **1994** **392 pp** **Cloth** **Rs. 400**