# Strategic Information Systems for Developing Countries

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*Strategic information systems (SIS) are being developed and used for competitive advantage in many organizations in the developed nations. The authors contend that such systems would have significant use for developing countries as well. In this article, two models are presented: a model for Strategic Information Systems for Competitive Advantage in developing countries, and a model for Strategic Information Systems for Economic Development (SISED). The article concludes with a discussion of desired preconditions for SIS development.*

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## Introduction

Strategic Information Systems (SIS) are conceptually much more than a technique, clone or isomorphism of Management Information Systems (MIS), Computer Information Systems (CIS), or Decision Support Systems (DSS). It represents a radical departure from other information systems concepts—a completely new way of thinking about the role of information systems in the strategic planning process. It has been adapted and applied to a myriad of models and strategic constructs including Porter's Competitive Strategies framework (Porter, 1980) and McFarlan and McKenney's Strategic Grid (McFarlan et. al., 1983), the value added chain, strategic opportunities matrices, portfolio analyses, and the life-cycle concept. Indeed, the idea that information systems are an integral part of the strategic planning process is more revolutionary than evolutionary.

Today, strategic information systems are considered vital for the long term survival of organizations. They (SISs) have been identified as one of the ten information systems megatrends (Kanter, 1985). The conventional wisdom is that SIS's are essential in supporting, shaping, and implementing organizational missions, policies and direction. This capability has been called the SIS vision (Wiseman, 1985).

In the private sector this vision has generally been directed towards the achievement of competitive advantage. To date, most strategic information systems have been developed for use in the private

sector of advanced and developed nations. The literature abounds with examples of strategic information systems for competitive advantage (SISCA). Examples include the SABRE and APOLLO reservation systems for airlines, a clinical laboratory installed in doctor's offices by Metapath Inc. (Wiseman, 1985) and SISCAs that provide pricing information used for competitive advantage (Grand Union, Red Lobster, and GE) (Beath and Ives, 1986). The value of strategic information systems, however, is more ubiquitous, and extends beyond the private sector and the developed nations.

Both SISCA and strategic information systems for economic development (SISED) can be invaluable to less developed nations. The former (SISCA) focuses primarily on profit, but its secondary objective is to make selected domestic companies in a given nation more competitive in the world market. SISED in fact is aimed at improving the economic health of a developing nation.

When a strategic information system is applied to the public sector, the focus is on the commonwealth—the provision of high quality goods, services, and utilities for the promotion of national economic development and international trade. Human and economic welfare are paramount. For example, in a deregulated airline industry, cut-throat price competition may deemphasize safety (reduced maintenance expenditures, long hours for pilots, etc.) whereas in a government regulated airline industry, safety would be the primary consideration.

### Current Models for Identifying SIS Opportunities

Most of the current research and applications in strategic information systems relate to companies and organizations in a free economy. Based on the body of knowledge in strategy formulation (e.g. Glueck, 1980; Porter, 1980; Thompson and Strickland, 1986) and especially Porter's model, several authors have proposed systematic approaches for identifying SIS opportunities in an organization (Rackoff et. al., 1985; Wiseman, 1984, 1985). The following is a synthesis of the important models for SIS identification.

Typically, three major strategic dimensions (or factors) are cited: strategic target; strategic thrust and strategic mode (see figure 1). Each factor has several qualitative values. The targets identified are : supplier, customer and/or competitors; the thrusts are : differentiation, cost, focus, innovation, growth, and/or alliance; and the modes are defensive or offensive. SIS opportunities may exist for one or more factor value combinations.

In addition, Warren McFarlan (Ball, 1986) has suggested answering the following five basic questions for identifying SIS opportunities :

(1) Can information systems (IS) technology build barriers for competitors ?

(2) Can IS build high switching costs for customers ?

(3) Can IS change the basis of competition ?

(4) Can IS technology change the balance of power in supplier relations ?

(5) Can IS technology generate new products ?

Ives and Learmonth (1984) have suggested a 13-stage customer resource life cycle for identifying SIS opportunities. It has also been suggested (Palvia et. al, 1988) that critical success factors (Anthony et. al, 1972; Ohmae, 1983; Rockart, 1983) may be used for focusing on more important areas of the SIS grid of figure 1. Finally, a variety of planning processes (Applegate et. al, 1987; Cohen, 1973; Palvia, et. al, 1988: Rackoff, et. al, 1985; Steiner, 1979; Steiner, 1977), and technological forecasting technique (Applegate et. al, 1987; Bouchard, 1970; Burton, et. al, 1970; Dunnette, 1964; Palvia, et. al, 1988; PUU, 1978; Taylor, et. al, 1958; Torrance, 1957; Wheelwright, et. al, undated) have been discussed for SIS implementation.

### Strategic Information Systems in Developing Countries

While most of the literature on strategic systems is written for implementation in a developed, free and competitive economy, we believe that this body of knowledge has application for developing countries and more controlled economies as well. For example, it is hard to imagine that every country in this class will answer "NO" to all of the five questions posed by Warren McFarlan (Ball, 1986).

In this section, we extrapolate the SIS model discussed earlier (Figure 1) to developing countries.

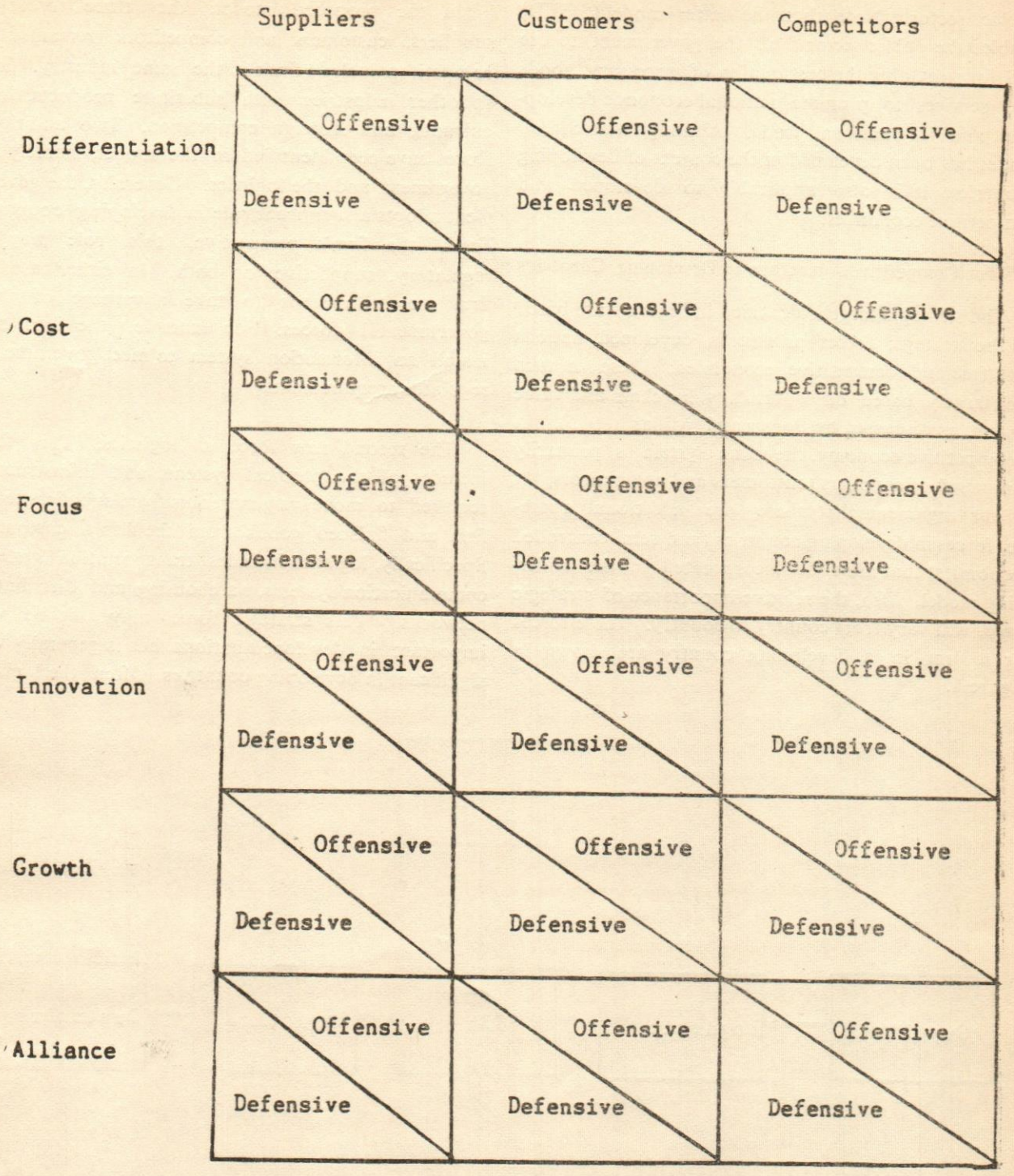


Fig. 1 The SIS Scanning Grid

We are convinced that SIS opportunities exist in developing countries both for the private sector (to gain competitive advantage) and the public sector (to promote economic development). The specific strategic forces will vary; however, the underlying model is still a valuable tool. We develop and report two conceptual SIS scanning models for developing countries; one for the private sector and one for the

public sector. Note that the latter model (SISED) enables the public sector (i.e., the government) to use SIS for providing the best quality of necessary goods and services to promote national economic development and international trade. Although the SISED model has been developed in the context of developing countries, it is also applicable to developed and competitive economies.

### SIS for Competitive Advantage in Developing Countries

The strategic targets identified in Figure 1 are based on the strategic forces present in developed nations with free and competitive economies. These in turn are largely based on a firm's value chain and value system, as discussed by Porter and Millar (1985). In a competitive economy, the value system is primarily comprised of suppliers, customers and competitors. It is our argument that there are additional strategic forces in developing countries (and semi-controlled economies) that must be incorporated in the underlying model. Also, the relative importance of strategic forces will vary from country to country. These forces for a firm in a developing country are shown in Figure 2.

In the proposed model, the three forces of suppliers, customers and competitors remain. The competitors include firms in the same industry, firms in other industries with substitute products, new entrants, and foreign competition. Two additional forces have been identified in the model, namely the government and the logistics. Generally, the government adopts a significant role in developing countries. From the firm's perspective, this role may be regulatory, supportive, or both. In either case, the firm may take steps to take advantage of these governmental forces. For example, the firm may install an information system to meet governmental regulatory requirements.

The second new force is logistics. This force includes all the physical systems and infrastructure required to move raw materials from suppliers to the firm and finished goods from the firm to customers. Specifically, logistics includes transportation systems, communication systems, warehousing and distribution networks. This strategic force may not be very important in developed nations, but is generally very significant in developing countries. Often the logistics

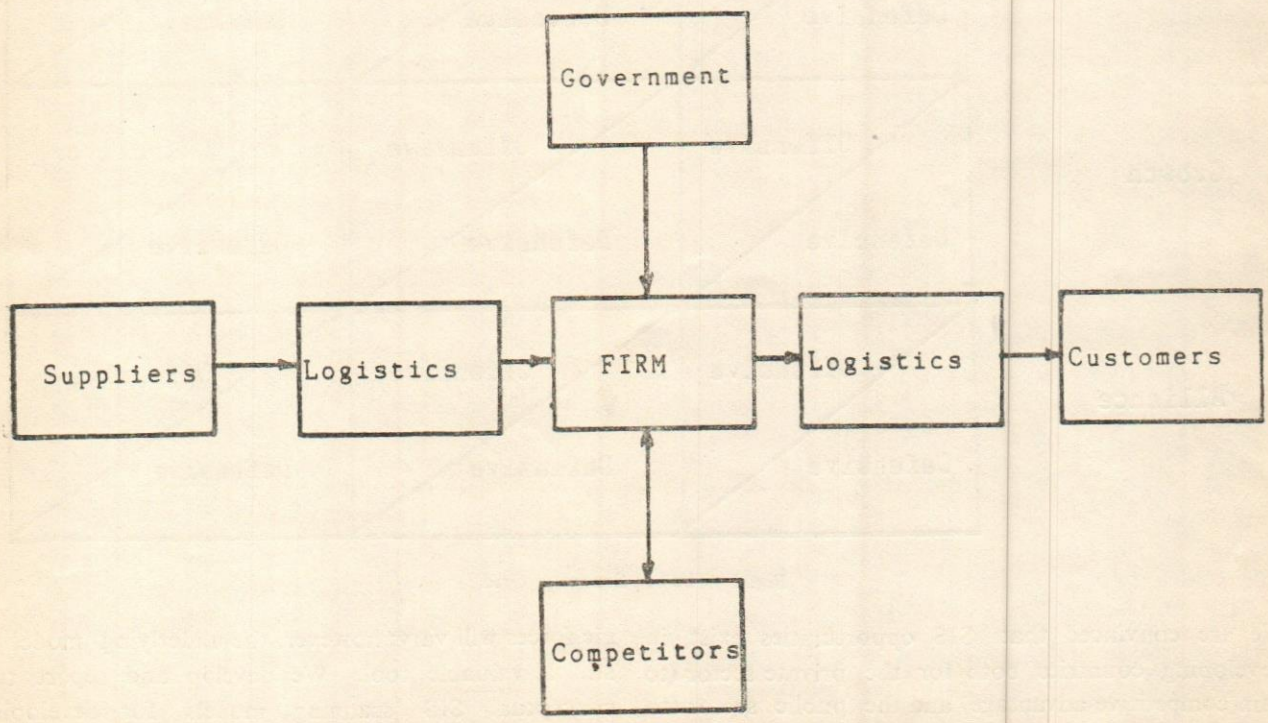


Fig. 2 Strategic Forces for a Firm in a Developing Country

systems and the infrastructure in such countries are far from adequate. A firm may be in a strategically stronger position when it uses technology to overcome some of these logistics problems. For example, a telecommunications system may be used to track and expedite deliveries to more crucial distribution points.

These, then, are the suggested strategic targets for a firm in a developing country. Again the firm may use one or more of the six strategic thrusts, identified in the previous section. The SIS scanning grid for developing countries is shown in Figure 3. The strategic mode in each cell (though not shown in Fig. 3) may again be defensive or offensive. An SIS opportunity may exist for any of the 60 combinations shown in the scanning grid. This, we believe, is a rich

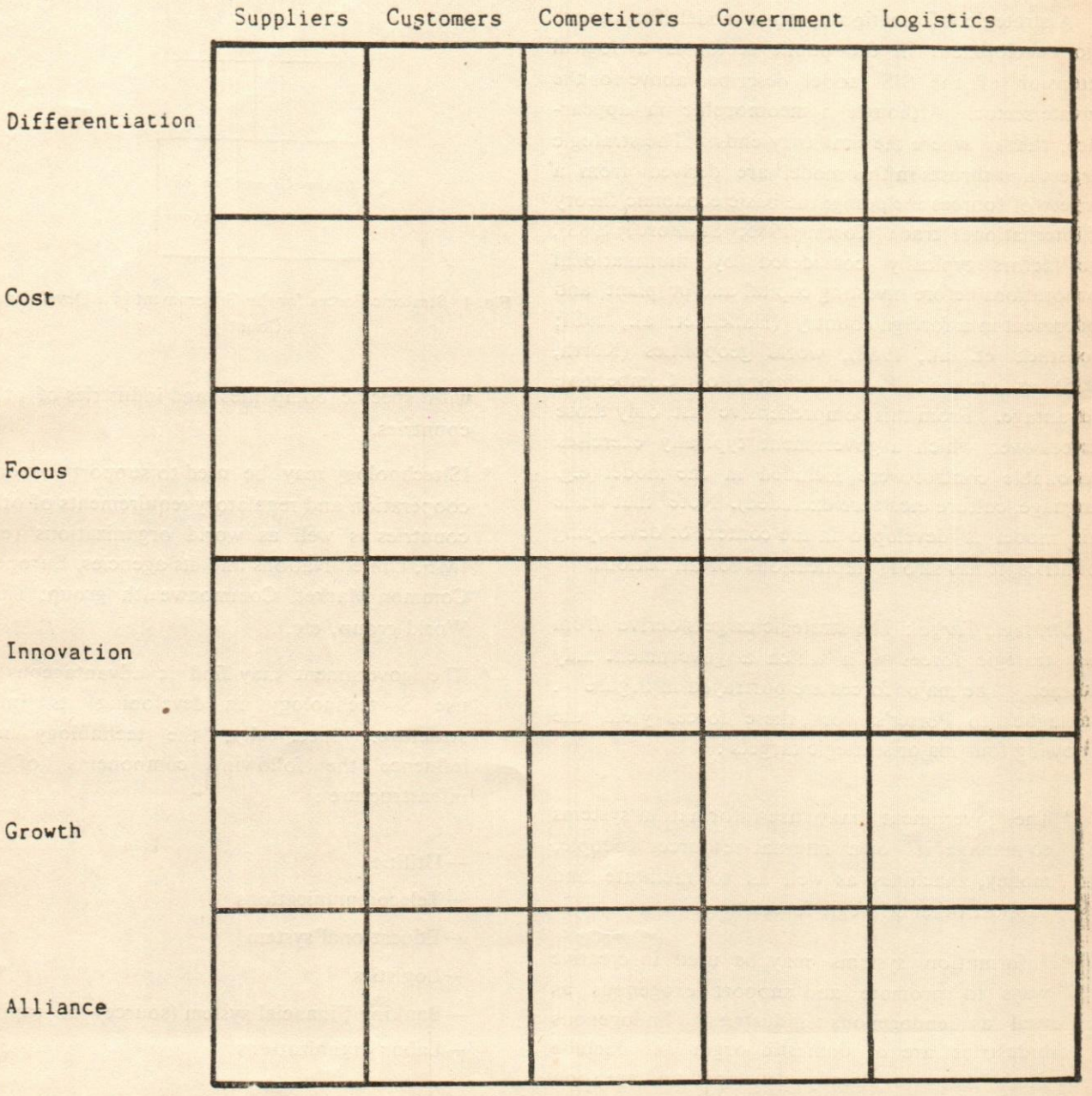


Fig. 3 Strategic Information Systems for Competitive Advantage Scanning Grid For Developing Countries

model for SIS identification. Of course, depending on the firm and the country, some combinations may be more attractive than others; while some may not be feasible or applicable. A sound planning process will have to be undertaken to generate feasible and implementable ideas.

## SIS for Economic Development (SISED)

A strategic information systems model for economic development in the public sector is a logical extension of the SIS model described above for the private sector. Although homeomorphic in appearance, that is where the similarity ends. The strategic targets and thrusts in this model are derived from a variety of sources including: the basic economic theory of international trade (Korth, 1985; Stanford, 1983), the factors typically considered by multinational corporations before investing capital and/or plant and equipment in a foreign country (Hanell et. al., 1981; Ronstadt et. al., 1982), world geopolitics (Korth, 1985) as well as Porter's theory of Competitive Advantage. From this comprehensive list, only those factors over which a government typically exercises reasonable control were included in the model (e.g. language, culture etc. were excluded). Note that while this model is developed in the context of developing countries, it has strong implications for all nations.

*Strategic Target*: The strategic targets derive from the strategic forces with which a government may interact. The major forces are portrayed in Figure 4. Analagous to Porter's work, these forces yield the following four major strategic targets :

* The government may use information systems to manage its own internal resources (people, money, machines) as well as to facilitate and support other strategic forces.

* Information systems may be used in creative ways to promote and support exogenous as well as endogenous industries. Endogenous industries are of domestic orgin and include those that are already developed and are soon to be developed. Exogenous industries include multinational corporations and joint ventures with specific companies and industries of other countries.

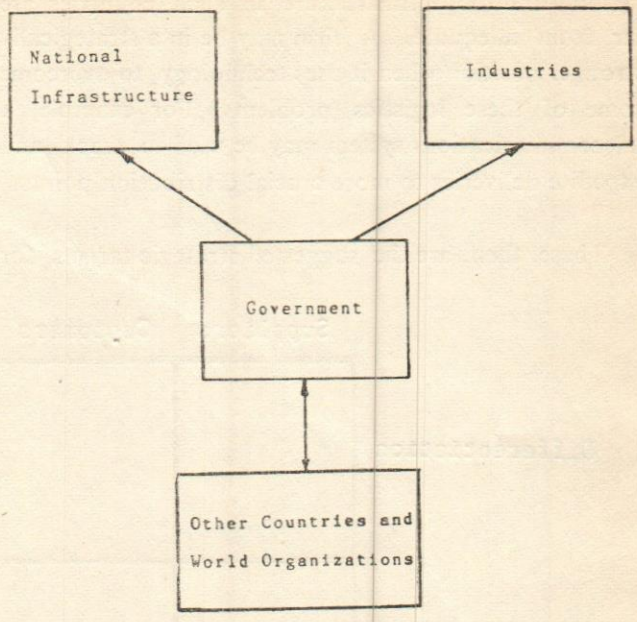


Fig. 4 Strategic Forces for the Government in a Developing Country

* IS technology may be used to support economic cooperation and regulatory requirements of other countries as well as world organizations (e.g., IMF, United Nations and its agencies, European Common Market, Commonwealth group, Third World group, etc.).

* The government may find it advantageous to use IS technology in developing its infrastructure. Specifically, the technology may influence the following components of the infrastructure :

  —Utilities
  —Telecommunications
  —Educational system
  —Logistics
  —Banking/Financial system (sources of capital)
  —Labor organizations

*Strategic Thrust*: As before, strategic thrusts refer to the kind of advantage gained by actions taken. In

this model, however, these actions are initiated by government and not by competitors within an industry. Six thrusts or strategies are identified for the public sector model. These thrusts are :

* *Focus* : Concentration by government on a particular industry or segment of government etc.
* *Innovation* : A fundamental and creative change in the way a segment of government or an industry operates etc.
* *Growth* : Expansion of an industry, government segment, an infrastructure etc.
* *Alliance* : Forging partnerships with specific industries, other countries etc.
* *Direct Support* : Providing direct support in one or more of the areas identified as the targets of government strategy like :

  —Financial (aid or contribution)

  —Technological

  —Experts/Consultants

  —Tax Advantages

* *Indirect Support* : Providing indirect support in one or more of the areas that follow for one or more of the targets of government like :

  —Information

  —Education/Training Programs for Industry

*Strategic Mode* : Once again in this model there are two strategic modes, offensive and defensive.

The targets and thrusts can be organized into a $6 \times 4$ matrix or scanning grid (Figure 5). The mode in each cell of the grid may again be defensive or offensive. Again, we believe this grid provides a rich set of SIS opportunities to explore.

**Requirements for Strategic Information Systems**

There are some desirable preconditions for the successful development and implementation of strategic information systems in an organization. We classify these into two categories : business/organizational requirement and technological requirements. These requirements are not absolute prerequisites; rather, they increase the likelihood of success. The absence of these preconditions pose certain barriers for SIS development; compensating strategies need to be adopted to overcome them (Morris, 1987). Thus these requirements suggest further actions needed to be taken by organizations before deployment of SIS (in both developed and developing nations).

**Business/Organizational Requirements**

1. The SIS must be patterned after the strategic vision (or corporate strategy) of a company (Cunningham, 1985). Before undertaking SIS development, the organization leaders should be strategically oriented and be explicitly doing strategic planning.
2. Top management must be involved. This is crucial since SISs involve significant risk, have a long-term planning horizon, involve substantial investment and have a wide scope.
3. Information must be recognized as a resource on par with other resources : men, money, materials. One measure of this requirement is that the chief information officer (CIO) reports directly to the chief executive officer of the company. In this role, the CIO becomes an interpreter, educator, advocate, and stimulator (Cunningham, 1985). Another measure is the maturity of the organization in its use of information systems, (i.e., it must have systematically passed through transaction processing and management information systems (Morris, 1987). In terms of the Nolan stage model (Nolan, 1979), the organization should be in or near the maturity stage.
4. The strategic position and nature of the firm and/or industry and environmental factors may require or facilitate the use of IS technology for gaining strategic advantage. Thompson and Strickland (1986) identify four generic types of firms and five types of generic industry environments and different competitive strategies for each one of them. Environmental factors include the size and

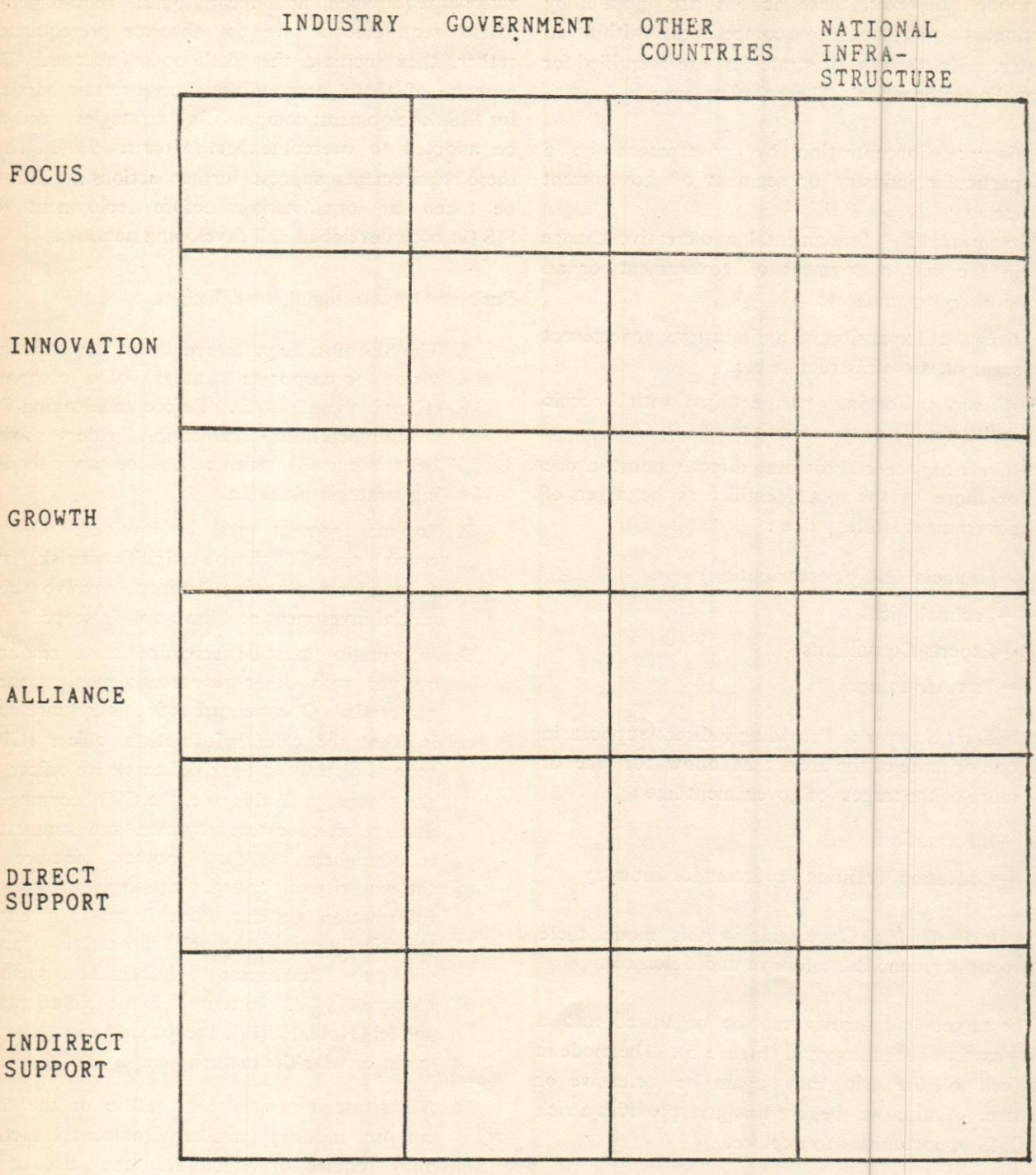


**Fig. 5** Strategic Information Systems for Economic Development (SISED) Scanning Grid

intensity of competition, the relationship with the suppliers and customers, and in some nations the logistics systems as well as governmental influences.

5. Creativity must be emphasized. According to Cunningham (1985), the common denominator for all successful SISs is a "flash of brilliance". Harriman, President of Syntectics (Boston Globe, 1986), states that corporations are pursuing creativity actively to counter the

inherent barriers due to organizational structure. Government and individual firms should promote activities and programs designed to improve the creativity of its human resources.

6. The commitment to change and the use of a rational process for implementing change must exist. The presence of entrepreneurs (Wiseman, 1985) and the presence of a project champion (Palvia and Chervany, 1985) have been recommended for implementing change. For SIS, the project champion should preferably be from the management team. A well accepted and rational process is the Lewin-Schein's three-stage change process (Lewin, 1947; Schein, 1964). Faced with the seriousness of cyberphobia, entrepreneurs should build support among employees and managers before, during, and after the introduction of computer systems (King, 1983).

**Technology Requirements**

According to Cunningham (1985), "in a buyer's world in which every customer becomes a market segment, it has got to be a two-way street : market-driven technology rather than technology-driven marketing." The technology has to constantly adapt to changing needs. The additional technological requirement for a successful SIS, over and above conventional resources, are :

1. Computer-based models. This means acceptable software to do extensive "what-if" analyses in an ineractive and iterative mode. These models include mathematical, decision support systems (DSS), expert system (ES), and simulation models.
2. Computer-based large databases accessible from remote locations. These databases should include operational and tactical data of the company's internal environment as well as relevant data from the external environment.
3. Telecommunication and distributed processing. The targets for SIS are : competitors, suppliers, customers, logistics and government. Since many of these targets are geographically dispersed, telecommunications and distributed processing play a vital role.
4. A synergism of IS technologies. The confluence and connectivity of the islands of computers (micro and mainframe), communications, and office automation leads to significant innovative possibilities (McFarlan, 1983). All three islands are relatively volatile and their connectivity is a significant challenge.

**Summary**

In this paper, we have demonstrated the viability of using model for the development of strategic information systems for Competitive Advantage (SISCA) and Economic Development (SISED) for developing countries. The SISCA model is developed from ideas frequently discussed in the literature on developed and competitive economies, like the U.S.A. The SISED model is an extension of the SISCA model. These models, properly utilized, should help developing nations in exploiting information technology to accelerate economic growth and social welfare.

Prior to the industrial revolution, most economists subscribed to the "Absolute Advantage Theory" of international trade. Later David Ricardo proposed the "Comparative Advantage Theorem of International Trade" (Stanford, 1983). Today, both the theories are considered to be incomplete. Their failure to adequately explain the dynamics of international trade is partly due to the fact that neither accounts for the impact of technology and information. It was assumed that :

1. There would be no difference in technological levels between nations.
5. Relevant technology would be readily available to trading nations.
3. Relevant information will readily flow among nations.

All three assumptions have since been proven false. The value of being technologically competitive

goes unchallenged today. Even attracting foreign investment which has long been considered a function of a plethora of factors, shows technology "looming larger" than ever before as a major element. Many developing countries are already making determined efforts to assimilate information technology to accelerate economic development. We believe that our contribution, in this context, will help the developing nations and world organizations in promoting the effective use of strategic information systems.

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# Fight TUBERCULOSIS

1. If you are having continuous cough for more than two weeks or if you notice blood in sputum, may be, you are suffering from T.B. of lungs.

2. Get yourself examined especially your sputum at the nearest Primary Health Centre, Dispensary or T.B. Centre.


3. T.B. can be cured provided medicines as advised by the doctor are taken regularly for the prescribed period.

4 Prevention is always better than cure. So get your child vaccinated with B.C.G.

**Central Health Education Bureau (D.G.H.S.)**
**Min. of Health and Family Welfare, Kotla Road,**
**New Delhi-110002.**

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# Agro-Industrial Residues : Valuable Source for Building Materials

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*Agro-industrial residues are of great economic importance as valuable sources of materials particularly in construction activities. They may find gainful utilization in the production of a variety of building materials and products which may be used in the place of conventional materials. The authors argue, in this article, that a variety of building materials produced from such agro-industrial wastes may also reduce the cost of construction.*

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## Introduction

There is a need to provide shelter to more than 700 million people and over 240 million animals as well as storage for food grains the magnitude of which is likely to touch a target of 240 million tonnes by the turn of the century. India is facing an acute shortage of about 21 million dwelling units, of which 76% are farm houses in rural areas. In addition, about 25 million people, living in slum settlements of big cities also need low cost dwellings (Khushoo, 1986). Apart from this, India has to maintain a buffer stock of about 30 million tonnes of foodgrains, which also makes tremendous demands on available storage space. For all such structures, building materials like bricks, cement, timber etc. are required. In this context, agro-industrial residues are of great economic importance as valuable raw materials. They may find gainful utilisation in the production of a variety of building materials and products which could be used in the place of conventional materials. A variety of new building materials produced from such agro-industrial residues may also reduce the cost of construction.

This paper attempts to identify and assess various agro-industrial residues, useful from the building industry's point of view. Besides, the paper also presents an account of technologies developed for their conversion into useful building materials.

## Agro-Industrial Residues

Agro-industrial residues originate mainly from

crops, animals and agro-processing centres. They include crop residues, wild growing biomass, food processing wastes and animal refuse. The exact quantity, nature and disposal systems of such residues have not been accurately established because of their varied and scattered nature and seasonal availability. However, surveys have been carried out in different parts of the country, on the basis of which it can be estimated that about 350 million tonnes of various agro-industrial residues are annually produced in India in the form of straw (rice/wheat), stalks (maize/sorghum), cobs (maize/sorghum), shells (groundnut/coconut), sticks (jute/cotton), husk (rice/coconut) or peels and vines of fruits and vegetables (Srivastava, et. al. 1981). Due to its scattered and seasonal availability, bulky nature, low density and typical physico-chemical characteristics, much of this stock remains unutilised. Local and traditional uneconomical usage and lack of information regarding their potential as important raw materials for various industries, also contributes to their underutilization.

Some of these agro-industrial residues could be easily processed into the much needed building materials as timber substitutes, base materials, admixtures and fuels in the production of bricks, cement concrete, roofing materials and floorings, and fittings and fixtures, thus providing respite to the conventional building materials sources which are in great demand and have become costly.

An indepth literature survey identifies the following major agro-industrial residues which have possibilities of utilization in the manufacture of different types of building materials :

*Wheat Straw*: About 32 million tonnes of wheat straw is available annually in India which is conventionally used as fuel, animal feed, grain storage structure etc. It could be used for the preparation of straw board.

*Paddy Straw*: About 88 million tonnes of paddy straw are estimated to be produced in India. It is mostly burnt in the field but could be used for production of paper, paper/straw board etc.

*Rice Husk*: More than 18 million tonnes are produced per annum. The husk could be used for production of boards and bricks in addition to its use as animal feed after suitable treatment.

*Maize Stalk*: About 14 million tonnes of maize stalks are produced in India, presently used as animal feed or fuel. It could be successfully used for production of paper and board.

*Bagasse*: About 5.25 million tonnes of bagasse are estimated to be produced in India every year. Most of it is used as fuel but has great potential for production of pulp and paper.

The other agro-industrial residues useful from building materials point of view are *sorghum sticks* (32 mt), *gram straw* (11 mt), *pigeon pea stubble* (4 mt), *groundnut shell* (8 mt), *sugarcane trash and dry leaves* (2 mt), *press mud* (0.2 mt), *jute sticks* (3 mt), *cotton stalk* (10.5 mt), *coconut husk* (0.1 mt), *arecanut husk* (0.1 mt) *and rubber wood* (0.3 mt).

In addition to these agro-industrial residues, several other products such as cashewnut shell liquid, wood wool etc. have tremendous scope for applications in the development of various building materials.

**Building Materials**

Products like building and refractory bricks, cement, concrete, fibre and particle boards, insulation materials, adhesives, joint fillers etc. are some of the conventional building materials which can be prepared from the above mentioned agro-industrial residues (Table 1). The technologies for such conversions of agro-industrial residues into building materials have been developed by various research and development institutions. Some details are given below :

*Bricks*

Lightweight, cheap and sound building bricks could be produced from some agro-industrial residues. Table 2 presents the characteristics of rice husk and rice husk ash bricks, compared to conventional burnt clay bricks and soil cement bricks.

TABLE 1 : Applications of some typical agro-industrial residues in building construction

| Residue | Mode of use | Application |
|---|---|---|
| Rice husk ash | Rice husk ground to suitable fineness and mixed with lime | Rice husk cement for masonary mortar, foundation concrete and mass concrete work, bricks. |
| Saw dust | Cement and saw dust mixed in the ratio of 1 : 1, 1 : 2, 1 : 3 | Partition walls, false ceilings, roofing materials etc. |
| Straws | Mixed with chemicals to form pulp | Corrugated roofing material |
| Bagasse | Mixed with cement | For roofing and building boards |
| Coconut husk and coir | Mixed with acquous adhesives | Particle boards, Wall board, roofing sheets |
| Rice husk | Mixed with binders | Building boards |

Source : Kaushik and Vasan, (1985).

TABLE 2 : Comparative characteristics of rice husk/rice husk ash bricks

| Type of brick | Compressive strength kg/cm² | Water absorption % in 24 hours | Wheathering loss in weight % | Density, g/cm³ | Strength/ density ratio |
|---|---|---|---|---|---|
| Rice husk bricks | 30-40 | 15 | 5 | 1.50 | 26.70 |
| Soil-cement bricks medium | 18 | 15 | Max. 10 | 2.00 | 9.00 |
| Burnt-clay bricks | 35 | 25 | — | 2.00 | 17.50 |
| Rice husk ash bricks | 50-80 | 25-30 | 8 | 1.00 | 60.00 |

Source : Borthakur, et. al. (undated).

*Concrete*

Tropical Development Research Institute, UK has used rice husk as an aggregate in light weight concrete blocks or bricks. The cement-husk blocks could survive cold weather without deterioration. Light weight concrete blocks were prepared at IIT, Kharagpur by mixing cement, rice husk ash and rice husk in the ratio of 1:4:2 (Pandey, et. al. 1976). The mixture yielded light weight concrete of 47 kg/cm² strength. Central Building Research Institute, Roorkee has also developed a process to make cement-coconut pith concrete which is reported to be fairly cheap as compared to conventional insulating materials. The introduction of coir fibres in concrete helps in improving the strength characteristics. The comparative performance of coir fibrous concrete is presented in Table 3.

*Refractory Bricks*

Tridymite types of refractory bricks, suitable for lining in boilers, curing/dehydration structures, ship and locomotive boilers, brass foundary furnaces etc. can be manufactured by mixing rice husk ash with aluminous cement and fillers. These refractory bricks are reported to possess good insulating properties and are reported to sustain temperatures of 900-1400°C (FAO Report No. 30—1967), (Maheswari, 1972).

TABLE 3 : Strength characteristics of cement-concrete using coir fibres

| Strength characteristics, Mix 1:2, 6:2.4 | Percentage of 25 mm coir fibre | | | | | |
|---|---|---|---|---|---|---|
| | 0 | 0.5 | 1.0 | 1.5 | 2.0 | 3.0 |
| Cube strength, kg/cm² | 145.0 | 149.6 | 164.0 | 171.5 | 174.0 | 155.0 |
| Cylinder strength kg/cm² | 122.0 | 139.0 | 152.5 | 146.0 | 134.0 | 113.0 |
| Indirect tensile strength, kg/cm² | 18.0 | 19.1 | 23.4 | — | 19.0 | — |
| Direct tensile strength kg/cm² | 21.0 | — | 22.5 | — | 26.6 | — |
| Flexural strength, kg/cm² | 32.0 | 33.0 | 34.0 | — | 34.8 | 24.0 |
| Shear strength, kg/cm² | 44.9 | — | 57.5 | — | 47.7 | — |
| Impact strength, kg/cm² | 434.0 | 607.0 | 774.0 | — | 602.0 | 570.0 |

Source : Kaushik and Vasan (1985).

*Cementitious Materials*

Regional Research Laboratory, Jorhat, in collaboration with Annamalai University, Annamalai, has developed a process for the manufacture of a cement like product from rice husk ash for use in masonary mortar, plastering, foundation and mass concrete work. Cement Research Institute, Ballabhgarh and Central Building Research Institute, Roorkee have also developed a process to make high quality pozzolanic materials from rice husk ash and clay. This material, when mixed with lime, gives a very good quality cementitious material, known as lime-pozzolana cement. This cement, when mixed with conventional portland cement and sand gives portland-pozzolana cement which is reported to be superior for water retention, comparable in compressive strength and cheaper than conventional portland cement-sand mortar. Table 4 presents the properties of rice husk-clay-pozzolana cement. IIT, Kharagpur has developed a similar product, known as 'Ashmoh' from rice husk ash. It is reported that rice husk ash, when mixed with 25-40% lime and water and simply ground in a vibratory grinding mill to 290 micron size, yields a cement like material. The cement thus, prepared has been reported to give compressive strength of 55 to 105 kg/cm² and 80 to 130 kg/cm² compared to 115 kg/cm² and 175 kg/cm² for standard portland cement after 3 and 7 days of curing, respectively (Chakravorty et. al. 1976).

TABLE 4 : Properties of rice-husk-clay pazzolana cement

| Sl. No. | Property | Value |
|---|---|---|
| 1. | Loss of ignition, % | 1.50 |
| 2. | Sp. gravity | 2.34 |
| 3. | Lime reactivity, kg/cm² (IS 1727-1967) | 64-106 |
| 4. | Lime pazzolana mortar, strength kg/cm² | 44-72 |

Source : Central Building Research Institute, (1977).

*Boards*

Boards of various types are used in flush doors, partitions, false ceilings, cladding, furnitures and in certain decorative constructions. These boards are usually classified in two categories, namely: fibre and particle boards. Fibre boards are made of fibres of

wood or any other ligno-cellulosic material while the particle boards are composed of distinct particles or pulps of wood or other ligno-cellulosic fibrous substances mixed with any organic binder or glue.

A number of agro-industrial residues have been used for preparation of the above boards. These boards could be rivetted, screwed or nailed and are useful for wall panelling and as floor under layment. There are technologies using either PF resin as binder (developed by RRL, Jorhat) or no binder (Mahanta, 1971). Shukla (1976) has developed 3 processes for making such boards which include binderless process, process using sodium silicate and phenal formaldehyde resins as binder. Table 5 presents the characteristics of panel/hard boards.

RRL, Jorhat and Forest Research Institute, Dehradun have prepared particle/insulation boards from bagasse. The insulating boards prepared by FRI,

TABLE 5 : **Engineering properties of rice husk boards**

| | | |
|---|---|---|
| (a) Density | : 900—1200 kg/m³ | |
| (b) Modulus of repture | : 194.35—302.68 kg/cm² | |
| (c) Tensile strength | | |
| (i) parallel to surface | : 165.17—208.16 kg/cm² | |
| (ii) perpendicular to the surface or internal bond strength | : 7.36—11.68 kg/cm² | |
| (d) Shear resistance | : 22.85—40.55 kg/cm² | |
| (e) Resistance to screw withdrawal | : 46.89—75.69 kg | |
| (f) Hardness | : 943.94—1382.54 kg/cm² | |
| (g) Compression | : at room temp. (30 ± 1 °C) | at elevated temp. (95 ± 2 °C) |
| (i) Retention of compression | : 7.20—2.40% | 16.63—7.93% |
| (ii) Compressibility | : 3.16—1.21% | 6.34—1.15% |
| (h) Water absorption | : Without wax | Waxed |
| (i) 2 h immersion | : 25.23—12.63% (db) | 11.73—6.03% (db) |
| (ii) 24 h immersion | : 42.95—21.65% (db) | 20.92—9.32% (db) |
| (i) Thickness of swelling | : Without wax | Waxed |
| (i) 2 h immersion | : 12.27—5.37% | 6.42—3.57% |
| (ii) 24 h immersion | : 25.93—15.13% | 10.11—3.96% |
| (j) Air permeability coefficient | | |
| (i) at board density 200-600 kg/m | : $686.60\times10^{-10}$ —$33.36\times10^{-10}$ cm² | |
| (ii) at board density 900-1200 kg/m³ | : $3.45\times10^{-10}$ —$0.36\times10^{-10}$ cm² | |
| (k) Thermal conductivity | | |
| (i) at board density 200—600 kg/m³ | : 0.0339 — 0.0833 kCal/h m² °C | |
| (ii) at board density 900—1200 kg/m³ | : 0.1203 — 0.1573 kCal/h m² °C | |

Source : Shukla (1976).

Dehradun from bagasse are also reported to possess satisfactory properties such as thermal conductivity, sound absorption coefficient, resistance to moisture and strength. Chemical treament of such boards not only render them immune to termite and fungal attack but also make them reasonably fire resistant.

Coconut husk and coir dust are also used for preparing hard, durable and unlaminated boards of desired thickness, capable of being sawn, nailed or glued. These boards could be subjected to a process of purification which renders it completely insect and weather proof and also imparts a hard stony appearance, capable of taking colour finishes. The pith embedded in coconut husk fibres, containing reactive ingredients, undergo a chemical change during the process of making particle board and impart sufficient bond strength between the chips to form a strong board. The coconut husk board have been reported to be resistant to fire and decay. CBRI, Roorkee has developed a process to prepare wood wool boards (Agrawal, 1985).

FRI, Dehradun has developed a process for making hard boards from sawdust (GOI, 1975). These boards can be painted, varnished or polished and can be used in panelling, partitions, ceilings, cupboards, shelves, doors of all types and as a core for plywood. Table 6 gives the typical characteristics of boards prepared from saw dust and bagasse. In addition to the above described major agro-industrial residues, groundunt husk, wood wool, jute sticks, arecanut husk etc; are also useful in preparation of hard and particle boards.

TABLE 6: **Characteristics of bagasse and saw dust hard boards**

| Characteristics | Value | |
|---|---|---|
| | Saw dust boards | Bagasse boards |
| Bending strength, kg/cm² | 130 | 150 |
| Tensile strength, parallel to surface, (kg/cm²) | 75 | 80 |
| Bulk density, g/cm³ | 1.3 | 1.3 |
| Water absorption, % after | | |
| 2 h | 1-2 | 1-2 |
| 24 h | 5-10 | 5-10 |

Source : Government of India (1975).

*Plywood Substitute*

Spent maize cobs cut into suitable transverse sections of required thickness and pressed with glue, make an excellent plywood substitute. Increased durability can be achieved by treating the cobs with some light preservative.

*Roofing Sheet*

Coir wastes, rice and wheat straw, palmyrah leaves etc. are agro-industrial residues, used in providing shelters to millions of poor all over the world in the form of thatchings. CBRI, Roorkee is reported to have developed preservation treatments for protecting these thatches against fire, decay and insect attack which improves their service life and safety (Rai et. al. 1964). Vyas, et. al. (1978) have observed that paddy straw sheet are quite effective for control of the microclimate. The corrugated roofing sheets prepared from coir wastes require 30% less cement compared to AC sheet. These sheets are light but tough and can be trasported over hilly and rough roads without any breakage. They possess good thermal insulation properties and so are expected to provide greater comfort in the tropics as compared to AC and GI sheets. These could be laid on roofs like AC sheets and do not require any further finishing, water proofing or treatments. The material is fire resistant too. The characteristics of such corrugated roofing sheets are given in Table 7.

*Expansion Joint Fillers*

Bagasse, due to its attractive compression and recovery has successfully been used for preparation of expansion joint fillers and finds applications in all such constructions where joints in slabs, beams, shells, prefabricated components etc. are to be filled up. Chozer and Dixit (1985) have reported development of expansion joint fillers from bagasse in combination with mexphalt solution and animal gum. These joint fillers conform to BIS Test IS : 1836-1961 as regards

TABLE 7 : **Characteristics of corrugated roofing sheets made of agro-industrial residues**

| Characteristics | Value |
|---|---|
| Size | 1.5 × 1 m² |
| Thickness | 3.5 — 5.0 mm |
| Corrugation pitch | 10 cm |
| Corrugation depth | 3.7 cm |
| Water absorption | 10—15% in 24 h wetting |
| Breaking load on | |
| 30 cm span | 30.145 kg |
| 60 cm span | 65.75 kg |

Source : Guha et. al. (Undated).

compression, recovery, loss in weight, change in volume and weathering. These fillers are reported to be economical as they cost only 30% of the joint fillers available in the Indian market (Chozer et. al. 1985). CBRI, Roorkee, has also developed a process for manufacturing expansion joint fillers from coconut pith which conforms to IS: 1838-1961 standards (Jain, et. al. 1964).

*Lime Substitute*

CBRI, Roorkee, is reported to have developed a method for converting carbonation press mud into building lime according to ISI specifications.

*Insulation Material*

Rice husk could be used as loose insulation in buildings, animal/poultry shelters and cold storage plants. However, loose filling of rice husk between interior and exterior walls present a fire hazard unless treated with borax/boric acid for flame proofing.

*Other Building Materials*

Rice and wheat straws are used for preparation of grain storage structures while coir dust could be used in combination with rubber to form composite floorings, ceiling boards and similar products. Such flooring sheets (containing 50% fine coir dust) are reported to keep without deterioration for a period exceeding 5 years (GOI, 1975).

**New Building Materials-Economics of Usage**

Even 1% reduction in the cost of building materials can lead to a 70% reduction in the cost of housing projects (Chakravarty, 1985). The demand estimate of cement is of the order of 80 million tonnes per year by the end of VII Plan as against the present installed capacity of 25 million tonnes per year. This would require capital investment of the order of Rs. 1,800 millions per year, including modernisation. On the other hand, an ordinary steel batch ball mill can convert a modern rice mill into a mini-cement plant producing about 500 tonnes of cement every year. The fixed and working capital repuirements for the production of 'Ashmoh' cement, 500 t/y, using ball mill of 1.52 m + 1.52 m, 3 tonne iron balls and a 25 kw electric motor as reported by the Regional Extension Centre, Chandra Sekhar Azad University for Agri. and Technology, Kanpur are Rs. 1,15,000 and Rs. 1,63,000, respectively. The cost of production of cement works out to Rs. 16.35/bag (50 kg.) (with the use of additive) or Rs. 14/- bag (without the use of any additive), respectively. The cost of mortar made of lime-pazzolana cement and sand varies between Rs. 61.50 to Rs. 77.50 per cm depending upon the ratio of ingredients, whereas the cost is Rs. 110/cm in the case of cement sand mortar of equal compressive strength.

Similarly, for the production of rice husk bricks, capital requirement is not high and all the equipment required is available locally. For a factory producing 5,000 bricks per day in two shifts, a capital investment of Rs. 40,000 and working capital of Rs. 60,000 per month are suggestad by Borthakur, et. al. (undated). The cost of production of rice husk worked out to be only Rs. 100/- thousand bricks, giving a net profit of Rs. 25/- per thousand bricks. Similarly in the case of rice husk ash bricks, the cost of production, with an investment of Rs. 1,20,000/-, works out to be Rs. 90/- per thousand bricks. These bricks can be manufactured profitably in the areas where burnt clay bricks are costly and husk is

available. These bricks provide good thermal insulation. As the weight of a building on the foundation is a significant design factor, use of rice husk bricks can save the cost of foundation.

For preparation of the boards, the substitute for timber, the total capital investment for a 5 t/d capacity rice husk board plant was estimated to be Rs. 15,25,000 with an average cost of production varying between Rs. 10-13/$m^2$ at 1976 base prices. The profit from one such plant is given in Table 8. Similarly, the total capital requirement for 10 t/d capacity plant producing hard boards and using sawdust as raw material was worked out to be Rs. 20 lakhs at 1975 base prices and the cost of production of 8 mm thick board was then estimated to be Rs. 374/t or Rs. 0.33/sq. ft. (Shukla, 1976). When coir wastes is used for producing corrugated roofing sheets, the total capital investment for a production capacity of 45 sheets/d (150 cm × 90 size cm) was estimated to be Rs. 1,10,000 at 1978 base prices.

TABLE 8 : **Profit from a 5 t/d capacity rice husk board plant (1976 prices)**

| Amount of PF resin used | Production cost Rs./$m^2$ | Annual production cost Rs × $10^3$ | Selling price Rs/$m^2$ | Annual receipt Rs × $10^3$ | Profit Rs/y $10^3$ |
|---|---|---|---|---|---|
| 8 | 10 | 1,400 | 15 | 2,100 | 700 |
| 10 | 12 | 1,650 | 16 | 2,440 | 590 |
| 12 | 13 | 1,900 | 17 | 2,380 | 480 |

Source : Shukla (1976).

The expansion joint fillers made from bagasse are very economical as they cost only 30% of the joint fillers available in market. (Chozar et. al. 1985). Similarly the cost of 1.5 m × 1 m size corrugated roofing sheet made from agro-industrial residue was reported to be Rs. 20/$m^2$ (Guha, et. al. undated).

In addition to the direct economic considerations, there is also the attractive proposition of using various agro-industrial residues as fuel for the production of different building materials. It is reported that paper and board production requires 12 kCal/$cm^3$, cellulose fibre : 70 kCal/$cm^3$, brick/refractory : 0.2 kCal/$cm^3$ and cement requires 0.8 kCal/$cm^3$ energy (Chakravarty, 1985). It takes 25 tonnes of coal to make 100 tonnes of cement in an average portland cement manufacturing unit. In such cases, the use of residues of certain crops which have high calorific value (above 17 MJ/kg except for maize stalks, rice husk and rice straw) could be advocated. They can be directly recycled or can be converted into combustible fuel by briquetting, pyrolysis or incinerated for heat recovery through recuperation.

Besides, there is another economic perspective—that of environmental improvement which has a direct bearing on economic benefits and expenditure associated with handling, transportation and disposal of the above mentioned agro-industrial residues. The disposal cost alone of these materials is reported to be as high as Rs. 15-20/t. (Chakravarty, 1985)

**Research and Development Strategies**

The processes of recycle and the recovery of valuable building materials from different agro-industrial residues have already gained the attention of scientists, technologists and researchers, as evidenced by the above literature survey. Appropriate technologies have been well established at the laboratory and pilot plant level and can be readily taken up for large scale applications in appropriate economically beneficial situations.

However, despite considerable technological developments, their actual performance on utilisation front can be described as insignificant. Hence, there is substantial scope for qualitative and quantitative improvements in such technologies. Another aspect which needs the immediate attention of policy makers is the absence of incentives. This aspect should be considered in the light of pollution problems for which the country pays the cost in terms of reduced public health and lower productivity. Some important areas for research for the development of suitable substitutes are mentioned below :

(1) Data on the various residues are by no means comprehensive and there are large information

gaps on the availability and in some cases even the sources/usage of some of the residues/ wastes are unknown. There is an urgent need for compiling a national directory of residues. In this context, a computerized data bank is vital for storage, classification and retrieval of information. This would identify present and future needs. Moreover this system could also be used for collecting and spreading technical, scientific and managerial information about the utilisation patterns and potential. The research aspect of this proposition is the assessment of physico-chemical characteristics of individual agro-industrial residues.

(2) Development of suitable low cost machinery for processing of residues to produce building materials.

(3) Improvement in the economics of production and utilisation of such building materials, especially of those which are useful for construction of structures for dwellings/farm storage/ animal shelters.

(4) Utilisation of urban and rural wastes and animal refuse as building material rather than as land filling.

(5) Possibilities of using some of the agro-industrial residues as source of cheap fuel in the manufacture of building materials such as cement, bricks etc.

(6) Preparing up-to-date feasibility reports on the technologies for use by entrepreneurs.

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# Standard Operating Procedure for Construction of Bunk Houses

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*In this article the authors propose a method by which construction costs as well as construction time can be considerably reduced through pre-fabricating of structures that go into the making of bunk houses. The result is an increase in productivity in an important section of construction activity.*

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## Introduction

Bunk house building is essentially a customer oriented industry; conforming to the stipulated delivery dates and the price per unit are therefore vital factors. As cost and time are inter-related, a fabrication industry which builds bunk houses with shorter construction schedules will succeed in maintaining prices at reasonably satisfactory levels. Thus the cycle time of construction has an impact on the economic viability of the fabrication industry.

The conventional method of sequential fabrication viz., item by item erection, alignment and assembly does not offer much scope for reducing cycle time. But if we adopt a system of sub-assembly and jigs for the steel structures in parallel, cycle time is reduced. What this involves is a re-desgin of the working processes and switchover to another standard operating procedure.

This study was carried out with the cooperation of a number of local fabrication industries. A simplified manufacturing process has been formulated on the basis of this study.

## Conventional Method of Fabrication and its Disadvantages

### *Fabrication of Steel Structures*

As far as the steel work of the bunk house is concerned, it is being erected item by item, aligned and then welded to fabricate the final assembly.

This is a very difficult job especially at great heights, besides being more time consuming.

Unless skilled people are available, it is very difficult to check the alignment of loose items. Finally, this type of fabrication is not advantageous for mass production.

*Closing of outer shell*

After the steel structure has been assembled, wooden liners in the MS angle framework and rubber gasketing are provided. Finally the aluminium sheeting is fixed.

*Outfit work*

The outfitting work involves different trades viz., sheet metal, J&C, Electrical etc. and their activities follow in a parallel sequence, with inter-dependencies among them.

**Concept of Sub-Assemblies & Jigs**

*Mini Sub-assemblies*

Mini sub-assemblies mean the assembly of elements into a built up section. In the bunk houses, a number of fabricated sections in the form of strong beams and girders can be taken up as mini sub-assemblies.

Sub-assembly of a unit signifies an independent physical sub-unit of the steel structure. The sub-assemblies of a unit can be fabricated simultaneously. This also provides scope for downhand welding which in turn helps reduce the total welding time of the unit. Finally sub-assembling promotes the optimum deployment of welders and welding machines.

*Quality checks through jigs*

Quality checks of individual sub-assemblies can be done through jigs for ensuring perfect alignment and for checking the overall dimensions of the unit. If any inaccuracy is noticed, it can be rectified at the stage of sub-assembling itself.

**Steps to be initiated for implementing Sub-assemblies/ Jigs**

*Identification of Mini & Sub-assemblies*

This has to be done after taking into account various factors like maximum scope for downhand welding, convenience in final assembly, development of resources etc.

The following 6 sub-assemblies go towards forming the final unit :

I Base structure
II Roof structure
III Front MS Angle framework
IV Rear MS Angle framework
V Left hand side MS Angle framework
VI Right hand side MS Angle framework

The sequence of operations of each sub-assembly and the final assembly along with the procedural details are given in Annexures I & II. Annexures III & IV give an idea of sub-assemblies IV & V.

It is suggested that the mini sub-assemblies which are identified with asterisk (*) mark in the Annexure-II are to be made ready prior to the commencement of the sub-assemblies in mass production.

*Numbering of Elements*

The numbering of elements of a structural unit in a working drawing should be sub-assembly-wise; this will differ from the procedure when the entire structure is taken as a unit. Such a numbering process will facilitate the easy identification of the sub-assembly-wise elements. The following codification can be adopted according to the requirements : the first digit indicates the sub-assembly number, the second and third digits indicate the plate numbers, the 4th, 5th and 6th digits indicate the section numbers and the last three digits indicate the brackets lifting/dragging numbers.

**Scheduling of mini/sub-assemblies and unit making**

The scheduling at the cutting and fabrication shops should be sub-assembly-wise. There should be close monitoring of the despatch of the materials i.e., elements in their sequential order from cutting area to fabrication area to ensure the growth of the structure uninterruptedly.

*Design of Jigs*

*Standard jigs for the fabricatian of* :

(i) base structure
(ii) front MS angle framework
(iii) rear MS angle framework
(iv) left & right hand side MS angle frameworks, and
(v) roof structure framework are designed.

This facilitates quick mass production, ensures dimensional accuracy and avoids repetitive making of the jobs.

In the design of jigs, it is suggested that one or two MS plates (preferably pitted) may be used as the ground support on which the guide bars of the jig will be welded according to the loft markings. The jigs have been designed keeping in view factors such as its suitability for mass production, standard size of the bunk houses and the grillage work involved in fabrication.

The frameworks can initially be tack welded when the jig is being used and can later be full welded separately after the jig is withdrawn.

*Fabrication of Base Structure*

It is advantageous to fabricate the section of the base structure (grillage) in mass production using the standard jig. The skin of the base structure can be laid down after withdrawing the framework from the jig and then full welding can be completed as per sequence of operations indicated in Annexure-II.

*Fabrication of Front & Rear MS angle framework*

For the mass fabrication of the front and rear MS angle frameworks, there is a convenient jig arrangement along with the sub-assembly. The sequence of operations involved along with the elements required are indicated in Annexure-II.

*Fabrication of Left & Right hand side MS frameworks*

A common sub-assembly along with the jig arrangement has been made for the fabrication of both the left and right hand side MS angle frameworks.

*Fabrication of Roof Structure*

To facilitate easy fabrication, the roof structure has been divided into 4 mini-sub-assemblies viz., (i) front (half) frame; (ii) rear (half) frame: (iii) T-bar; and (iv) skin.

Both the front and rear frames are to be fabricated in the jig (shown in Annexure IV) and the final sub-assembly is to be carried out in the camber skid laying the skin first on the skid. A simple sketch of the suitable camber skin has been shown in Annxure-V.

It is also suggested that a loft template be made to ensure perfect cambering of the roof structure.

*Final Assembly of Steel Structure*

The MS angle frameworks of all the four sides are to be erected on the base structure using plumb and spirit level and then the roof structure sub-assembly is aligned and tacked by giving temporary vertical supports to the T-bar of the roof. The sequence of operations are described in Annexure-II.

The closing of the outer shell by aluminium sheet and other outfitting works can be carried out as per existing system of construction.

*ANNEXURE—I* **Sub-Assembly-Wise Elements for Bunk House**

| Sub assembly No. | Description | Elements | | |
|---|---|---|---|---|
| | | Plating | Sections | Brackets/ Lifting/ Dragging |
| 1. | Base structure | 1 to 6 | 601-605<br>606-613 | 38-61<br>60-69<br>671-674 |
| 2. | Roof structure | 7 to 15 | 633-642<br>624-631<br>70, 71 | B5 (8 Nos.)<br>36-37 |
| 3. | Front MS Angle Framework | | 658-661<br>614-615<br>649-653<br>620-621<br>675-680<br>666<br>20-23 | B 1 (4 Nos.)<br>B 4 (24 Nos.) |
| 4. | Rear MS Angle Framework | | 662-665<br>654-657<br>622-623<br>681-685<br>25 | B 1 (4 Nos.)<br>B 4 (32 Nos.) |
| 5. | Left hand side MS Angle Framework | | 643-644<br>645-646<br>616-617 | B 4 (10 Nos.)<br>B 1 (2 Nos.) |
| 6. | Right hand side MS Angle Framework | | -do- | -do- |

*ANNEXURE—II* **Standard Operating Procedure for Fabrication of Bunk Houses**

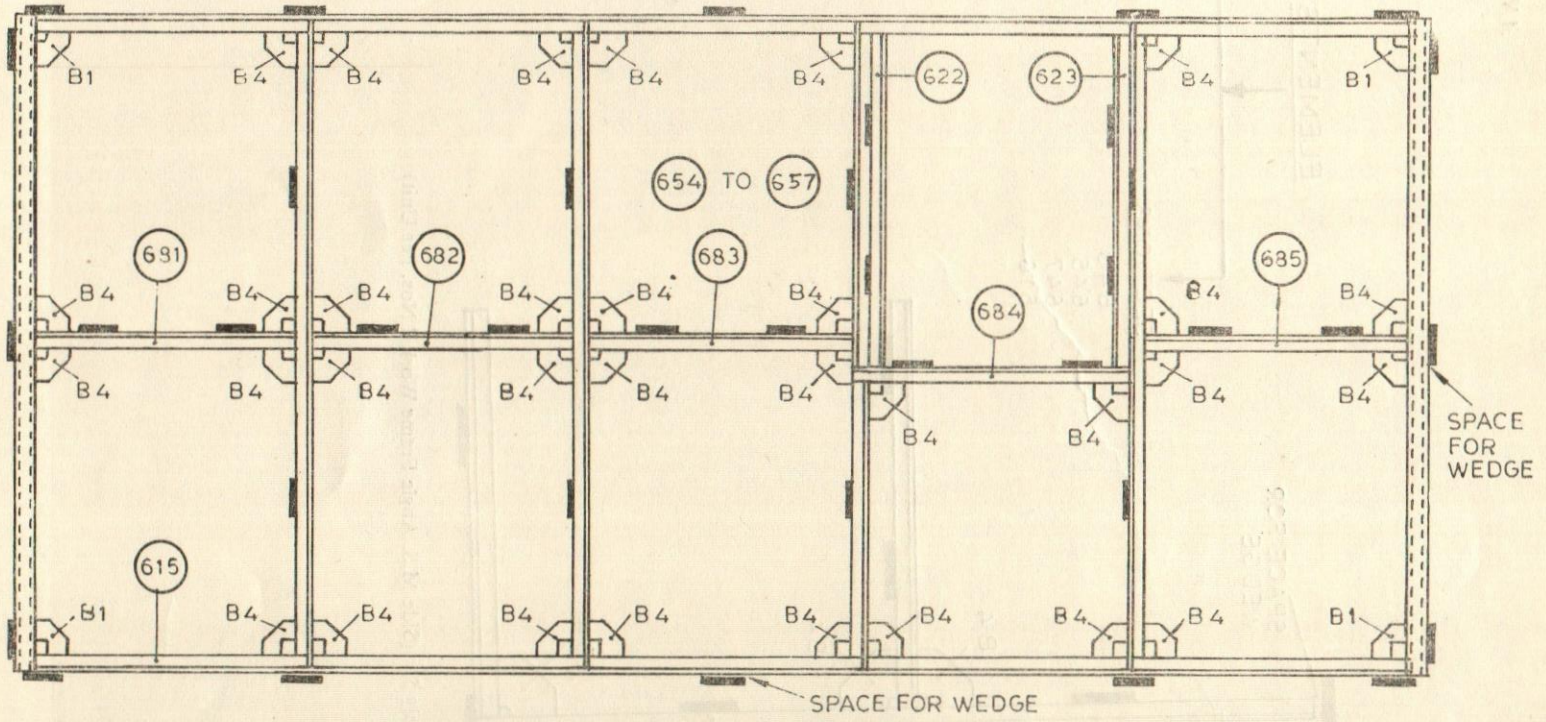
| Activity Number | Description | Predecessor | Elements | |
|---|---|---|---|---|
| | | | Sections | Plating/ Bkts/Lifting eyes |
| 1 | 2 | 3 | 4 | 5 |
| | **Sub-assembly—I** | | | |
| 101 | Lay I-bars in the jig | — | 601-605 | |
| 102 | Lay-U-channels in the jig | 101 | 606-613 | |
| 103 | Lay Flat bars in the jig | 102 | 26-35 | |
| 104 | Align & tack them | 103 | — | |
| 105 | Weld lifting & dragging hooks | 104 | 38-61*<br>66-69*<br>671-674* | |
| 106 | Withdraw the framework from the jig | 105 | — | |
| 107 | Lay the skin* on the framework | 106 | — | 1—6* |
| 108 | Tack weld | 107 | — | |
| 109 | Turn the assembly | 108 | — | |
| 110 | Complete full welding | 109 | — | |
| | **Sub-assembly-II** | | | |
| 201 | Lay skin* on the camber skid | — | — | 7—15* |
| 202 | Loft markings | 201 | | |
| 203 | Lay T-bar | 202 | 632 A)*<br>632 B) | |
| 204 | Lay both the front half & rear half frameworks* | 203 | 624-631<br>633-642 | |
| 205 | Lay end flat bars | 204 | 70-71<br>36-37 | |
| 206 | Align & tack | 205 | | |
| 207 | Complete staggered welding to the skin | 206 | | |
| 208 | Weld the brackets | 207 | | 35—8 Nos. |
| 209 | Complete full welding | 208 | | |
| | **Sub-assembly-III** | | | |
| 301 | Lay square section pillars* in the jig shown in Annexure V | — | 658-661 | |
| 302 | Lay MS angles in the jig | 301 | 614,615<br>649,653<br>620,621<br>675,676<br>678,679<br>650,666 | |

*(Contd.)*

*ANNEXURE—II Contd..*

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 303 | Align all the angles in the jig | 302 | | |
| 304 | Tack weld | 303 | | |
| 305 | Lay brackets and tack weld | 304 | | 20--23<br>B 1 (4 Nos.)<br>B 4 (24 Nos.) |
| 306 | Remove the framework from jig | 305 | | |
| 307 | Full weld | 306 | | |
| | **Sub-assembly-IV** | | | |
| 401 | Lay square section pillars* in the jig shown in Annexure V | | 662-665 | |
| 402 | Lay all the MS angles | 401 | 654-657<br>622-623<br>681-685 | |
| 403 | Align & tack | 402 | | |
| 404 | Lay brackets & tack weld | 403 | | 25<br>B 1 (4 Nos.)<br>B 4 (32 Nos.) |
| 405 | Remove frame from jigs | 404 | | |
| 406 | Complete full welding | 405 | | |
| | **Sub-assembly—V** | | | |
| 501 | Lay MS angles in the jig | | 616,643<br>645,646 | |
| 502 | Align & tack weld | 501 | | |
| 503 | Lay the brackets and tack weld | 502 | | |
| 504 | Remove from jig & full weld | 503 | | |
| | **Sub-assembly—VI** | | | |
| 601 to 604 | Same as above | | 617,644<br>647,648 | |
| | *Final assembly* | | | |
| 701 | Lay sub-assembly 1 | 110 | | |
| 702 | Erect sub-assemblies 3,4,5, & 6 by giving supports | 307,406<br>504,604 | | |
| 703 | Align to plumb & spirit level & tack weld | | | |
| 704 | Complete full welding | | | |
| 705 | Lay sub-assembly 2 (roof structure) by giving temporary supports below T-bar | | | |
| 706 | Align & tack weld | | | |
| 707 | Align brackets & tack weld | | | B 1 (4 Nos.)<br>B 3 (8 Nos.) |
| 708 | Complete full welding | | | B 4 (4 Nos.) |

* indicates mini-sub-assemblies.

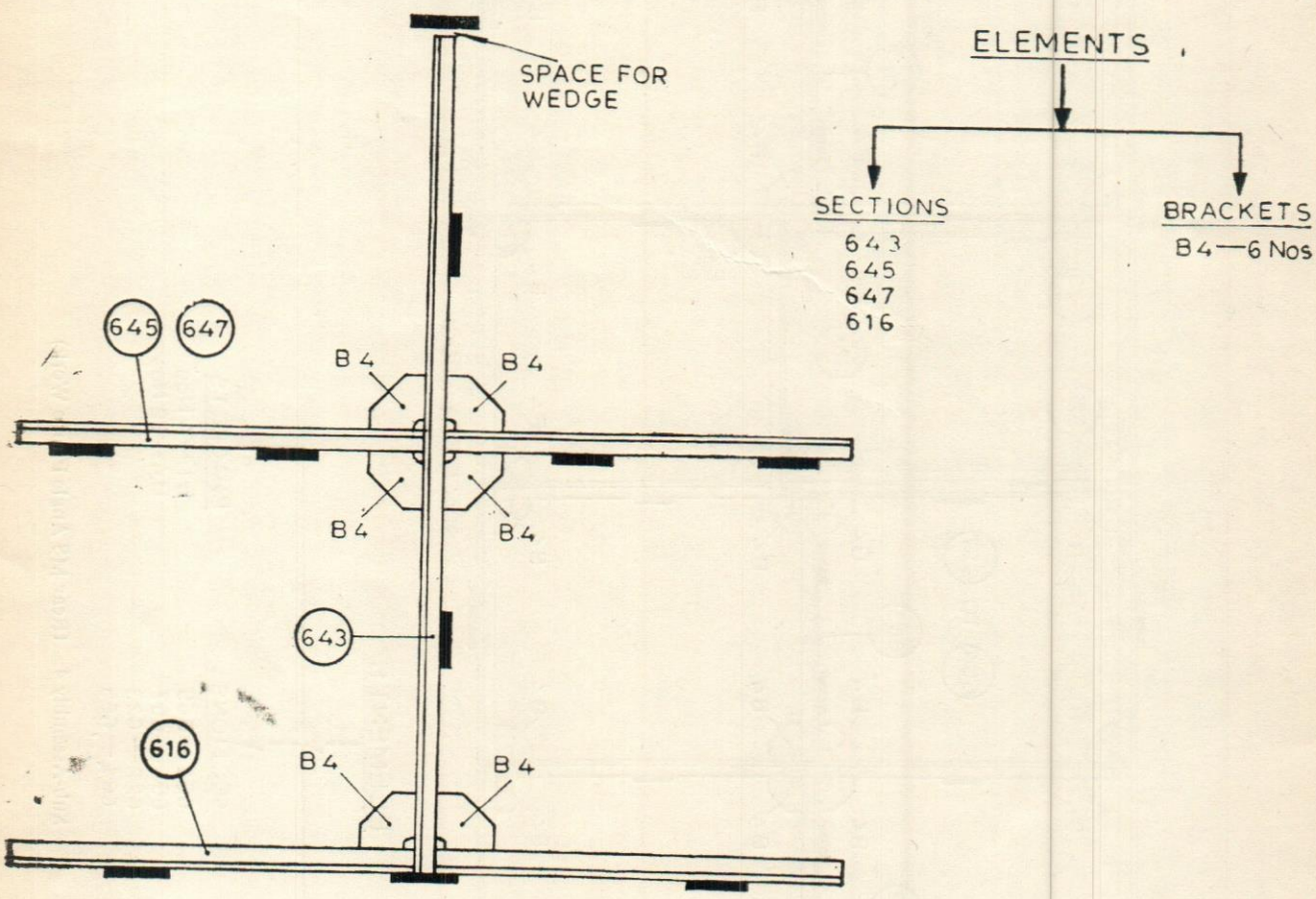



ELEMENTS

| PLATES | SECTIONS | BRACKETS |
|---|---|---|
| 25 | 662—665 | B1—4 Nos |
| | 654—657 | B4—32 Nos |
| | 622—623 | |
| | 681—685 | |

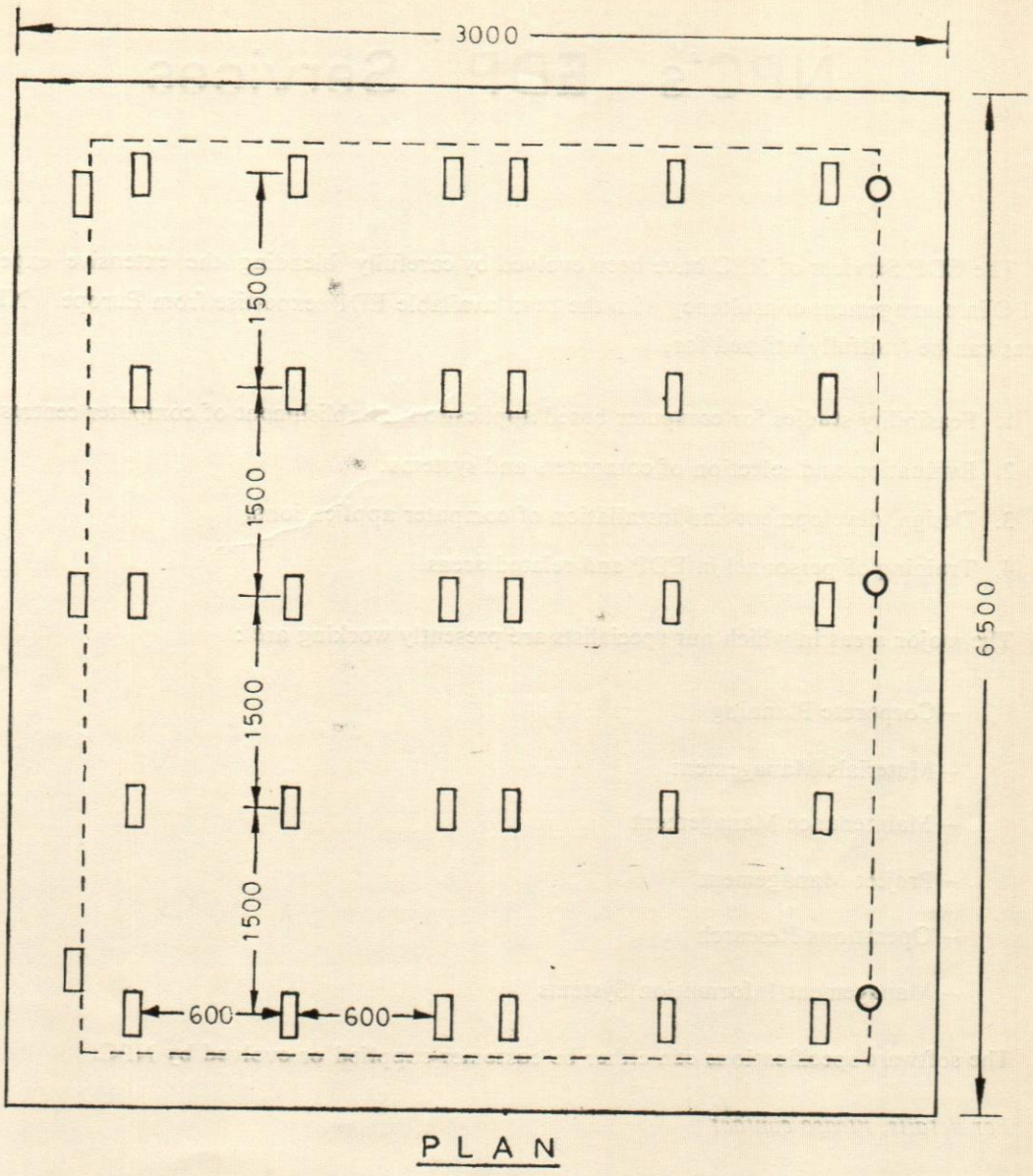
**Sub-Assembly 4. (Rear MS Angle Frame Work)**

*ANNEXURE-IV*




Sub-Assembly 5. (Side M.S. Angle Frame Work 2 Nos. Per Unit)

*ANNEXURE-V*




Camber BK1O Arrangement for Fabrication of Roof Structure

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# Inventory Productivity : A World Business View

Nesa L'abbe Wu

*This article discusses the production and inventory control through the US Just in Case System, the Japanese Just in Time System and the Optimised Production Technology Way.*

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*Productivity, Vol. 29. No. 3, October-December 1988, 267-274*

## U.S. Inventory and Production State

*Economic State of Inventories*

Businesses have been attempting to reduce inventory pile-ups over the past five years. The wild fluctuations in final sales over the past few years have made this very difficult, however.

Manufacturers, who hold nearly half of all inventories, have the hardest time reducing stocks, because sales have been stagnating recently and inventories have been piling up at the factories. Capital goods producers have been especially hard hit as imports continue to grab most new businesses. Retailers and distributors have been living hand to mouth with their inventory because of only mediocre sales and quick delivery times promised by domestic suppliers. Car dealers, surprisingly, are an exception to this.

Manufacturers have the most difficult task in controlling inventories, but they have been leading the way in inventory control by making use of new inventory control systems in an environment of stiff competition, high interest rates, and low inflation rates, an environment that doesn't encourage high stock levels. Because forecasts do not look for any significant changes in interest rates or inflation and because there is still a lot of excess capacity around, further inventory reductions are going to be necessary. While the computer industry has been especially hard hit by excess inventory gluts, they and many other high-tech companies could take a lesson in inventory control from the traditional manufacturers.

Given the fast-changing technology associated with

the computer industry, many high-tech managers have been reluctant to admit that their current inventories have either been out-classed, making them overvalued, or simply been rendered obsolete. This scenario has made the computer industry notorious for overvalued inventories. It has been recently bringing high-tech managers and their accountants under increased pressure to make more realistic valuations of their stocks.

*Reducing Inventories via Purchasing*

According to Norman Kobert, a Florida-based management consultant, there are a number of points to consider when hedging against stockouts. (Kobert, 1985; Kobert, 1984). All stockouts are not equal in their effect on production and the potential cost benefit of inventory hedging must be considered before blindly reducing all stocks. Three of Kobert's points with brief explanations follow:

1. Aging of commitments by level of requirement : All items are not required at the same time in sequencing of stock commitments. If the overall leadtime for an operation is X-weeks, then individual items are required at X, X-1, X-2, X-3, weeks, etc. The closer delivery can be coordinated to the demand week, the less actual inventory will be on hand.
2. Pipelining : Allows scheduler to gamble on stocks which haven't actually arrived yet. It requires close monitoring of suppliers and subcontractors, as well as internal departmental scheduling. This technique can especially be applied to items of low criticality, because if one is wrong in his expectations, he can easily recover.
3. Make or buy decisions to reduce hedge inventories against irregular demands. One way to account for demand variability other than inventory investment is to consider outside procurement during peak demand times. This technique can sometimes be adopted as a regular operating policy even during non-peak demand periods. Many U.S. companies have been relying more and more on the outsourcing of parts. Obviously, outside purchase during peak demand cuts down inventory carrying costs, but those cost savings must be weighed against the cost of outside procurement. Many U.S. companies are finding that they can actually buy an item overseas cheaper than they can make it, as well as receive a higher quality item in many cases. This is true even after considering extra shipping costs and duties. Outsourcing can be applied to personnel as well as inventories.

As already mentioned, cost must be considered when deciding at what level to carry safety stocks for individual items. Safety stocks can be either a real hedge or an excessive cost, depending on the item under consideration.

According to Kobert, it might be a good idea to define three degrees of criticality in regards to safety stocks for which he establishes the following reaction rules:

* Minor items whose stockout would cause little inconvenience and could easily be overcome : Any safety stock for this type of item would be a needless expense.
* Major items whose stockout would cause expediting inconvenience, and additional costs due to minor production delays, extra shipping and handling charges. etc : Emergency quantities of these types of stocks could be obtained locally at a premium. The extent of the extra costs should determine the size of stock on these types of items.
* Critical items whose stockout would cause major delays in shipment and/or production with excessive costs resulting from both the effects of the stockout and the efforts to overcome the situation : Emergency quantities of these items are not available locally at any cost. Safety stocks would be called for with these types of items, but reasonableness should be considered in determining their size.

In order to successfully implement materials requirement planning (MRP), it would be wise for a company to rely heavily on its purchasing department. According to John P. Flanegan, of the Florida-based

consulting firm Anderson Associates, "...MRP systems are not working anywhere near as well as the computer manufacturers would lead you to believe. And the very best systems all have one thing in common : the people using them don't believe their reports." He contends that in order to have MRP systems that work, it is necessary to have valid systems contracts in force.

MRP calculations and forecasts in and of themselves are not faulty; but they fail to consider the imprecise relationship that usually exists between buyers and sellers. A system contract helps establish a solid working relationship between a company and its supplier and allows production people to talk to other production people in a candid manner not usually considered acceptable in standard business operations. This is almost identical to the buyer-supplier relationship which exists in the just-in-time inventory method as practiced in Japan. The difference lies in the fact that in Japan a supplier is so close that it is almost part of the company which it supplies.

**The Japanese Just-in-Time System**

*Just-in-Time Production (the KANBAN system)*

A just-in-time production system is an integrated manufacturing and supply system aimed at producing the highest quality, and, at the same time, the lowest cost products through the elimination of waste. Waste here, is, defined as anything which does not add value to the product; it is anything other than the minimum amount of materials, equipment or workers. The waste incurred in the production process includes overproduction, wasted time spent at machines, losses in the transportation of parts and goods, waste created during processing of goods, wasted time resulting from taking inventory, waste of motion, and waste in the form of defective units.

A just-in-time system is one that integrates and controls the entire process. It specifies what should be stored, moved, operated on or inspected and precisely when it should be done. Just-in-time production continuously strives to improve production processes and methods. It attempts to reduce, and ultimateiy to eliminate, inventories because high inventories tend to cover up production problems.

One of the most popular just-in-time systems is Toyota's KANBAN system. It was developed by Mr. Ohno who felt that overproduction was the central evil which led to waste in other areas. To eliminate the problem of waste, Ohno devised a production system based on two main structural features : the just-in-time concept and automation. The just-in-time concept implies that the exact number of required units is brought to each successive stage of production at the appropriate time. This meant a reversal of the normal thinking process. Ordinarily, units are transported to the next production stage, as soon as they are ready. Ohno, however reversed this. Now, each stage is required to go back to the previous stage to pick up the exact number of units needed. This results in a significant decline in inventory levels.

Just-in-time production necessitates certain changes in the factory and the way in which it is managed. Changes must occur in supplier selection, in plant layout, in production equipment, in scheduling methods, in materials handling methods, in maintenance control, in quality control, and in worker training.

The Japanese have worked very hard to overcome a variety of problems inherent to any production system, and especially to the just-in-time system. Some of these problems are : stockout and component shortages, high setup costs, idle resources and capacity imbalances, worker resistance and motivation, vendor reliability, inventory imbalances, quality losses, maintenance downtime, and all sorts of productivity losses.

The tools used by the Japanese to combat these problems and to make just-in-time possible are numerous. A stable monthly master production schedule, stable bill of materials, small end item lot sizes, high volume production, focussed factories and group technology avoid stockouts and component shortages. Single digit setup time reduces high setup costs. Company Unions that allow for a flexible workforce and also a careful monthly capacity

planning reduce idle resources and capacity imbalances. Worker resistance is minimized because, together with the foreman, the workers act as middle management and enjoy lifetime employment. Subcontract networks ensure vendor reliability, and quality circles reduce quality losses. Maintenance downtime is combatted through the introduction of preventive maintenance, quick maintenance response, and a variety of visual displays. Productivity is constantly improved because of continuous improvement of the production system through automation and because of workforce participation.

*Just-In-Time Purchasing*

The just-in-time system goes beyond the shop floor. It also includes shipments of purchased goods that start with the just-in-time demand for materials and parts. Since the timing and quantity of parts are best and most accurately known by final assembly, this is where the just-in-time system will start. Final assembly goes to its "suppliers" and brings back only the necessary parts at the required time. "Suppliers" produce exactly the kinds and quantity of parts necessary to replace those taken by the assembly line. To "produce" these parts, "suppliers" go to their own "suppliers" and get only the necessary parts. Thus, the entire chain reacts very quickly to the actual assembly, and just-in-time production is achieved with minimum inventory.

Realize, though, that this system does not call for suppliers to carry large inventories. As a matter of fact, the goal is for the suppliers to carry less inventory than traditional practice. They stay in tune with the production rates of their customers.

*Reflections on Just-In-Time Purchasing and Production in U.S.A.*

The just-in-time inventory and manufacturing system as practiced in Japan has been experiencing a growing increase in popularity among American manufacturers. At the vanguard of the US's JIT movement are companies such as John Deere, IBM, Motorola. FMC, Eastman Kodak, Hewlett Packard, Apple and GM, to name a few.

What these companies have been finding is that JIT does not always result in zero inventory as is commonly believed. In practice, the Japanese operate with the lowest practical inventory base, while most US companies continue to work with excessive inventories. This leads to the hidden benefit of JIT, and arguably its best feature : the improvement of quality.

In most U.S. companies extra inventories are carried because eneryone wants to guard against bringing the production line to a halt. In Japan, workers know that if they blow a product line there's a good chance they will shut down production; mistakes show up immediately. Carrying zero or near zero inventories forces you to correct mistakes as they happen and to correct the events that caused the mistakes.

At the first work-shop at the Association for Manufacturing Excellence (AME), made up of former members of the Repetitive Manufacturing Group of APICS, the attendees got to see first-hand how the Japanese handle JIT in a tour of NOK's engine seal plant in LaGrange, Georgia. While there was little inventory evident, what impressed the American executives most was the well-defined and standardized routines employed throughout the manufacturing process. NOK management seemed intent on controlling as much as possible any process variables which could have an adverse effect on product quality.

Reduced inventories and improved quality are the two biggest advantages of JIT, but there are two others as well. First of all, JIT forces the manufacturer to choose fewer suppliers, in contrast to where a company has many suppliers, many of whom were adversaries. Also, JIT can really cut down inspection time. According to Gary Flack, a manufacturing consultant at Hewlett-Packard, incoming inspection of some parts has been totally eliminated at various Hewlett-Packard locations, an obvious time and money saving effect. The auto industry serves as a good example of JIT's benefits. GM has appoximately ten-fold the number of vendors that Toyota has, whereas Toyota can build a car of arguably better quality for

substantially less money, even including shipping costs.

It was mentioned earlier that a system contract approach fits nicely with JIT. This is specifically true as it applies to vendor selection. In order for the Japanese to have so few suppliers, actual vendor selection processes are vitally critical. In JIT as practiced in Japan, there is a very close buyer-supplier relationship to the point where the supplier is practically a part of the organization. There are obvious benefits to this, yet there are structural differences between Japanese and US business which do not make it practical for firms to be quite as close in the American environment.

Communication also necessarily improves with JIT, both within the company and with the suppliers. In order for JIT to work effectively, industrial engineers, process engineers, product engineers, buyers, material handlers, and logistics personnel must all work together and keep each other informed as to what they are doing and as to any problems they are having or may foresee from their end. Also, the vendors must be told as soon as possible that a buyer is going to a JIT system. The vendors have to be educated by purchasing personnel as to exactly what is expected of them. Those that cannot fit should be dumped as soon as possible.

As mentioned above, there are many cultural differences between Japan and America. One place this manifests itself is among the labor force. On one hand, the Japanese worker tends to place more emphasis on his job and feels part of a "family" dedicated to one purpose : increased productivity and profit. On the other hand, the American worker has a tendency to look at his job as a means to an end and is concerned with doing what has to be done to keep his job. These cultural differences extend to management as well. JIT's manufacturing system often entails that departments and workers sit idle for periods of time rather than producing work-in-process inventory that piles up behind bottlenecks. Many American managers have had a hard time accepting the fact that idle workers are okay sometimes. Also in a JIT system, instead of sitting idle, sometimes workers from one area could be shifted to help out in a bottleneck area. The problem with this is that, unfortunately, union regulations usually do not allow "job-sharing".

## Optimized Production Technology (OPT)

### *The OPT System*

Another revolutionary manufacturing system gaining some popularity in U.S.A. and Western European countries is optimized production technology (OPT), developed by Moshe Eliyahu Goldratt and being marketed by Creative Ouput, Inc. (Fox, 1983; Goldratt, 1984). OPT could most succinctly be described as a procedure to schedule work centers with finite loading, via a two-part package consisting of a simulated manufacturing program and a set of radical shop-floor management rules which enable a company to increase output while lowering inventories and expenses.

The simulated manufacturing program in OPT has four basic modules :

1. Buildnet—a network of all the plant's raw materials, resources, products, and customer orders.
2. Serve—module that locates bottlenecks in the system by running load profiles for each machine and resource.
3. Split—module that divides the network into two parts. The critical portion which contains the bottlenecks, and the non critical portions.
4. Brain—proprietary set of algorithms used to schedule the workers, machines, or tools at the bottleneck operations.

Figure 1 illustrates an OPT network-manufacturing model. The Serve module has been run and has identified Machine Center A as a bottleneck. The Split module would then divide the network into bottleneck and non-bottleneck segments. The Brain module then uses algorithms to determine job sequence as well as process and transfer batch sizes. Machine Center A then, would be scheduled at 100% utilization with enough inventory stationed by it to ensure there would always be enough work to do. Of course, the subassemblies would be able to handle the output from

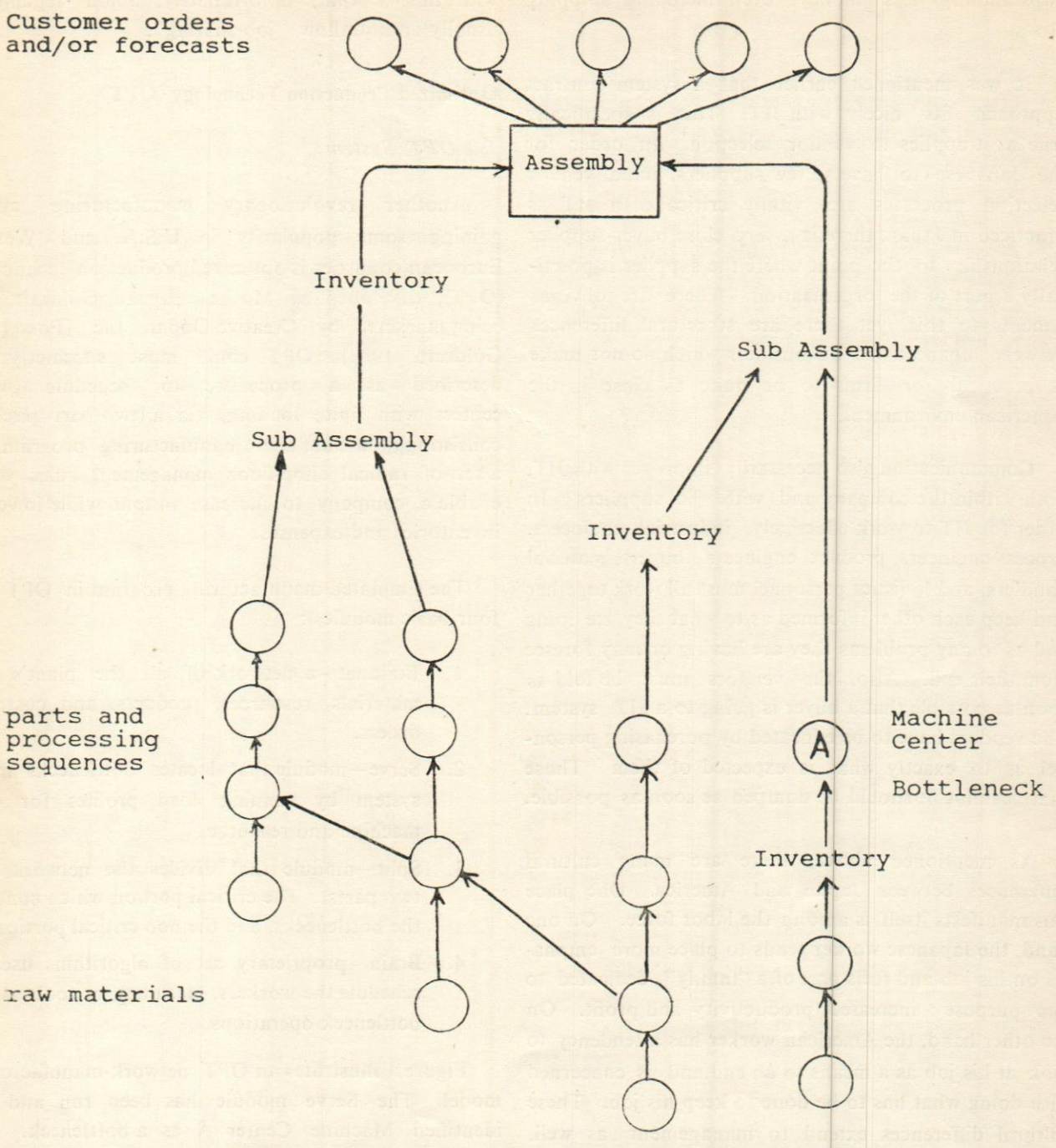


Fig. 1 : OPT Network Manufacturing Model (Reprinted from Creative Output Inc. Literature)

Machine Center A without delay beacuse they are not bottlenecks, but extra inventories could be placed at these areas to ensure that the product can be rushed through to finished inventory as soon as it comes off Machine Center A. It should be added that the master schedule, considering the given raw materials and customer orders, would have been done by the Buildnet module.

OPT, in essence, forces production managers and workers alike to coordinate their work and the flow of parts through a system with one consideration:

"bottlenecks" are what ultimately constrain manufacturing output. By identifying bottlenecks in advance and then scheduling all manufacturing activities productivity can be substantially increased. It is the bottlenecks and the demand for parts that determine what we can produce and when we can produce it.

But, as mentioned above, OPT is a two-part package. The manufacturing simulation is just a tool which can be used by managers to see where bottlenecks occur and how to schedule around them. The other part of OPT, and the more important part, is the actual management philosophy, which goes against the traditional philosophy which says that productivity is the highest when all workers and machines are going full tilt at all times. Traditional accounting methods hold that, from a cost standpoint, it is always better to run a batch of 1,000 parts through a machine than it is to run 100 parts. But if 900 parts are just sitting idle in inventory, then that is not really desirable.

*OPT Scheduling Characteristics*

Following are the basic precepts of OPT scheduling as drawn from *Inventories and Production magazine* (Fox, 1983) :

1. The utilization of a non-bottleneck resource is not determined by its own potential, but by some other constraint in the system—it cannot work at full capacity because it is dependent on output from another work situation.
2. Activating a resource is not the same as utilizing that resource—a non-bottleneck work center has excess capacity and should not be used 100% of the time, but only for the time it is needed.
3. An hour lost at a bottleneck is an hour lost by the entire system—bottlenecks are a systems limiting factor.
4. An hour saved at a non-bottleneck is a mirage —for the same reasons as in 3 above.
5. A transfer batch need not and sometimes should not equal the process batch.
6. The process batch size should be a variable—batch sizes should be dependent upon processes and will change throughout the system.
7. Capacity and priority need be considered simultaneously and not sequentially; output of the entire system must be considered when prioritizing jobs at a work center.
8. Murphy is not an unknown and its damage can be isolated and minimized—potential problems can be identified in advance and appropriate actions taken.
9. Plant capacity should not be balanced—a balanced plant is theoretically impossible, unless output at each stage is always in the same exact cycle.
10. The sum of local optimums is not equal to the optimum of the whole—as shown, optimizing throughout at each work center would be suboptimization on the whole because of bottlenecks; in order to optimize the entire system, it is necessary to suboptimize some work stations.

*Summary of OPT Productivity Rules*

OPT suggests two sets of productivity rules: one set for non-bottleneck machines and another set for bottleneck machines. Some of these basic rules are:

Non-Bottleneck Machines:

1. Reduction in batch size decreases in-process inventory.
2. Average rate of production is defined by the rate that the bottleneck machines can absorb the work.
3. Always provide work for bottleneck machines.

Bottleneck Machines :

1. Rate of material released into the system is defined by the bottleneck machines.
2. Increase batch size, decrease setups, increase productive time at bottleneck machines.
3. Download bottleneck machines.
4. Perform QC on parts entering bottleneck machines.

5. Have a dedicated set of people for bottleneck machines.
6. Improve processing at bottleneck machines.

*Similarities and Differences between OPT and JIT*

As can be seen, OPT is in many aspects similar to JIT. Both systems have as a basic premise the idea of running perceived bottlenecks at 100% capacity and, by doing so, increasing productivity and decreasing inventory to its lowest practical level. Both philosophies also ignore idle resources—they believe it is better to have an unused machine or worker as opposed to piling up unused inventories. Because of this last philosophy, both have had some problems being accepted by the more traditional managers as it goes against what they've believed all their lives. It might be noted, however, that both are gaining in acceptance among U.S. companies.

The basic difference between OPT and JIT lies in the simulated manufacturing program that is part of OPT. This program allows OPT to simulate a plant's production accurately enough to allow managers to identify bottlenecks and problem areas in advance. This is a definite advantage over JIT, which tends to correct problems in production systems after they occur. Also, while JIT is best suited for a repetitive manufacturing environment, OPT is best suited for a job shop situation, such as builders of machines, locomotives, etc., although there is no reason OPT could not be used in a repetitive manufacturing setting.

**Concluding Remarks**

American industry has the means available to improve efficiency, especially through the use of systems such as JIT and OPT. Both systems have proven very effective for those who have adopted them. Also, to wholly embrace JIT might be impractical because of the inherent cultural differences. Still, the main roadblock to instituting a new production philosophy such as JIT and OPT remains the management acceptance. To have idle capacity is not easily digested because everything Ameriean management ever learned about manufacturing was that full capacity use was the thing to do. The best way to convince any manager is the bottom line, and as more companies have success with OPT and JIT, we will see more changes in opinions from managers. It is believed that OPT is slightly superior, mainly because it projects problems in advance as opposed to the more management by exception approach of JIT.

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# Joint Ordering Policy Based on Least Total Cost

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*In this article the author develops a joint ordering policy for Materials Requirement Planning System based on least total cost per period. The requirements for different items are grouped for various periods so that the total costs are least per period.*

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**Introduction**

The concept of joint ordering has not been extended adequate attention by researchers for Material Requirements Planning (MRP) Systems. Callarman and Whybark (1981) has described and compared three procedures (Least Unit Cost, Least Period Cost, and Mclarens' Order Moment) for Materials Requirement Planning Systems. Gupta (1985, 1986) has developed the Least Unit Cost Method, McLaren's Order Moment Methods for MRP Systems with several all units discounts. Here the concept of joint ordering policy is developed for Materials Requirement Planning System using Least Total Cost per period approach. The lowest of ordering and carrying cost per period is evaluated for joint ordering policy. The joint orders for various products are placed for various periods. The quantities of those periods requirement for grouped items are selected which have the lowest carrying and ordering cost per period.

**Least Cost per period Method For Joint Ordering Policy**

Let $R_{ij}$ be the requirement of $i^{th}$ item during $j^{th}$ period, $i = 1, 2, 3 \ldots n$ are the number of items, which are supplied by a supplier, $j = 1, 2, 3 \ldots n$ are the periods in the planning horizon.

Define :

$C_o$ = Ordering Cost per order

$C_e$ = Carrying Cost per period (percentage)

$P_i$ = Unit Cost of the $i^{th}$ item

TABLE 1 **Requirements of Products : Period wise**

| Periods/ Products | 1 | 2 | 3 | .. | j | .. | n |
|---|---|---|---|---|---|---|---|
| 1 | $R_{11}$ | $R_{12}$ | $R_{13}$ | .. | $R_{1j}$ | .. | $R_{1n}$ |
| 2 | $R_{21}$ | $R_{22}$ | $R_{23}$ | .. | $R_{2j}$ | .. | $R_{2n}$ |
| 3 | $R_{31}$ | $R_{32}$ | $K_{33}$ | .. | $R_{3j}$ | .. | $R_{3n}$ |
| — | — | — | — | — | — | — | — |
| m | $R_{m1}$ | $R_{m2}$ | $R_{m3}$ | .. | $R_{mj}$ | | $R_{mn}$ |
| Total | $\sum_{i=1}^{m} R_{i1}$ | $\sum_{i=1}^{m} R_{i2}$ | $\sum_{i=1}^{m} R_{i3}$ | | $\sum_{i=1}^{m} R_{ij}$ | | $\sum_{i=1}^{m} R_{in}$ |

The total cost per period is computed for ordered quantities equal to whole number of periods' requirement for all the m items which are supplied by a single supplier. Here it is assumed that those units which arrive in the period, in which these are used, incur no carrying cost. $TCPP_j$ is the total cost per period when j periods requirements joint order is placed for all m items supplied by the supplier, where $j = 1,2 \ldots n$. Now, choose that the total cost per period ($TCPP_1, TCPP_2 \ldots TCPP_n$) which is the minimum. Suppose this occurs for k periods ($TCPP_k$ is the minimum) requirements of all m products. After this, again for the remaining periods the procedure is repeated and a minimum cost is selected. This is continued till all periods of the planning horizon are exhausted.

Column one of Table 2 represents the order size for all m products for one period requirements, for two periods requirements for three periods requirements and so on up to n periods requirements. Column two shows the period of requirements. Column three shows the prices $P_i$ ($i = 1,2, \ldots m$) of m products. Column four represents the inventory carried in units. When one period requirement is ordered for all m products, this is consumed during first period; therefore, no inventory is carried. When two periods requirements are ordered, the first periods' requirement is consumed during first period and second period's requirement of all m products is carried for first period so that it is consumed during second period, therefore no inventory is carried during second period. The total inventory carried is second period's requirement for one period. Similarly when three periods requirement of all m products is ordered, the first periods' requirement of all m product is consumed during first period, the second and third period requirement of all m products is carried during the first period. During the second period, second periods requirement is consumed and third periods requirement is carried. During the third period, this third periods' requirement is consumed. Therefore the inventory carried is :

$$\sum_{i=1}^{m} \sum_{j=2}^{3} R_{ij} + \sum_{i=1}^{m} R_{i3} \qquad (1)$$

Similarly when n periods requirement of all m products is ordered the inventory carried is :

$$\left[\sum_{i=1}^{m} \sum_{j=2}^{n} R_{ij} + \ldots \sum_{i=1}^{m} \sum_{j=3}^{n} R_{ij} + \ldots + \sum_{i=1}^{m} \sum_{j=k+1}^{n} R_{ij} + \ldots + \sum_{i=1}^{m} R_{in}\right] \qquad (2)$$

TABLE 2 **Proposed Method of Computing the Total Cost Per Period**

| Order Size | Periods or Reqmt. | Price per Unit | Inventory Carried in Units | Inventory Carried in Rupees | Inventory Carrying Cost in Rupees | Total Cost Per Period TCPP |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| $\sum_{i=1}^{m} R_{i1}$ | 1 | $P_i$ $i=1, 2..m$ | 0 | 0 | 0 | $\frac{C_o+O}{1}=C_o$ $=TCPP_1$ |
| $\sum_{i=1}^{m}\sum_{j=1}^{2} R_{ij}$ | 2 | $P_i$ | $\sum_{i=1}^{m} R_{i2}$ | $\sum_{i=1}^{m} P_i R_{i2}$ | $C_c \sum_{i=1}^{m} P_i R_{i2}$ | $\frac{C_o+C_c \sum_{i=1}^{m} P_i R_{i2}}{2}$ $=TCPP_2$ |
| $\sum_{i=1}^{m}\sum_{j=1}^{3} R_{ij}$ | 3 | $P_i$ | $\sum_{i=1}^{m}[\sum_{j=2}^{3} R_{ij}+R_{i3}]$ | $\sum_{i=1}^{m} P_i[\sum_{j=2}^{3} R_{ij}+R_{i3}]$ | $C_c \sum_{i=1}^{m} P_i[\sum_{j=2}^{3} R_{ij}+R_{i3}]$ | $\frac{C_o+C_c \sum_{i=1}^{m} P_i [\sum_{j=2}^{3} R_{ij}+R_{i3}]}{3}$ $=TC\ P\ P_3$ |
| — | — | — | — | — | — | — |
| $\sum_{i=1}^{m}\sum_{j=1}^{k} R_{ij}$ | k | $P_i$ | $\sum_{i=1}^{m}[\sum_{j=2}^{k} R_{ij}+\sum_{j=3}^{k} R_{ij}+\ldots+R_{ik}]$ | $\sum_{i=1}^{m} P_i[\sum_{j=2}^{k} R_{ij}+\sum_{j=3}^{k} R_{ij}+\ldots+R_{ik}]$ | $C_c \sum_{i=1}^{m} P_i[\sum_{j=2}^{k} R_{ij}+\sum_{j=3}^{k} R_{ij}+\ldots+R_{ik}]$ | $\frac{C_o+C_c \sum_{i=1}^{m} P_i[\sum_{j=2}^{k} R_{ij}+\sum_{j=3}^{k} R_{ij}+\ldots+R_{ik}]}{k=TCPP_k}$ |
| — | — | — | — | — | — | — |
| $\sum_{i=1}^{m}\sum_{j=1}^{n} R_{ij}$ | n | $P_i$ | $\sum_{i=1}^{m}[\sum_{j=2}^{n} R_{ij}+\sum_{j=3}^{n} R_{ij}+\ldots+\sum_{j=k+1}^{n} R_{ij}+\ldots+R_{in}]$ | $\sum_{i=1}^{m} P_i[\sum_{j=2}^{n} R_{ij}+\sum_{j=3}^{n} R_{ij}+\sum_{j=k+1}^{n} R_{ij}+\ldots+R_{in}]$ | $C_c \sum_{i=1}^{m} P_i[\sum_{j=2}^{n} R_{ij}+\sum_{j=3}^{n} R_{ij}+\sum_{j=k+1}^{n} R_{ij}+\ldots+R_{in}]$ | $\frac{C_o+C_c \sum_{i=1}^{m} P_i[\sum_{j=2}^{n} R_{ij}+\sum_{j=3}^{n} R_{ij}+\sum_{j=k+1}^{n} R_{ij}+\ldots+R_{in}]}{n=TCPP_n}$ |

This can be expressed as :

$$\sum_{i=1}^{m}\left[\sum_{j=2}^{n} R_{ij} + \sum_{j=3}^{n} R_{ij} + \ldots + \sum_{j=k+1}^{n} R_{ij} + \ldots + R_{in}\right] \text{units} \qquad (3)$$

Column five (Table 2) represents the inventory carried in rupees. The inventory carried in units is multiplied by unit prices $P_i$. Column 6 represents the inventory carrying cost which is obtained by multiplying the inventory carried in rupees with the carrying cost per period in percentage. Column 7 calculates the total cost per period. This total cost per period is obtained by dividing the sum of ordering cost and carrying cost by number of periods. Out of this total cost per period, the minimum total cost per period is selected. Say, this occurs for period k requirement. Now, the first order of all m products for k periods requirement is placed and then the same procedure is repeated for the remaining n—k periods. Again the total cost per period is calculated for (n—k) periods and out of these the minimum is selected. This process is continued till all the periods of the planning horizon are covered. This gives the joint ordering policy for all periods requirement of all m products based on Least Total Cost Per Period.

*Example* A company has twelve months requirements in units as follows. It incurs carrying cost 2% per month and ordering cost is Rs. 100 per order.

TABLE 3 **Data on Requirements of Different Products**

| Periods/ Products | I | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Total Reqmt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Product I | 10 | 20 | 20 | 70 | 180 | 10 | 250 | 270 | 230 | 40 | 0 | 10 | 1110 |
| Product II | 20 | 30 | 20 | 80 | 30 | 40 | 50 | 30 | 70 | 40 | 50 | 30 | 490 |
| Product III | 50 | 70 | 100 | 120 | 110 | 90 | 120 | 80 | 70 | 60 | 40 | 20 | 930 |
| Product IV | 0 | 50 | 80 | 180 | 0 | 80 | 180 | 150 | 10 | 100 | 130 | 180 | 1140 |
| Total Reqmt. of four Products | 80 | 170 | 220 | 450 | 320 | 220 | 600 | 530 | 380 | 240 | 220 | 240 | $\sum_{i=1}^{4}\sum_{j=1}^{12} R_{ij} = 3670$ |

The unit prices quoted by a supplier for these four products are Rs. 5.00, Rs. 2.00, Rs. 1.00, Rs. 10.00 respectively. Using the least total cost per period, we want to find the joint ordering policy for the company.

TABLE 4 **Detailed Calculations**

| Ordering Size $R_{ij}$ | Number of Periods Requirement | Unit Price | Inventory Carried in Units | Inventory Carried in Rupees | Inventory Carrying Cost | Total Cost Per Period |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| $\sum_{i=1}^{4} R_{i1}=80$ | One (First Period) | $P_1=5.00$<br>$P_2=2.00$<br>$P_3=1.00$<br>$P_4=10.00$ | 0 | 0 | 0 | $\frac{100+0}{1}=100$ |
| $\sum_{i=1}^{4}\sum_{j=1}^{2} R_{ij}=250$ | Two Periods (1st, 2nd) | ,, | 20<br>30<br>70<br>50 | 100<br>60<br>70 = 730<br>500 | 14.6 | $\frac{100+14.6}{2}=57.3$ |
| $\sum_{i=1}^{4}\sum_{j=1}^{3} R_{ij}=470$ | Three Periods (1st, 2nd, 3rd) | ,, | 60<br>70<br>270<br>180 | 300<br>140<br>270 = 2810<br>2100 | 56.2 | $\frac{100+56.2}{3}=52.07^*$ |
| $\sum_{i=1}^{4}\sum_{j=1}^{4} R_{ij}=920$ | Four Periods (1st, 2nd, 3rd, 4th) | ,, | 270<br>310<br>630<br>750 | 1350<br>620<br>630 = 10100<br>7500 | 202 | $\frac{100+202}{4}=75.5$ |
| $\sum_{i=1}^{4} R_{i4}=450$ | One Period (4th) | ,, | 0 | 0 | 0 | $\frac{100+0}{1}=100$ |
| $\sum_{i=1}^{4}\sum_{j=4}^{5} R_{ij}=770$ | Two Periods (4th, 5th) | ,, | 180<br>30<br>110<br>0 | 900<br>60<br>110 = 1070<br>0 | 21.4 | $\frac{100+21.4}{2}=60.7$ |
| $\sum_{i=1}^{4}\sum_{j=4}^{6} R_{ij}=990$ | Three Periods (4th, 5th, 6th) | ,, | 200<br>110<br>290<br>160 | 1000<br>220<br>290 = 3110<br>1600 | 62.2 | $\frac{100+62.2}{3}=54.1^*$ |

*(Contd.)*

TABLE 4 (*Contd.*)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| $\sum_{i=1}^{4}\sum_{j=4}^{8} R_{ij}=1590$ | Four Periods (4th, 5th, 6th, 7th) | ,, | 950<br>260<br>650<br>700 | 4750<br>520<br>650<br>7000 $=12920$ | 258.4 | $\frac{100+258.4}{4}=89.6$ |
| $\sum_{i=1}^{4} R_{ij}=600$ | One Period (7th) | ,, | 0 | 0 | 0 | $\frac{100+0}{1}=100$ |
| $\sum_{i=1}^{4}\sum_{j=7}^{8} R_{ij}=1130$ | Two Periods (7th, 8th) | ,, | 270<br>30<br>80<br>150 | 1350<br>60<br>80<br>1500 $=2990$ | 59.8 | $\frac{100+59.8}{2}=79.9$ |
| $\sum_{i=1}^{4}\sum_{j=7}^{9} R_{ij}=1510$ | Three Periods (7th, 8th, 9th) | ,, | 730<br>170<br>220<br>170 | 3650<br>340<br>220<br>1700 $=5910$ | 118.2 | $\frac{100+118.2}{3}=72.7$* |
| $\sum_{i=1}^{4}\sum_{j=7}^{10} R_{ij}=1750$ | Four Periods (7th, 8th, 9th, 10th) | ,, | 850<br>290<br>400<br>470 | 4250<br>580<br>400<br>4700 $=9930$ | 198.6 | $\frac{100+198.6}{4}=74.65$ |
| $\sum_{i=1}^{4} R_{i10}=240$ | One Period (10th) | ,, | 0 | 0 | 0 | $\frac{100+0}{1}=100$ |
| $\sum_{i=1}^{4}\sum_{j=0}^{11} R_{ij}=460$ | Two Periods (10th, 11th) | ,, | 0<br>50<br>40<br>130 | 0<br>100<br>40<br>1300 $=1440$ | 28.8 | $\frac{100+28.8}{2}$ 64.4* |
| $\sum_{i=1}^{4}\sum_{j=10}^{12} R_{ij}=700$ | Three Periods (10th, 11th, 12th) | ,, | 20<br>110<br>80<br>490 | 100<br>220<br>80<br>4900 $=5300$ | 106 | $\frac{100+106}{3}=68.67$ |
| $\sum_{i=1} R_{i12}=240$ | One Period (12th) | ,, | 0 | 0 | 0 | $\frac{100+0}{1}=100$* |

* Optimal value.

The optimal policy is as given in Table 5.

TABLE 5 **The Optimal Policy Plan Table**

| Order Number | Number of Periods Included | Order size in Units | Order size in Rs. | Carrying cost in Rs. | Ordering cost in Rs. | Least Total Cost per Period | Total Cost in Rs. |
|---|---|---|---|---|---|---|---|
| 1 | 3 (1, 2, 3) | 50<br>70<br>220<br>130 | 250<br>140<br>220 = 1910<br>1300 | 56.2 | 100 | 52.07 | 156.20 |
| 2 | 3 (4, 5, 6) | 260<br>150<br>320<br>260 | 1300<br>300<br>320 = 4620<br>2600 | 62.20 | 100 | 54.1 | 162.20 |
| 3 | 3 (7, 8, 9) | 750<br>150<br>270<br>340 | 3750<br>300<br>270 = 7720<br>3400 | 118.2 | 100 | 72.7 | 218.2 |
| 4 | 2 (10, 11) | 40<br>90<br>100<br>230 | 200<br>180<br>100 = 2780<br>2300 | 28.8 | 100 | 64.4 | 128.8 |
| 5 | 1 (12) | 10<br>30<br>20<br>180 | 50<br>60<br>20 = 1930<br>1800 | 0 | 100 | 100 | 100 |

## Conclusion

Normally production control manager is concerned with maintaining the MRP System and material manager is concerned with obtaining the best price for material. The model developed here takes care of both production and material systems. The scheme worked here considers jointly ordering from one vendor based on the least total cost per period.

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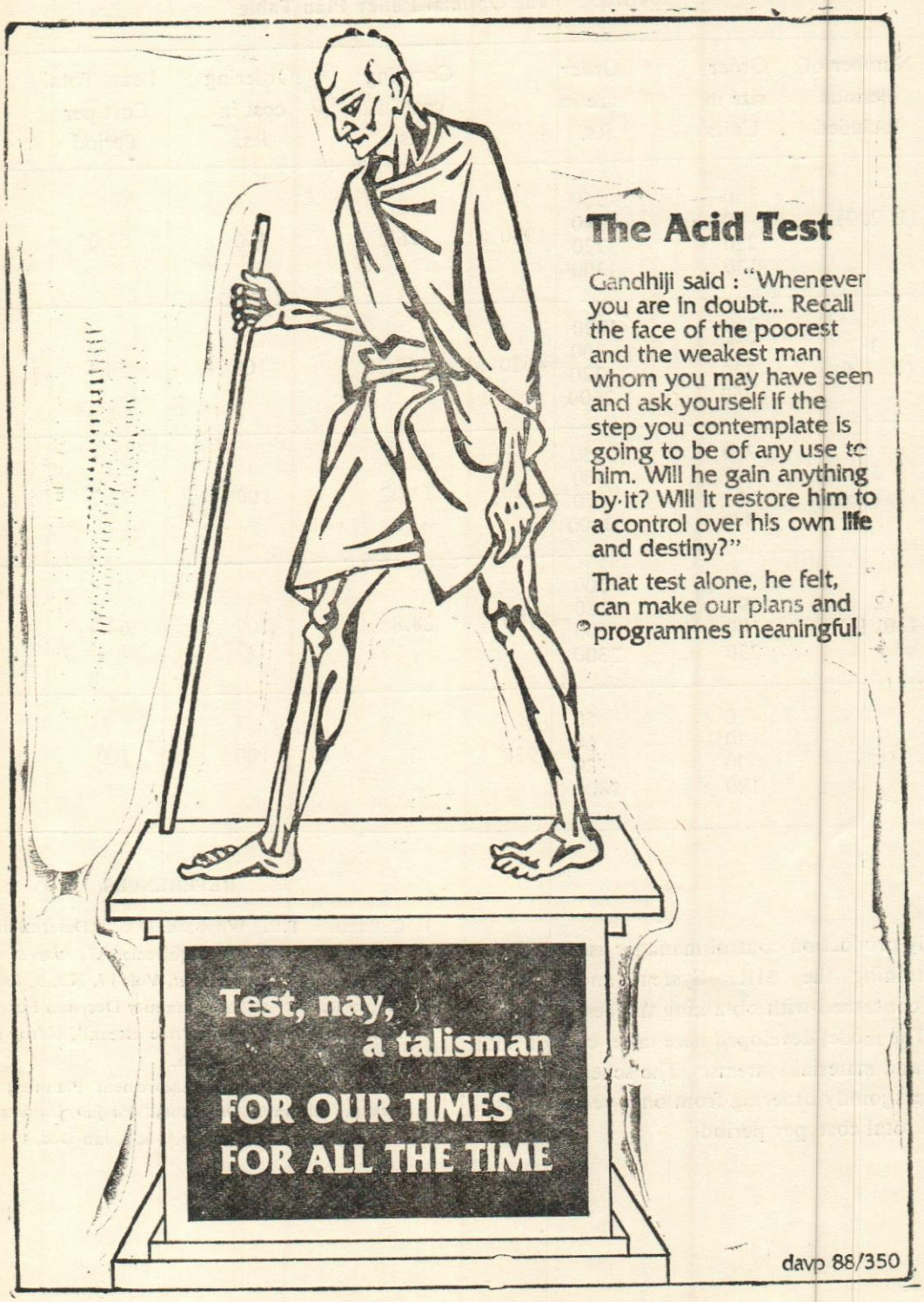
The Acid Test
Gandhiji said : "Whenever you are in doubt... Recall the face of the poorest and the weakest man whom you may have seen and ask yourself if the step you contemplate is going to be of any use to him. Will he gain anything by it? Will it restore him to a control over his own life and destiny?"
That test alone, he felt, can make our plans and programmes meaningful.
Test, nay, a talisman
FOR OUR TIMES
FOR ALL THE TIME
davp 88/350

# Managing Work Discipline

J.L. Rastogi

*Discipline is a product of positive characteristics of the people at work and those of the organisational environment. Any discrepancy in these may result in imbalance/maladjustment. Managing work discipline calls for appropriate strategies to deal with the needs of each situation, according to the author.*

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Discipline is one of the important factors having a direct bearing on people's productivity. It may have a positive or a negative connotation. When it is used as a noun, it is a positive concept, and means "a pattern of conduct or behaviour on the part of people at work which is compatible with the objectives and needs of the organisation. It implies acceptance of managerial authority, obedience of/compliance with reasonable and lawful orders and observance of rules and regulations including permissible deviations."

Discipline, however, may be either self-discipline or motivated discipline. Self-discipline arises from within an individual and is strengthened by intrinsic rewards facilitated by a conducive organisational environment. Motivated discipline, on the other hand, is externally induced through equitable administration of extrinsic rewards and punishments.

In general, appropriate rewards—financial and non-financial—do reinforce positive behaviour by increasing opportunities for need satisfaction; however, at times, the use of negative incentives through threats and punishments may not only be essential but also desirable to prevent deviation from accepted norms of behaviour. To yield the best results, positive and negative incentives have to be integrated and administered in an equitable manner.

The term discipline when used as a verb has a negative overtone and would imply only managing indiscipline, through the use of appropriate threats and punishments. It has, however, only a short term impact. The behaviour of the incumbent is, usually, oriented towards minimum compliance with a view to avoiding threats and punishments, and the motivating

effect of this approach wears off as soon as these are withdrawn.

How is it that inspite of the clear-cut distinction between discipline (as a noun) and disciplining (as a verb), our managers continue to concentrate on managing indiscipline rather than promoting positive discipline ? The reasons are not far to seek. Firstly, being deviations from the accepted norms, cases of indiscipline can be easily identified and isolated. Secondly, inadequate/improper handling of indiscipline is likely to vitiate the organisational environment. And finally, the distinction between managing indiscipline and promoting discipline tends to get blurred in practice. Managing indiscipline is an integral part of promotion of positive discipline, and adequate and proper handling of indiscipline would go a long way in promoting discipline. Cases of indiscipline reflect a conflict, very often, between the delinquent's needs and aspirations and the organisation's norms and expectations. These help us in identifying the gaps/deficiencies in the organisational working, and make us aware of the need for action, for problem solving and decision making. However, promotion of discipline calls for a much more comprehensive strategy than merely the effective management of indiscipline.

**Understanding Behaviour**

Discipline being a pattern of conduct of behaviour, its proper management requires a thorough understanding of the principles of human behaviour, as also the variables affecting it. To many of us, it may seem that the pattern of conduct/behaviour is a result of one's personality characteristics, e.g., one's values, attitudes, interests, commitment, loyalty, aspirations, responsibility, etc. But in practice it may not be necessarily so. Personality characteristics are, no doubt, important but these alone do not fully explain people's behaviour. If these are the sole determinants of one's conduct/behaviour, it should be consistent both on the job and outside. However, in many cases we may identify two sets of distinctive behaviour —one, on the job, and the other, outside the work place. Very often the same persons who are regarded as passive, irresponsible and indisciplined on the job, have been found to be very active, responsible and disciplined outside. They not only assume responsibility, but often seek it in social, religious and/or political activities. They have been found to exercise self-direction and self-control in the service of the objectives to which they are committed.

In fact human behaviour is much more complex than it is ordinarily presumed. According to Maier (1973), it is a product of interactions between two sets of variables—characteristics of the individual and characteristics of the situation/environment in which he finds himself. The situation is a source of stimulation and the individual's behaviour is in response to stimulation from the environment. Often we may not be aware that we have been stimulated and believe that the behaviour is spontaneous. But in practice spontaneous behaviour is more an exception than the rule. However, in the context of human behaviour, the situation/environment is not what it is, but how it is perceived by the individual concerned. Each one of us is likely to perceive the situation/environment through our own coloured glasses, and hence interpret it differently resulting in different sorts of behaviour.

**Determinants of Behaviour**

No doubt, even in the context of work, the broader environment in a country in its various facets, viz. technological, economic, socio-cultural, educational, political-legal, etc., does have a significant impact on human attitudes and behaviour; but here we will confine ourselves to a more limited set of variables, namely, the forces relevant in organisational working, many of which are within the control of management. However, because of the interacting and interdependent nature of these variables and their constituents, it is difficult to isolate their specific impact.

The people's characteristics influencing behaviour may comprise two sets of interacting variables—personal and group. The personal variables include factors like background and culture, values and attitudes, knowledge, skills and experience, level of aspirations and personality orientation. On the other hand, the group variables relate to the degree of

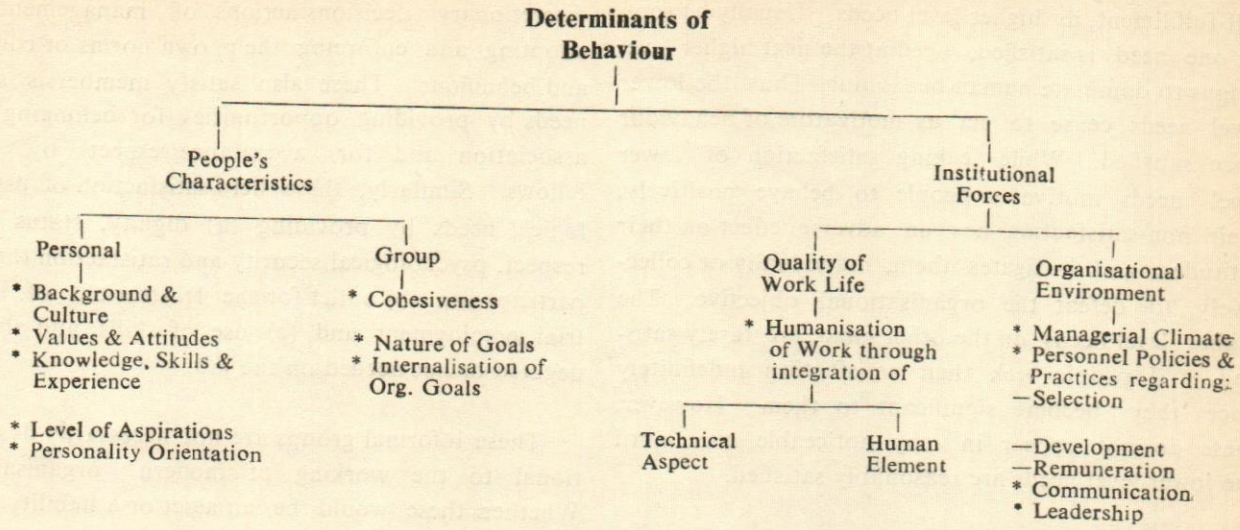


Fig. 1

group cohesiveness, the nature of group goals and norms and the degree of internalisation of organisational goals by the group.

The family and cultural background plays a very significant role in determining people's characteristics, orientations and behaviour. If one comes from a family/environment in which initiative, responsibility and orderly behaviour are positively re-inforced and rewarded, the person is likely to be more disciplined and cooperative. On the other hand, if one has been subjected to autocratic direction and control in one's early life, he is likely to be either completely submissive or stubborn in his later life, depending on his exposure and experiences.

Values and attitudes are yet another set of factors which one acquires over a period of time. Values are certain socially oriented ideals and aspirations which are deemed to be desirable, the degree of commitment which guides one to decide what he ought or ought not to do. Attitudes are a person's orientation towards the major components of one's life-experiences. However, knowledge, skills and experience contribute towards behaviour by making the person conscious of his own values, attitudes and commitments. While knowledge provides one a perspective, skills create certain obligations; and experience helps one integrate oneself with the environmental imperatives and thus arrive at an optimal solution.

The level of aspirations as reflected in one's degree of need satisfaction also has a direct bearing on one's behaviour. According to Maslow (1954), human needs are organised in a series of levels—a hierarchy of importance :

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

The first three of these needs, viz., physiological, safety and social, may be grouped into lower level needs, while the remaining two, viz., egoistic and

self-fulfillment, as higher level needs. Usually as soon as one need is satisfied, need at the next higher level beigns to dominate human behaviour. Thus, the lower level needs cease to act as motivators of behaviour once satisfied. While seeking satisfaction of lower level needs motivates people to behave positively, their non-satisfaction has an adverse effect on their attitudes, and instigates them, individually or collectively, to defeat the organisational objective. The higher level needs, on the other hand, are rarely satisfied, and people seek their satisfaction indefinitely once they become significant to them. However, these do not appear in any noticeable way until the lower level needs are reasonably satisfied.

Again, people with different personality orientations, viz., need for achievement (*n ach*), need for affiliation (*n aff*) and need for power (*n pow*) reflect different patterns of behaviour. The behaviour of a person high on *n ach* is oriented towards himself and his own success. He works hard to excel and has tremendous capacity to take initiative, assume responsibility and show results. He would be most effective in an environment which provides for autonomy, recognition and personal growth. However, behaviour of an individual high on *n aff* is likely to be more people oriented. He would be most effective in an environment which recognises human dignity and people's potential to learn, create and achieve. He works best in situations requiring people's involvement and cooperation. But the behaviour of one high on *n pow* tends to be dominating. He makes use of pressure and threats in his relationship with others. This type of personality may not be appropriate for effective working of modern organisations.

The informal groups at work have a significant impact of people's attitude and behaviour. These arise spontaneously out their informal interactions facilitated by some common cause or other integrating factors like region, caste or religion; or age, sex or seniority factors not reflected in the organisation chart, but prevalent in a formal organisational setting. Besides acting as an agency of social control and an effective means of communication, these groups provide alternate means for need satisfaction. The groups provide security to the members against arbitrary/discretionary decisions/actions of management by adopting and enforcing their own norms of conduct and behaviour. These also satisfy members's social needs by providing opportunities for belonging, for association and for acceptance/respect by their fellows. Similarly, these help satisfaction of psychological needs by providing (a) dignity, status, self-respect, psychological security and satisfaction through participation (b) outlet for the frustrations of industrial employment and (c) use of skills and abilities negated or not needed on the job.

These informal groups are not necessarily dysfunctional to the working of modern organisations. Whether these would be an asset or a liability to an organisation would depend on the approach of management towards these, on the one hand, and their cohesiveneses, nature of their own goals and their compatibility with the organisational objectives, on the other. If the existence of these groups and their constructive role in organisational working are recognised, and the management tries to strengthen their goals, the groups and their members are likely to extend their wholehearted cooperation to attain organisational objectives. On the other hand, if the members view the management as a threat to their existence as a group they will have an attitude of antagonism, resulting in dysfunctional behaviour.

The behaviour of people as members of informal groups is also determined by group cohesiveness, viz., the degree to which the members would stick closely to group values and norms. It has been observed that a cohesive group is likely to exhibit greater teamwork, gain greater social satisfaction from working together, have higher morale, less turnover and absenteeism than a group which lacks cohesion. The degree of compatibility of group goals with the organisational objectives. and internalisation of the latter by the group would also influence the nature of behaviour on the part of the members.

**Institutional Forces**

Two of the interacting institutional factors influencing work behaviour are quality of work life and the organisational environment. While the former

depends on the degree of humanisation of work through appropriate integration of technical and human elements of production, the latter would depend on the managerial climate, personnel policies and practices, quality of leadership and communication within the organisation.

People are not only interested in equitable pay packets, but also in the quality of work life. Although the nature of technology largely dictate the type of work organisation possible, the human element remains an equally active and vital force to make any venture a success. Thus, what is important to elicit positive behaviour, while taking care of the technological imperatives, is the extent to which human dignity, needs and potentials have been recognised in work design, and an environment created which is not only physically pleasent to work in but which also provides for satisfactory work relationship, and for opportunities, involvement, achievement and personal growth.

On the other hand, managerial climate as a constituent of overall organisational environment has immense relevance for the behaviour of people. Like individuals, every organisation, over a period of time, develops a culture, traditions, norms and standards. It is these which set the expected behaviour pattern within the organisation, conformity to which is recognised and rewarded; while deviations, discouraged often punished. The managerial climate itself is reflected in, besides other things, the quality of rules, regulations and procedures, the way these are formulated and interpreted and the extent to which these are implemented. For instance, if the rules, regulations and procedures are perceived as fair and equitable, and are seen to be facilitators rather than hinderences, and to be implemented earnestly, people will develop trust and confidence in the organisation and respond positively to its needs and objectives. However, vague, complex and/or discretionary rules, regulations and procedures and their bureaucratic interpretation and enforcement are likely to be dysfunctional, leading to apathy, and sometimes even negative behaviour.

There is a direct correlation between behaviour and the quality of human resources in an organisation, the latter largely determined by the nature of personnel policies and practices. For instance, a scientific selection process, opportunities for development and equitable remuneration integrate human needs, capabilities and potential with organisational objectives, requirements and expectations. This will bring about a higher degree of commitment and positive behaviour; on the other hand, whimsical personnel policies are likely to have a depressing and negative impact on people's morale and behaviour.

Again a manager gets the type of behaviour from his subordinates he deserves in terms of his own leadership orientation. An employee/relationship oriented manager adopts a leadership strategy based on the acceptance of human dignity and competence and aims at building effective work teams/groups with high performance goals by providing appropriate guidance, support and motivation. Such a manager is likely to have a favourable impact on his subordinates' behaviour. On the other hand, a job/task oriented manager is more concerned with production even at the cost of human dignity, needs and interests. He tries to get work done by making use of pressures, and if needed, threats. He is totally unconcerned with the impact of his leadership strategy on the morale, attitudes and behaviour of people in the long run.

The quality of communication within the organisation is yet another critical force having a bearing on people's behaviour. An open and appropriate communication system makes one aware of one's obligations/rights/benefits/privileges, points of weakness and strength; and highlight the opportunities and challenges available. It also facilitates quicker recognition of one's capabilities.

**Incompatibility and Maladjustment**

The state of discipline in any organisation at any point of time would depend on the nature of mix of people's characteristics and institutional forces. It should, however, be noted that the opposite of discipline is not necessarily indiscipline, but just no-discipline. Similarly opposite of indiscipline is not necessarily discipline, but only no-indiscipline.

Thus, between discipline an indiscipline there may be a state of no-discipline/no-indiscipline. While discipline elicits a positive response a no-discipline/no-indiscipline situation may result in an attitude of apathy/indifference. Indiscipline results in negative behaviour. Also, while no-discipline/no-indiscipline may be reflected in a high rate of absenteeism, turnover or an increased number of grievances or disputes, the state of indiscipline may have a different way of manifesting itself—as for instance in the conscious or unconscious violations of organisational rules, regulations and procedures, as well as its norms and expectations. It may even result in industrial action.

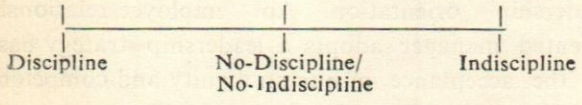


Fig. 2 Discipline—Indiscipline Continuum

The contributory causes of maladjustment and no-discipline would vary in different situations. A situation in which people's characteristics are positive and institutional forces negative, would be dysfunctional because the organisation would not be in a position to make proper use of people's capabilities. The reverse situation where institutional variables are positive but people's characteristics negative, would be equally frustrating, because people would fail to keep pace with the organisational requirements and expectations, leading to a state of no-discipline or even indiscipline. However the situation would be still worse where both the people and institutional dimensions are negative. There is likely to be confusion and chaos all around reflecting a lack of commitment on the part of the people and arbitrary/discretionary use of authority and control on the part of management.

**Need for a Diagnostic Approach**

In the organisations, the state of no-discipline/no-indiscipline is generally either ignored or not deemed worthy of corrective steps. However if any act of indiscipline is noticed, it is magnified; managers get emotionally involved and tend to blame the people, in this process ignoring the institutional variables. Consequential remedial actions, therefore, fail to yield the desired results.

What is needed is a meaningful/realistic approach towards discipline. Our strategy has to be adopted to the speciffc needs of each situation. This calls for continuous assessment of people's characteristics and institutional variables, proper diagnosis of the imbalances between them, if any, and immediate appropriate remedial action before these result in a pathological condition. Thus in a situation in which people's characteristics are positive but institutional forces, negative, an attempt should be made to develop the necessary infrastructure and environment that would not only recognise human dignity, capabilities and potential, but also motivate them to work productively, cooperatively and with economic, social and psychological satisfaction. It calls for an improvement in the quality of work life and also in the overall organisational environment, as not only directly reflected in institutional priorities, allocation of resources and practices but also as perceived by the people working for the organisation.

An appropriate quality of work life depends on the proper integration of the technical and human aspects of work. Thus while serving the technical requirements of the job, the human needs, interests and aspirations must be taken care of. No doubt, a pleasant and healthy work setting would have a favourable impact on the attitude and behaviour of people at work. but these would be more effective if associated with the tasks which are recognisable and meaningful for those who perform them; provide for satisfactory relationships; create a sense of responsibility and provide opportunities for achievement and personal growth.

Again, to be most effective, the appropriate quality of work life has to be supplemented by a favourable organisational environment as reflected in a conducive managerial climate, progressive personnel policies and practices and suitable leadership and communication strategies. The managerial climate conducive to the effective working of modern organisations would help to establish a work culture based on such norms and values which, while being fair and equitable, not only recognise people's capabilities, potential and achievements, but also encourage excellence, innovations and personal growth. The progressive personnel policies and practices, particularly relating to selection,

| | | People's Characteristics | |
|---|---|---|---|
| | | Positive | Negative |
| Institution Forces | Positive | Perfect Adjustment, Discipline | Maladjustment, No-Discipline/ Indiscipline |
| | Negative | Maladjustment, No-Discipline/ Indiscipline | Confusion and Chaos, No-Discipline/ Indiscipline |

Fig. 3 State of Discipline

development and remuneration would facilitate optimisation of the human assets by obtaining, retaining, and utilising the best of talents. Similarly, supportive leadership through the greater involvement of people would create a high degree of commitment and dedication on the part of the latter towards work and the organisation, while a systematic, proper and appropriate communication system would remove many of the misperceptions and misgivings in organisational relationships, and facilitate better integration of people—as individuals and as members of the informal groups—with the organisation.

On the other hand, in a situation involving positive institutional forces and negative people's characteristics, the managerial strategy has to be more people oriented. While retaining and strengthening plus points on the instititutional front, the organisation has to recognise and promote positive qualities in human nature and the constructive role of informal groups. The personal traits, orientations and attitudes are not necessarily inherent in human nature, but are largely products of the processes of socialisation, and experiences in life. Although the basic personality traits and attitudes are already largely developed in people by the time they take up jobs, the scientific processes of selection, initiation and developments go a long way in helping them to review, in the light of the changing realities, their own perceptions, and acquire those qualities which are more compatible with the organisational values and norms of behaviour. Thus, a supporting organisational infra-structure and environment would, while discouraging undesirable traits like antagonism, hostility, resistance, defiance, uncooperative attitudes and unrealistic points of view, not only recognise and re-inforce but also promote desirable qualities like loyalty, enthusiasm, drive, commitment, acceptance of responsibility and self-confidence, on the one hand, and the spirit of achievement, excellence and personal growth, on the other. Similarly, the management would have to recognise the existence of people's informal groups and integrate them with the organisation to make use of their positive dimensions in the latter's working.

An organisational situation with both negative people's characteristics and institutional forces, however, calls for all the more vigorous efforts on the part of the management to facilitate a transition from confusion and chaos to discipline by taking a more positive approach towards people and their needs, interests and aspirations, at the same time adapting a progressive strategy to integrate these with the values, norms and priorities of the organisation.

Thus, irrespective of the nature of the situation, the responsibility for the state of discipline in any organisation rests with the management. The promotion and management of discipline would depend on a proper diagnosis of the needs of each situation and appropriate measures to deal with specific imbalances and maladjustments between the people's characteristics, on the one hand, and the institutional forces, on the other.

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# Experiences of the Integrated Rural Development Programme: Some Policy Implications

J.S. Sodhi

*How effectively are IRDP schemes implemented? The author cites a number of micro and macro level studies, including the one that he carried out in Bhandara District of Maharashtra, to illustrate the loopholes that currently exist. He also prescribes a number of measures to overcome them, all designed to increase the involvement of officials entrusted with the implementation.*

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The objective of this paper is to present an incisive view of the Integrated Rural Development Programme (IRDP) as revealed by a number of micro and macro level studies. In addition, a case study on the programme, conducted by the author in Bhandara district of Maharashtra is also presented. The paper presents a comparative analysis with the help of findings of some of the important studies (Appendix 1) on the subject. Since the Eighth Plan is under formulation, such an analysis is expected to help in clearly focussing the issues involved.

## The Bhandara District Study

A study was conducted in six blocks of the Bhandara district in Maharashtra. The field work was undertaken in April 1986. Based on stratified random sampling, a sample of 252 beneficiaries was selected. Personal interviews were held with the head of the beneficiary households in their village. The primary data so generated was supplemented by the informal interviews with the concerned officials.

### *Identification of households*

IRDP guidelines stipulate that the identification of households was to be completed with the help of a survey of the housholds below the poverty line. Any household with an annual income of upto Rs. 3,500 was eligible to be categorised as below poverty line. Accordingly in Bhandara district, the identification of households was completed through a survey in June 1982. The survey was conducted by the teachers and

the village level workers of the state government agencies. After the survey, the list of Below Poverty Line (BPL) families was prepared by the District Rural Development Agency (DRDA) officials. The survey obtained information regarding the income levels of the households and their preferences for various schemes. The identified beneficiaries and other members of the village community made the following observations regarding the survey :

(i) The teachers involved in the survey were not adequately trained for the job. The responses were elicited by them on a small printed card and no worksheets were attached for calculating the net income of the households.

(ii) The village community was not aware of the purpose of the Survey.

(iii) The Survey was done in haste.

These findings are confirmed by some earlier studies in Maharashtra and other parts of the country. The study in Satara reported that the enumerators never received any guidelines from the block level authorities (Sodhi, 1987). The Report of Thane highlighted that the functionaries involved in the survey were not aware of any instructions in this regard (Aranha and Kaundinya, 1985). Other reports found similar weaknesses in the identification of households through the survey (NABARD, 1984; PEO,1985). The only notable exception seemed to be Rajasthan where all the preparatory work was done by May 1980 (Ahuja, 1983).

Lack of adequate training and poor commitment on the part of enumerators resulted in large scale inclusion of ineligible households and the exclusion of eligible ones in the BPL list. In Bhandara district, 56 per cent of the sample beneficiary households had an annual income above Rs. 3,500 at the time of survey. More than half of the households were, therefore, ineligible and as such should not have been included in the BPL list. These results are strengthened by the findings of studies in other districts. The proportion of ineligible housholds was found to be 26 per cent and 15 per cent respectively in the two major studies (PEO, 1985; NABARD, 1984). The evaluation reports of Thane and Satara revealed that the percentage of those wrongly selected was 40 per cent (based on the fact that the beneficiaries were the farmers, who were owning 5 acres and above land) and 45 per cent respectively (Aranha and Kaundinya, 1985; Sodhi, 1987). Similarly, in one of the districts of the South, one study found that 21 per cent of the sample beneficiaries were wrong selections (Centre for Development Studies, 1983).

Comprehensive policy guidelines, therefore, need to be formulated now for proper identification of the households below the poverty line. The BPL list may be modified by the DRDAs. The data must be gathered afresh through a door to door survey. The survey should be conducted every year to include newer entrants to the poverty line and also to exclude those who have crossed it. Equally important is to impart appropriate training programmes for the enumerators.

*Coverage of households*

*Poorest of the poor* : In the selection of the households, an important issue is the adoption of the Antodaya approach in the implementation of the IRD programme. The data on the income-wise distribution of all the beneficiaries in Bhandara district was not available and, therefore, the sample beneficiaries data has been used to highlight whether or not the poorest of the poor have been assisted at the first instance. Our study in Bhandara district revealed that there was no beneficiary households whose income was less than Rs. 1,000 p.m. (Table 1) although according to the BPL survey, there were 18 per cent (35, 792) households, whose total annual family income was below Rs. 1,000. The Antodaya approach was, therefore, completely ignored in the district, while implementing the programme.

In other districts too, the poorest of the poor were not necessarily the first and always in a minority among the beneficiaries (PEO, 1985). The Thane district study found that the proportion of landless workers was marginal, implying thereby that the poorest were not selected (Aranha and Kaundinya, 1985). In Delhi, only 6.6 per cent of the sample beneficaries were the poorest of the poor with a

TABLE 1 Coverage of the Poorest of the Poor in the IRD Programme

| Name of the study | Number of Households with annual Income | |
|---|---|---|
| | Upto Rs. 1500 | Others |
| Bhandara | Nil* | 252 |
| PEO | 178 (20.5) | 690 (79.4) |
| NABARD | 480 (31.8) | 1487 (68.2) |
| Jaipur* | 28** (7.3) | 355 (92.7) |
| Quilon | 15 (28.8) | 37 (61.2) |

* Household income upto Rs. 1,000 per annum.

** Number of households upto a per capita income of Rs. 200 per annum.

Figures inthe parentheses represent the horizontal percentages.

household income of upto Rs. 1,500 (Sudan, 1984). The studies in Akola, Satara and Sawai Madhopur also strengthen the finding that the poorest of the poor were not given assistance at the first instance (Sodhi 1985; 1986; 1987). The programme meant for the poorest, therefore, did not reach them in adequate numbers and they were not accorded the priority envisaged in the guidelines.

For the selection of the poorest of the poor, a conscious policy effort now needs to be made. Beneficiaries seemed to have been selected on a first come first served basis. These are generally the better off sections from among the households below the poverty line. Despite the procedure of selecting the households in the Gram Sabha meetings, even in the earlier Antodaya programmes, many of the beneficiaries did not come from the poorest section (Pant, 1981). Since the poorest of the poor do not come forward on their own, the authorities need to give them assistance through deliberate efforts.

*Scheduled Castes and Tribes*: The coverage of Scheduled Castes and Tribes has been accorded a high priority in the IRD programme. The Government of India had laid down that 30 per cent of the households, assisted under the IRD programme, must belong to these categories. In Bhandara district, our study found that 40 per cent of the sample beneficiaries were from the Scheduled Castes and Scheduled Tribes (Table 2). The total coverage, accoring to the Planning Commission's study, was about 32 per cent (22.5 per cent SC's and 9.2 per cent ST's). Area wise, the coverage was less than expected in some of the hill districts and the agriculturally less developed districts (PEO, 1985). Other studies showed that the coverage was 27 per cent in Quilon (Centre for Development Studies, 1983), 25 per cent in Tirunelveli and Periyar districts (Canara Bank, 1987), 47 per cent in Hyderabad (State Bank of Hyderabad, 1983), 58 per cent in Jaipur (Ahuja, 1983), 26 per cent in Satara (Sodhi, 1987) and 42 per cent in Sawai Madhopur (Sodhi, 1986). Only one study found an exceptionally low coverage of 4 per cent among the sample beneficiaries (NABARD, 1984). The programme, therefore, mostly gave adequate coverage to the Scheduled Castes and Scheduled Tribes population.

*Bonded Labourers*: Another aspect of the coverage of the poorer sections of the BPL households related to the special directive of the government, to integrate the IRD programme with the schemes for rehabilitation of bonded labourers. None of the studies, however, has looked into this aspect and our enquiries in Bhandara district did not yield any information, because there was no information with the DRDA. It is, therefore, difficult to assess whether the bonded labourers have at all been included in the IRDP and to what extent. Even the data on the all India coverage did not yield any information on this aspect.

*Planning at the block level*

The IRDP involves meticulous planning at the block level. The block plans are expected to ensure optimum utilization of social resources, integration of various on-going programmes being implemented by different departments and formulation of development plans with the objective of providing economically

TABLE 2 Coverage of Scheduled Castes (SC) and Scheduled Tribes (ST) among the IRDP beneficiaries

| Name of the study | No. of households* | No. of households belonging to | | | |
|---|---|---|---|---|---|
| | | SC | ST | SC and ST | Others |
| Bhandara | 198697** | — | — | 81173 (40.8) | 117524 (59.2) |
| PEO | 1170* | 343 (29.3) | 127 (10.8) | 470 (40.2) | 700 (59.8) |
| NABARD | 2058296 | — | — | 890995 (43.3) | 1167301 (56.7) |
| Parbhani | 31659** | — | — | 5903 (18.6) | 25756 (81.4) |
| Jaipur | 380** | — | — | 230 (60.5) | 150 (39.5) |
| State Bank of Hyderabad | 310 | 113 (36.4) | 28 (9.0) | 141 (45.5) | 169 (54.5) |
| Quilon | 128 | 31 (24.2) | Nil | 31 (24.2) | 97 (75.8) |
| Tirunelveli & Periyar | 60 | — | — | 15 (25.0) | 45 (75.0) |
| Delhi | 9628** | — | — | 2914 (30.3) | 6714 (69.7) |

* No. of beneficiary households.
** Total number of eligible families for IRDP benefits.
Figures in the parentheses are the horizontal percentages.

viable activities for the rural poor. The IRD block plan has necessarily to be linked with the development programmes of other departments which would eventually be a component of the comprehensive plan.

The IRD block plans are expected to be prepared in two stages: (i) A five year development profile or a perspective plan and (ii) An annual action plan.

In Bhandara district our study found that the authorities had not prepared the five year perspective block plan. The field team was told that this was due to the fact that the DRDA was set up only in the middle of 1982 i.e. more than a year after the issue of guidelines for preparation of a block plan (1980-85). Due to this time lapse, the DRDA authorities in Bhandara felt that it would not be useful to undertake the perspective plan exercise. Therefore, only the annual action plans were prepared. For preparing the annual block plans, the DRDA authorities collected statistical information from the blocks and held discussions with the block and bank representatives. Approval of these plans was then sought at the state level Consultative Committee. In addition to the preparation of annual plans, the lead bank of Bhandara district had also drawn up a detailed district credit plan for 1983-85.

The experience of other evaluation reports also showed somewhat similar results. The remarks of the study by the Planning Commission (PEO, 1985) are:

(i) The exercise of perspective plan was not attempted in about half of the studied states.

(ii) Even where this exercise was taken up, it covered only few districts within a state.

(iii) Instead of formulating the perspective plans on the basis of families or the cluster of villages, the DRDAs have divided the physical and financial targets into the existing blocks irrespective of the size, population and potential for development.

The PEO study further stated that all that the DRDAs seemed to be interested in was to make provisions of the credit to be obtained from the banks and no careful exercise had been attempted for the successful implementation of the programme.

Our study in Bhandara district found that the factors which contributed to non-preparation of the perspective plans were (i) lack of training and guidance for the preparation of block plans (ii) non-involvement of the commercial banks at the planning stage (iii) lack of data for preparation of such plans and (iv) the indifference of the DRDA officials towards the preparation of perspective plans.

The preparation of the block plan is probably the only method of ensuring that the IRD programme becomes a truly developmental endeavour. The steps indicated in the preparation of the plan are comprehensive enough and it may be advisable to follow them even now.

*Time Lags*

Two important criteria to judge the efficacy of the implementation machinery are: the gap between applying for assistance and its sanction, on the one hand, and the sanction and disbursement of the assistance on the other. In Bhandara district, our study found that the average time gap between submitting the application and getting it sanctioned was 2.8 months and the receipt of the assistance was delayed by another two months. The average time taken for getting assistance after submitting the application was therefore about five months (Table 3a – 3e). The authorities had hoped that the time required for clearing the application and giving assistance would not be more than ten weeks. The time taken in Bhandara, therefore, was very high.

The State Bank of Hyderabad study has given more details about the time taken at various stages of giving assistance. The time from identification to the preparation of application was 70 days, the time taken in the BDO's office in sponsoring the application to the banks was 50 days and the banks took, on an average, 34 more days for sanction and another 24 days in releasing the loan (State Bank of Hyderabad, 1984). The Jaipur study found that the time taken between the date of application and disbursement of loan was less than 40 days for 43 per cent of the beneficiaries and 40 to 80 days for 30 per cent of the beneficiaries (Ahuja, 1983). In Satara district, the time taken between application and sanction was about three months (Sodhi, 1987).

TABLE 3a **Households at various stages of obtaining assistance**

(Percentage of Households)

| Months | BHANDARA | | | PARBHANI |
|---|---|---|---|---|
| | Between submission of application and sanction | Between sanction and obtaining the assistance | Between submission of application and obtaining assistance | Between submission of application and getting assistance |
| Upto one | 2.4 | 3.6 | 0.8 | 30.2 |
| 1-3 | 70.2 | 86.1 | 49.2 | 57.7 |
| 3-6 | 25.4 | 10.3 | 36.7 | 4.0 |
| 6 and above | 2.0 | — | 13.1 | 8.1 |
| Total Time Gap (Months) | 3 | 2 | 5 | |

TABLE 3b **Households at various Stages of Obtaining Assistance**

(Percentage of Households)

| Months | PEO | |
|---|---|---|
| | Between identification and sanction | Between sanction and actual provision |
| Upto one | 65.0 | 82.6 |
| 1-3 | 9.7 | 12.1 |
| 3-5 | 5.6 | 4.0 |
| 5 and above | 19.6 | 1.4 |

TABLE 3c **Households at various stages of obtaining assistance**

| Months | QUILON |
|---|---|
| | Between application and disbursement of loan (% households) |
| 0-3 | 21.2 |
| 4-6 | 23.1 |
| 7-9 | 5.8 |
| 10-12 | 30.8 |
| 13 and above | 19.2 |

TABLE 3d **Households at various stages of obtaining assistance**

| Days | JAIPUR |
|---|---|
| | Between application and disbursement of loan (% households) |
| Upto 40 | 42.9 |
| 41-80 | 30.5 |
| 81-120 | 6.4 |
| 121 and above | 20.4 |

The time lag data showed that the time taken for processing the application was much higher than the expectations. Moreover, some of the studies also showed that the community showed lack of enthusiasm in applying for assistance after getting information for the same (Sodhi, 1985; 1986; 1987). It was expected of the officials at the village and block levels that they would try to remove the misgivings of the households below the poverty line and systematically educate them about the benefits of the programme. Actual experience revealed that this was not done and insufficient information filtered to the target beneficiaries. The village level workers generally shared the information with a selected few.

TABLE 3e **Households at various stages of obtaining assistance**

| Item | STATE BANK OF HYDERABAD | | | |
|---|---|---|---|---|
| | Identification to preparation of application | Sponsoring of application by BDO to Bank | Sanction of application by the bank | Release of loan |
| Average No. of days | 70 | 50 | 34 | 20 |
| % of households | 40.2 | 28.7 | 19.7 | 11.3 |

Discussions with bank and block officials in Bhandara district revealed that the time lags were high due to a feeling of mistrust between the commercial banks and the block officials. The applications were generally scrutinised twice, at the block level as well as at the banks.

The DRDA officials generally complained to the field team in Bhandara district that there were undue delays at the banks. The experience of some of the studies in this regard showed that these are mostly due to the wrong timings of sending applications to the banks. In Sawai Madhopur district, for example, the lead bank office reported that a large percentage (over fifty) of the applications were forwarded by the blocks during January-March i.e, during the last

quarter of the year, because the blocks have to complete their yearly targets (Sodhi, 1987). The study by NABARD reported that 60 per cent of applications in a year were forwarded to the banks during the second half of the year (NABARD, 1984). In the states of Andhra Pradesh, Karnataka and Maharashtra, 41 per cent of the applications were received by the banks during the last quarter of the year (State Bank of Hyderabad, 1984). Other micro studies in Akola and Satara (Sodhi, 1986; 1987) too revealed the same trend.

*Impact on Income*

Most of the activities of the IRD programme are undertaken with a view to enhance the income level of the beneficiaries. This is the most important objective of the programme and a large number of studies have, therefore, devoted a considerable part of their analyses to the impact of various programmes on the increase in the income of the beneficiary households.

The study in Bhandara district found that the annual income of each beneficiary household had increased by Rs. 1,020 per annum due to the IRDP assistance. Programmewise, the income of the milch cattle beneficiaries had increased by Rs. 1,296 per annum. Other programmes in Bhandara district were bullock cart, piggery and goat and sheep rearing and the beneficiaries reported annual income increases of Rs. 852, Rs. 708 and Rs. 652 per household respectively. A comparative picture of the impact on income as reported by other studies is presented in Table 4.

The analysis of additional income, due to assistance, becomes much more meaningful when seen alongwith the expected incomes, the relative level of poverty and the likelihood of the beneficiary households crossing the povetry line. The estimates of the expected incomes have been prepared programmewise by the respective state governments. A comparison of the additional incomes of the beneficiaries in Bhandara with the estimates prepared by the Maharashtra Government (Guidelines on IRDP,

TABLE 4 **Average additional annual income per household (Rs.) due to the IRDP assistance**

| Study/ Schemes | Bhandara | PEO | Jaipur | Delhi | Akola | Dhule | Sawai Madhopur |
|---|---|---|---|---|---|---|---|
| Milch Cattle | | | | | | | |
| (i) One | 12961 | — | 1093 | — | 724 | 768 | 321 |
| (ii) Two | — | — | — | 3491 | 1978 | 1081 | 501 |
| Bullock pair | 856 | — | — | — | 292 | — | 1101 |
| Goat Units | 559 | — | 64 | — | 203 | — | 1096 |
| Piggery units | 1296 | — | 300 | — | 630 | — | — |
| Bullock pair and cart | — | — | 2585 | — | — | 925 | 4917 |
| Animal Husbandry | — | 1071 | — | — | 418 | — | — |
| Sheep rearing | — | — | 92 | — | — | — | 1048 |
| Camel cart | — | — | 9200 | 5920 | — | — | 3722 |
| Agricultural Schemes | — | 1105 | — | — | — | — | — |
| Dugwells | 864 | — | — | — | 700 | 1328 | 652 |
| Secondary sector | — | 1575 | — | — | — | — | — |
| Tertiary Sector (ISB) | 1272 | 2770 | — | — | 648 | 1666 | — |

Govt. of Maharashtra, 1983) showed that there were wide gaps between the expected and actual incomes e.g. the additional incomes from milch cattle was only one-third of the expected income leaving a wide gap of Rs. 2,431 per household per annum. The additional income from the bullock pair and sheep beneficiaries was only 30 per cent of the expectations.

An analysis of poverty levels showed that 54 per cent of the households were below the poverty line at the time of taking assistance. The assistance provided had helped about 24 per cent of the sample beneficiaries to move above the povetry line. It is, however, important to know that about two-third of those moving above the poverty line belonged to the higher income groups of Rs. 2,400-3,500. Only 20 per cent of the households with an initial income of Rs. 1,200-2,400 had crossed the poverty line (Table 5).

TABLE 5 **Distribution of households crossing the poverty line due to IRDP assistance**

| Name of the study | Percentage of beneficiary households crossing the poverty line |
|---|---|
| Bhandara District | 24.0 |
| PEO | 49.4 |
| NABARD | 47.1 |
| Jaipur District | 23.2 |
| Quilon District | 48.1 |
| Akola District | 42.0 |
| Dhule District | 37.0 |
| Sawai Madhopur | 40.0 |

The Planning Commision's study found that there were 75 per cent beneficiaries below the poverty line at the time of taking assistance. The assistance enabled about half of these beneficiaries to cross the poverty line. However, most of them were the relatively better-off sections within the poverty group. Among the poorest of the poor group, only 8 per cent crossed the poverty line (PEO, 1985).

The NABARD study found that a little less than half of the beneficiaries had crossed the poverty line. The study hlighlighted that the rest of the households had moved from the lower income to higher income groups but were not able to cross the poverty line (NABARD, 1984).

The Jaipur study estimated that 41 per cent of the eligible beneficiaries had moved above the poverty line. The land-based activities helped to raise more than three-fourth of the beneficiaries above the poverty line and the activity of sheep rearing helped only 1 per cent of the beneficiaries to cross the poverty line. The scheme of camel carts, bullocks and pumpsets proved to be a great success and a much larger proportion of beneficiaries, who were assisted in these programmes crossed the poverty line as compared to the beneficiaries in other programmes (Ahuja, 1983).

The studies of Tirunelveli and Periyar districts showed that out of the 70 per cent of the beneficiaries who were below the poverty line, 55 per cent were able to cross it after getting some assistance. The activities of dairy and bullock showed a much higher income than sheep rearing (Canara Bank, 1983).

The estimates of the households below the poverty line are on the basis of a household income of upto Rs. 3,500 per annum at the price level of 1979-80. If adjustments of the price level are made for the years in which the studies were conducted, the profile of households crossing the poverty line changed. The rural bank's study estimated that, if the household income is adjusted for the level of prices prevailing in 1982-83 (the year of the survey), the proportion of households crossing the poverty line declined from 47 per cent to 22 per cent (NABARD, 1982). Similarly, the Planning Commission study estimated that if the escalated value of the annual income of Rs. 3,500 was taken into consideration at the time of the survey, only 20 per cent, compared to 49 per cent, actually crossed the poverty line (PEO, 1985).

Thus, the impact of the programme has been below expactations and in real terms only about one-fifth or less could move above the poverty line. Most of

these studies have been completed during the first five years of the programme and it is also debatable if the beneficiaries will be able to maintain continuity of additional incomes from the IRDP assistance in the long run. If the experience of past programmes is any guide, it is not too unrealistic to assume that the income impact will not last long. There is, therefore, a possibility that a percentage of IRDP beneficiary households will slide back in to the poverty group.

*Concluding Remarks*

The Eighth Five Year Plan is likely to give an impetus to the IRD Programme. It is, therefore, important that the experiences of the implementation of the programme and impact are taken note of and appropriate steps taken to improve its functioning. To begin with, the list of households with the DRDA should be modified to ensure that the limited outlays of the programme are utilized for the target group only. The selection of programmes to be taken up for the beneficiaries should be based on the needs of the area and its population. Even within the programme, shortcomings will have to be removed. For example, in the animal husbandry programme, milch cattle has been identified as the main asset. Here, the quality of milch cattle needs to be improved. The provision of adequate and timely veterinary services should also be accorded high priority.

In the minor irrigation programme, a major problem has been that the works have not been completed fully. Wells must be dug up to the required depths. Attention would also have to be paid to the construction of irrigation channels to get additional incomes from renting out water. Besides the package of programmes in the broader category of the ISB needs to be strengthened with increased assistance. Only then will the programme have the potential of generating sizable incomes. In the Scheme of Training of Rural Youth for Self Employment (TRYSEM) the selection of trades should be undertaken after a detailed survey. The training component of this programmes needs to be strengthened and the DRDA authorities should help all the trained youths in getting loans from banks. The availability of raw materials and marketing channels should be one of the important determining factors while taking up specific programmes in the districts and blocks.

As things stand, the beneficiary is on his own (except when the loan has to be recovered) after the disbursement of assets. No follow-up is done on the utilisation of assistance. There is, therefore, paucity of official information on the possession or otherwise of the assets. Some of the beneficiaries we studied in Bhandara were not in possession of their assets even before the full repayment of debt. Morever, a large number of those who were in possession of assets were not utilizing them fully. The officials, were unconcerned about this aspect. and did not look for measures to improve the utilization of assistance. Regular verification of assets and their proper utilization by the beneficiaries must become an important concern of the DRDA authorities.

A significant policy change and intervention of the Government is required to raise the accountability of the officials involved in the implementation of the programme. This may be in the areas of identifying the right people, a maximum coverage for the poorest of poor, preparation of the perspective plans and maximum utilization of the assets given to the beneficiaries. The vital link with the beheficiary, may, therefore, have to be kept even after given the assistance. Training can play an increasingly important role in changing the attitude of the officials, which should now be provided at regular intervals for all the officials involved in the implementation of the IRD Programme.

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## *APPENDIX 1*—Details of Other IRDP Studies

The research studies on the evaluation of the IRDP programme were undertaken mostly during 1982-1986. They examined various aspects of the programme and an attempt has been made in the paper to compare the results wherever it has been possible to do so. A brief description of the studies referred in the text is given below.

*SATARA Study*: Evaluation of the IRD Programme, with special reference to the TRYSEM Programme. The study was conducted by the Shri Ram Centre for Industrial Relations and Human Resources, New Delhi. The field work was done in 1985-86. In the district, the study covered three blocks and 162 beneficiaries.

*THANE District Study*: The study was conducted by the College of Social Work, Bombay. The field work of the study was done in 1984. The study covered two blocks of the district, four villages and 73 sample beneficiary households.

*NABARD Study*: The study was conducted by the National Bank for Agriculture and Rural Development, Bombay. The field work of the study was done in 1983. The study covered 15 states, 30 districts, 60 blocks and 1409 sample beneficiary households.

*PEO Study*: The study was conducted by the Planning Commission, New Delhi. The field work was done in 1983-84. The study covered 16 states, 33 disiricts, 66 blocks and a total of 1170 sample beneficiary households.

*QUILON District Study*: The study was conducted by the Centre for Development Studies, Trivandrum. The field work of the study was done in 1983. The study covered one block in the district, two villages and 128 sample beneficiary households.

*AKOLA District Study*: The study was conducted by the Shri Ram Centre for Industrial Relations and Human Resources, New Delhi. The field work of the study was done in 1985. The study covered two blocks, 15 villages and 191 sample beneficiary households.

*SAWAI MADHOPUR District Study*: The study was conducted by the Shri Ram Centre for Industrial Relations and Human Resources, New Delhi. The field work of the study was done in 1986. The study covered six blocks, 77 villages and 830 sample beneficiary households.

*ALLAHABAD AND FATEHPUR Districts Study*: The study was conducted by the G. B. Pant Social

Science Institute, Allahabad in 1981, It covered a sample of 300 Antodaya beneficiaries in the two districts.

*DELHI Study*: The study was conducted by the Indian Institute of Public Administration, New Delhi. The field work of the study was done in 1983. The study covered 5 blocks, and 92 beneficiaries.

*TIRUNELVELI AND PERIYAR Districts Study*: The study was conducted by the Canara Bank in 1983. It covered two districts and a sample of 60 beneficary households.

*HYDERABAD Study*: The study was conducted by the State Bank of Hyderabad. The field work was conducted in 1983. The study was done in 19 branches of the State Bank of Hyderabad in the states of Andhra Pradesh, Karnataka and Maharashtra. The total sample of the study was 310 beneficiary households.

*JAIPUR District Study*: The study was conducted by the Institute of Development Studies, Jaipur. The field work was done in 1983. The study covered 9 blocks. 73 villages and 380 sample beneficiary households.

*DHULE District Study*: The study was conducted by the Shri Ram Centre for Industrial Relations and Human Resources, New Delhi. The field work of the study was done in 1985. The study covered two blocks, 14 villages and 179 sample beneficiary households.

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# Industrial Productivity : Some Issues Relevant for Policy Making

**Arun Ghosh**

*The author analyses the reasons that make the Indian Economy a high-cost one and recommends a two-fold solution, one of which involves a change in the internal working of industries and the other the industrial environment. The former requires a change in the work culture and the latter an increase in the competition faced by Indian industries.*

*Dr. Arun Ghosh was formerly Secretary to the Government of India and Chairman, Bureau of Industrial Costs and Prices.*

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The issue of productivity in industry is of considerable significance today. For one thing, available data appear to indicate that the over-all capital : output ratio in India has been increasing over time, implying that we have been required to make steadily larger investments to get the same volume of output. This has an adverse implication : that either the efficiency of our investment—in terms of direction of investment—has been progressively going down or that the management of our assets, our labour and our material resources has been deteriorating.

These are important issues which need to be carefully examined, for we need to adjust our broad economic policies, indeed the very basis of our planning, in the light of the answers to the questions that arise in this context. It is relevant in this connection to note that increasingly, our policy makers have been talking not of increasing the rate of investment in the economy, but of the efficiency of use of our existing assets, so that in a sense, the focus is already on the best means of raising efficiency. It is for this reason that attention is today focussed on the liberalization of industrial (and import) policy, liberalization of technology import, and modernization of the industrial structure.

These are all important measures. However, it is possible that in our anxiety to find a quick answer to the problem of the present low level of productivity in Indian industry, we are missing the wood for the trees.

The phenomenon of increasing capital: output ratio is one that needs to be further analysed. For one

thing some increase in the capital: output ratio is inevitable when a large proportion of the investment is for the development of infrastructure facilities. Roads, rail transport, power supply, communications, all have a high captial : outpul ratio. Indeed, for facilities like roads, there is no direct output arising from investment. The increase in output comes from the increased economic activity that follows from the availability of better roads and communications. And to the extent that investment in infrastructure has been a major area of thrust in the plan, some degree of increase in the over-all (incremental) capital : output ratio is inevitable.

**Gestation Period**

But there is also an unfortunate side to this development. The gestation period of our investments is needlessly high. In fact, the period of construction of our projects has been getting increasingly prolonged in recent years. To some extent, of course, infrastructure projects may be expected to have a somewhat longer gestation period than specific industrial projects—dams, roads, railways and communication systems take longer to complete than, say, a flour mill or a textile mill. But then, even by the normal standards of the former, the gestation periods of our projects are far too long.

To the extent that the gestation period of new investments is longer then warranted, the capital: output ratio is bound to be higher than it ought to be. In the first place, delays in construction tend to increase capital costs, both because of escalation of prices over time and because of the higher accumulated interest during construction period which has to be capitalized. Secondly, at any given point of time, there is an accumulation of unfinished projects, and past investments on them do not give the output that could be expected from them. Hence in an over-all sense, the capital; output ratios keep on increasing merely because of delays in project construction.

How serious the problem has become, of late, can be judged from two sets of data. According to the annual report of the Ministry of Programme Implementation, as of 31 March 1987, considering only central government projects, each of a minimum value of Rs 20 crores, the *total* cost of unfinished projects (excluding those likely to be completed during 1987-88) was approximately Rs 73,500 crores: what is worse, some of the projects have been under construction for as long as 13 years. Secondly, a specific project like the Visakhapatnam Steel Plant, which is now expected to be commissioned by 1990-91, would have taken some thirteen years to complete as compared to, say, the Pohang Steel Plant in South Korea which took 30 months to complete, and indeed our own Bhilai Steel Plant (first phase) which was commissioned in about there and a half years from the commencement of construction.

What are the *causes* for such delays in construction of projects? The Economic Administration Reforms Commission (EARC) found that our financial procedures are responsible to a great extent for the present state of affairs. It cited the example of the Kudremukh Iron Ore Project (involving an investment of some Rs 700 crores) which was completed ahead of schedule, merely by changing the procedures for the allocation of funds for project implementation, and by giving the project authorities both the responsibility and the power to speedily implement the project.

**Incomplete Projects**

A second point that arises—to which the EARC did not understandably devote any attention—stems from the very large number of unfinished projects in hand, all of them competing for the limited financial resources available with the government for project implementation. If, as per the annual report of the Ministry of Programme Implementation, the total investment needs in the future involved in all major central government projects is Rs 73,500 crores, and if one assumes that the future needs of funds would be half this figure, or, say, 50 per cent of the total investment involved, the pending projects alone would require some Rs 37,000 crores to complete. This is a figure derived merely on the basis of a statistical probability, and not by adding up the future requirement of funds for all pending projects, and would, therefore, be subject to error. The figure does not, however, include large projects approved recently, like the Narmada Valley Project, the cost of which is currently estimated at Rs 15,000 crores over a period of some 20 years.

What is significant here is the enormity of the total amount of funds required, especially in the light of the paucity of resources with the government. Sanction of funds in driblets is only likely to escalate the cost of all projects, delay their completion and accrual of benefits thereof, and raise the over-all capital output ratio for the economy as a whole.

What is obviously required in such a situation is action on three fronts: first, the maximum economy, indeed austerity, in the matter of current administrative expenditures by government; secondly, a deliberate moratorium on new project starts until at least the more significant of the pending projects is completed; and finally, a thorough screening of all pending projects and their prioritization, so that the more important of them can be quickly completed. This last task cannot be the responsibility of any one ministry or department and can be undertaken only by an authority like the Planning Commission. Unfortunately, the very tough decisions necessary in this context are somewhat difficult in practice, because of sectoral or local pressures.

As indicated earlier, the increasing capital : output ratio in the economy as a whole is a major cause for concern in any study of industrial productivity; and a systematic drive to lower the capital : output ratio by speedy completion of projects would have the immediate result of (a) reducing the burden of capital servicing cost in respect of infrastructure facilities, and (b) making available the benefits of better infrastruture facilities, sooner rather than later. Apart from the direct impact (on the over-all capital : output ratio, through a lowering of the capital cost), improvement of the infrastructure is likely to have a directly beneficial role on industrial productivity.

**Infrastructure : Power**

Infrastructure costs in India are today inordinately high, and impinge on industrial costs heavily when compared internationally. The high proportion of infrastructure costs to total costs raises over-all industrial costs. For example, power costs in India have been escalating rapidly in recent years, and high power costs tend to raise over-all industrial costs. Moreover factors like irregular supply, tripping, voltage fluctuations and restrictions on peak hour loading may raise industrial costs from anything between 10 per cent in normal circumstances to as much as 20 per cent or more in certain exceptional circumstances.

The above figures are startling, but are based on diverse studies on the subject, and are not difficult to demonstrate in broad terms. Inadequacy of power supply has increasingly led industry to rely on relatively less efficient captive power generation; and frequently, the cost of such power is something like twice the cost of power from the grid. Assuming that power costs are, say, 10 per cent of the total cost of an industrial undertaking, and assuming that the unit has to provide 50 per cent of its base load from captive generation, the total power cost would jump from some 10 per cent to 15 per cent of the total cost. It is relevant to note that recently, the government has made it obligatory for large new industrial undertakings to provide for a minimum of 33 per cent of power on a captive basis, with the recommendation that project authorities would be well advised to provide for a higher percentage of their power requirements on a captive basis.

The cost of power tripping, of voltage fluctuations and of unscheduled power shedding can be quite high; and depending on the industry, the impact on costs considerable. Two examples may be given; in one instance, in an aluminium manufacturing unit, the molten metal got congealed in the "pots" where alumina is refined into molten aluminium, requiring a shutdown of the plant and indeed, the replacement of the "pots", involving not only loss of production but also additional capital investment to salvage the plant. In another case, in a plant manufacturing antibiotics, entire batches of the antibiotics—in the process of being manufactured—had to be thrown out periodically because of "contamination" arising from power tripping. The costs have never been quantified but are certain to be quite heavy.

In many operations, restrictions on peak load demand have had the effect, according to one recent study, of raising costs by anything from 5 to 10 per cent. True, these costs are not all cumulative. But for continuous process industries, especially metallurgical and chemical industries, the costs of poor

*quality* of power supply can be quite high as indeed illustrated by the case of the pharmaceutical industry.

These are extreme examples, where the inadequacy of power supply could lead to increases in unit costs by 20 per cent or even more. More typically, a 10 per cent increase in unit cost because of the inadequacy as well as the unevenness of power supply is quite common. The inadequacy of other infrastructure facilities, by way of transport and other facilities can also increase industrial costs significantly. It is known, for instance, that uncertainties of transport compel the management of industrial undertakings to keep much larger inventories than necessary (or maintained in other countries). With the cost of money as high as it is today, an increase in inventories from say fifteen days' requirements of production (as normal abroad), to three to six months' stocks (as customary for many industries) can have a major impact on the cost of inventories, and therefore on total costs. If material costs are, say, 50 per cent of total costs, six months' inventories—as compared to one months' inventory of materials—may lead to an increase in inventory costs by more than 20 per cent.

It would, therefore, be recognized that "externalities" are a major factor in the present high cost structure of Indian industry; and any improvement in the infrastructure facilities available can help to bring down industrial costs quite sharply. This is a point which needs to be kept in mind in the formulation of policies for increasing the efficiency and productivity of industry.

**Internal Management**

While "externalities" are important, internal management is no less so; and perhaps it would be correct to state that the management of men, materials and finances in most industrial undertakings in India today leaves much to be desired. Indeed, it has become quite fashionable today to blame labour and overmanning for the present high structure of industrial costs, and this view is constantly put forward not only by spokesmen of industry but also by many policy makers. It is necessary to put this issue in its proper perspective.

Efficiency of production may be said to depend on three factors : efficiency in the use of capital; efficiency in the deployment of labour; and efficiency in the use of materials (and power) in the process of production. (Proper use of by-products falls under the last category.) We have, in part—though only in part—looked at the problem of efficient use of capital. Efficiency in the use of labour and materials involves both labour participation and good management. Indeed, even in regard to labour participation, management has a heavy responsibility, for instance, by imparting the required skills through on-the-job training, better work environment, and other means.

One should not, of course, deny the problems created by a rigid policy of "no retrenchment"; most of all, this engenders in the management a feeling that modernization should not even be attempted because of the reluctance of labour to adapt itself to new equipment and new tasks. Because of the difficulty of retrenchment, many managements have argued that modernization may lead to the employment of *more* labour rather than less. The jute industry is a classic example of absence of modernization because of a somewhat rigid policy as to labour. Nonetheless, barring one or two such extreme examples—especially in "sunset" industries—the role of labour policy in the present high cost structure of industry is much exaggerated.

Take the case of the steel industry. Here, employment of labour per tonne of steel produced is the highest in the world, in fact several times the employment of labour per unit of output in other steel producing countries. Nevertheless, it still remains true that in India, labour cost as a percentage of the total cost of production of steel varies between only some 12 and 15 per cent (in the case of the plants under SAIL). Further, next to South Korea, Japan and Brazil, labour costs per tonne of steel are still lower in India than in all other steel producing countries. In fact, inadequate maintenance—for which management must be made squarely responsible—and suboptimal use of materials have been responsible for much the greater part of capacity underutilization and inefficiency of production, observed in Indian industry.

It is in the overall management of all available resources of men and materials that our capacity utilization (as well as the quality of product) declines, and costs go up. It would be useful, in this context, to cite some figures and to illustrate how the laxity of internal management has led to both a steady decline in industrial productivity and to the continuance of high industrial costs in India.

Take again the example of steel plants. Part of the problem arises from poor maintenance and inadequate replacement, which are management responsibilities. More specifically, the yield of hot metal per cubic metre of available blast furnace capacity per day, is a standard index of productivity at an important stage of steel production in an integrated steel plant. This output depends on a large number of factors in which the ash content of coke and the iron content of the iron ore, as also the size and design of the furnace have a bearing. But the more important factors are uniformity of the input mix, the timely input of different materials, control over the furnace temperature, top gas pressure, and a host of other factors within the purview of shop floor management. When the Bokaro Steel Plant was commissioned in the seventies and had only one blast furnace, it attained an output of 1.3 tonnes of hot metal per cubic metre of blast furnace capacity per day. This parameter (at Bokaro) over the past several years (until 1984-85, the latest year for which published data are available) has been as follows :

| 1980-81 | 1981-82 | 1982-83 | 1983-84 | 1984-85 |
|---|---|---|---|---|
| 0.83 | 0.89 | 0.82 | 0.86 | 0.90 |

The comparable figures for the Tata Iron & Steel Company are of the order of one tonne per cubic metre of capacity per day. One has to note in this context the much older vintage of TISCO blast furnaces. The comparable figures for the other steel plants during 1984-85 are :

| *Bhilai* | *Durgapur* | *Rourkela* | *IISCO* |
|---|---|---|---|
| 0.90 | 0.62 | 0.70 | 0.59 |

The answer to the riddle lies in maintenance (the IISCO and Durgapur being sadly neglected plants), and the management of the available materials in a manner conducive to maximizing the yield rate. (It may be surmised that productivity would have sharply increased in the steel plants during 1987-88, since output has increased quite singificantly). The sharp variations not only from one plant to another but also in the same plant from year to year indicate differences in the quality of management. It should be noted here that the blast furnace productivity in Japan and South Korea has now reached around 2 tonnes per cubic meter of capacity per day; during the seventies, the same blast furnaces in Japan gave an output of some 1.2 tonnes per cbm/day. In other words, improvisations with regard to inputs (eg. use of greater sinter burden), control over input feed so as to ensure uniformity of inputs, electronic control over temperature inside the blast furnace as well as the application of top gas pressure and other technological innovations have brought about the observed improvement in productivity. All these are factors within the control of management.

Power consumption is an important index of management innovativeness and efficiency; and Indian industry has been notorious in regard to the excessive use of power per unit of output. Aluminium smelting illustrates the problem vividly. In India, power consumption per tonne of aluminium produced varies between some 18000 kwh and 20000 kwh. The figures in respect of the National Aluminium Company (NALCO) (based on the latest technology) are not available, but the foreign collaborators of NALCO, namely M/s Pechinay of France, have achieved a power consumption of some 13500 kwh per tonne of aluminium. While to some extent, plant design is responsible for this state of affairs, management of the plant as well as the quality of power available can make a big difference to the total consumption of power in an aluminium plant. With the cost of power accounting for a very large part of the final cost of aluminium production, a 50 per cent increase in the total quantum of power consumed (per tonne of aluminium) can make a big difference to the final price of the metal.

Such examples abound in all industries. The cost

of power (in 1981) per tonne of cement produced varied from Rs 22.1 to Rs 64.6 in various cement plants in India; the total energy consumed varied from 3.671 gega calories to 6.636 gega calories per tonne of metal produced by different steel plants (in 1980-81); again the total energy consumed (by way of coal, electric power and furnace) per tonne of white printing paper varied from 9.3 billion kilo calories to 23.05 billion kilo calories (the international standard being something like 4 billion kilo calories). In the sugar industry, the cost of sugarcane varies greatly from one area to another, but the variations in conversion costs are even more startling. In 1981-82 four sugar factories had a conversion cost of less than Rs 400 per tonne, while five factories had conversion costs ranging from Rs 3000 to 4000 per tonne, and one factory had a conversion cost higher than Rs 4000 per tonne. (Ghosh, 1982, 1984). It speaks volumes, not only of the inefficiency of managements but the inefficiency of the very system which permits such highly inefficient producing units to continue to function at the cost of the consumer.

In a study of the textile industry in India in the early eighties, the World Bank found that most of the units operated under 19th century conditions, with poor ventilation and lighting, outmoded, ill-kept and badly maintained equipment, and a general environment which could only lead to inefficient production. Preparatory equipment which might improve the quality of cotton for yarn spinning was generally conspicuous by its absence, leading eventually to poor quality of textile production. In a research study comparing long term productivity trends in India and the USA, a Dutch researcher found the index of productivity in the Indian cotton textile industry (USA=100) to have declined from 39.6 in 1937 to 15.7 in 1975 (Bart van Ark, 1987).

**Enterprise**

The point that emerges from the above trends observed in Indian industry is that for some reason, the management of Indian industry has not been attuned to seeking steady productivity gains; whether it is because of a sheltered market, or because of the lack of an "industrial culture", Indian industry has not evinced the spirit of enterprise that has characterised manufacturing industry in the developed countries. This characteristic is exemplified best in the use of age old, inefficient Lancashire boilers for generating steam by many units in the manufacturing industry. After the oil price hike of November 1973, the Petroleum Conservation and Research Association (PCRA) conducted a survey of the establishments using such outmoded boilers, in 1975-76. It was then found that with the higher price of furnace oil (after the oil price hike), replacement of the 5000 odd outmoded boilers (then in operation) by modern, fuel, efficient boilers was likely to be fully paid for in less than one year, sometimes in less than six months. Accordingly, a major publicity campaign was mounted by the PCRA, with a view to economising on the use of oil. In 1978-79, when a repeat survey was organised by the PCRA, it was found that the outmoded boilers had been replaced in less than five per cent of the concerned establishments; the number of old, fuel inefficient boilers still exceeded 5000. The reason given by the management of the concerned establishments was that they were used to the old boilers and did not want to take any risks involved in a change of boilers; some others implied that since costs and prices were going up generally, they were not particularly bothered because they were making good profits anyway, without changing the boilers.

It is in this context that it is necessary to view the problem of productivity in Indian manufacturing industry. It is obvious that mere financial incentives—while important—are not enough. There is need for an *attitudinal change*. And this attitudinal change can only come about by reducing the semi-monopoly or "cartelization" of important segments of industry. The most important desideratum in this context is freedom of entry; and the recent liberalisation of industrial licensing is, to that extent, a justified approach to industrial policy at the present juncture.

It is necessary to foster increased competition, and introduce a system which would reward efficiency and penalise inefficiency. There are too many areas of unwarranted intervention, as for example in the sugar industry, where past official policy has only helped to

perpetuate inefficiency. Even in the case of the cement industry, where "dual pricing" helped to increase capacity, a wrong policy approach – making levy cement a percentage of output rather than of rated capacity of cement plants—has encouraged cement producers to form a cartel and depress production, in the interest of jacking up the price of free sale cement.

**Import Liberalization**

The policy of import liberalization has, however, a different impact on the Indian economy, and needs much greater deliberativeness and pre-planning than has been in evidence. The reasons are simple. As long as total production costs are higher in India than abroad for reasons beyond the control of manufacturing industry, care has to be taken to ensure that Indian manufacturing industry is suitably protected. Two examples should suffice. The manufacture of equipment for power generation and transmission by BHEL is efficient by international standards; in fact the conversion costs of BHEL are lower than those of competitors abroad, but BHEL equipment is more expensive than imported power equipment because of the higher prices of steel and other inputs in India. BHEL has no control over the latter; and in this situation to permit the import of power generating equipment (either against external aid or against suppliers' credit) would be tantamount to slowing down India's efforts at industrialization. Similar is the instance of the import of machine tools from Japan for the Maruti Udyog Ltd., in preference to equally good machine tools manufactured by HMT, at the insistence of the Japanese collaborators. Such a policy is wrong in principle for the reason that any possible productivity gain at Maruti Udyog Ltd. are likely to be more than offset by the discouragement to the process of industrial growth of the economy.

Likewise, the freedom to import capital goods—at a concessional rate of import duty—by manufacturers in India, in the name of modernization, is not likely to be helpful *unless the importers of capital goods are made to face external competition themselves*. In other words, piecemeal import liberalization is unlikely to foster competition; it can only harm the indigenous industry. Import liberalization has, therefore, to be carefully planned.

An opposite conclusion would be reached when one examines the case of the Indian tyre industry—with nearly a dozen collaborations with all the major foreign tyre manufacturers—which has of late formed a cartel with a view to pushing up prices. In such instances, the threat of import of tyres is the only remedy. In other words, the threat of import should be used to curb monopolies and the formation of cartles; but actual import, to the detriment of domestic production, should be undertaken only after very careful consideration. There is, it seems, too much emphasis today on superficial modernization of the production process, somewhat haphazardly and piecemeal through the import of equipment and technology without an attempt to raise the general level of skills.

**Industrial Culture**

But, as stated at the outset, as long infrastructure costs are high, Indian industry would continue to have a high cost structure. And to the extent that much of the infrastructure has to be provided by the Government—either directly, as for instance roads, or through government owned companies, as for instance in power or steel – one has to look for other ways of improving efficiency, eg. by streamlining procedures, encouraging efficiency, and otherwise bringing about the development of an "industrial culture".

Better education and training and better skill formation are some steps towards such a transformation. The other lies in finding an *institutional solution to the problem of management* of public enterprises. The recommendations of the EARC (to which referance has been made earlier), made as far back as 1983, are still valid today. There is need for "autonomy" of State enterprises from governmental control and direction; there is also need for the development of a managerial cadre which will take pride in performance and which will be judged (and rewarded or penalised) on the basis of performance—for which yardsticks can be easily laid down. In short, it is in the efficient operation of public enterprises that a large part of the total costs of manufacturing industry would depend. The example of the Railways is relevant here; by and large, the Indian railways are better managed than many other segments of economic aetivity; and by and large, Indian railway opera-

tions have so far been left to the control of the Railway Board, without too much political interference. (And where there is intervention, it has led to the introduction of a diseconomy, as for instance through the introduction of prestigious superfast passenger trains which take up a great deal of line capacity; or free travel to all manner of politically favoured groups, which affects to railway finances).

**Conclusion**

To sum up, the search for higher productivity involves a multi-tiered approach. At one end, it involves the fostering of an "industrial culture", which is a slow and long process. At the other end, it involves the increasing introduction of greater competition, through both incentives and disincentives, which need to be carefully planned. For example, competition through the removal of barriers to entry is a formula which has proved useful, and may yet be more useful if this formula is effectively pursued (not merely in "form" but in substance). On the other hand, competition through import needs to be more carefully weighed and assessed and applied in a well planned orderly manner. Disincentives (eg. for wasteful use of power) need to be especially thought of where financial calculations of return are disregarded; there is even a case for shutting off power supply to units which refuse to change over to fuel-efficient production methods.

Most of all, there is need for increased emphasis on improved conditions of work, for these are known to improve productivity. A better plant layout, proper movement of materials (eg. on a conveyor belt where necessary), better maintenance of equipment, better ventilation and lighting, greater cleanliness, the supply of proper uniforms (for work) and subsidized meals from the cafetaria are known to have increased labour productivity enormously, eg. several times the costs incurred. There is need for "educating" managements in this regard.

Finally, it is no use seeking higher productivity through over-capitalisation (eg. through the use of robots) in Indian industry. Not only are wage-rates in India much lower than abroad, justifying labour intensive rather than capital intensive methods wherever possible; but the need is to raise the average, over-all productivity of the entire labour force, which is only possible through increased employment but with higher productivity of labour all round.

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# Energy Conservation in Indian Industry

**V. Raghuraman**

*Developed countries have reduced their energy intensities primarily as a result of pragmatic policies and programmes in the industrial sector. Considerable scope exists for Indian industries to improve their energy efficiency. The voluntary efforts of the industries and cautious Government responses need to be galvanised into cohesive, goal-oriented programmes. Some of the measures in accelerating the energy efficiency in the Indian industrial sector have been spelled out in this paper.*

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The Indian energy scene is replete with continuing energy shortages with no promise of respite in the foreseeable future. The problem is seemingly acute in the power sector, though, the shortfall in capacity addition in the Seventh Plan is expected to be much less proportionately than under earlier plans. And, although' there is a raising trend of plant load factor (PLF) of the thermal power stations, the gap is likely to be over 9000 MW in 1989-90. On the oil front the possibility of striking another Bombay High is still elusive and current production is stagnating at 30 million tonnes. The Adivisory Board on Energy (1986) has estimated that there will have to be an investment of Rs. 450,000 crores for acheving a production of 450 million tonnes of coal, 654 billion units of power capacity (138,000 MW) and 50 million tonnes of oil, which will have to go towards meeting the demand till 2004-2005. Even if this figure is only indicative, the resources required to be mobilised to realise these figures do not seem within reach, if the Seventh Plan experience is any guide. The oil, power and coal sectors estimated their requirements at Rs. 113,000 crores while the allocation made was Rs. 54,000 crores. In addition the oil requirements need to be met substantially by imports (40-50 million tonnes every year), a drain on our precious foreign exchange resources.

The country is, thus, faced with the challenge of meeting the serious energy shortfalls and economic stagnation. The situation obviously calls for innovative strategies and action on both the supply and demand fronts. The planning mechanism in our country has leaned heavily on augmenting supplies. It is well known that supplying new sources of energy takes many years. Hence, there has to be a greater

emphasis on the management of demand. In this context, energy efficiency offers a practical means of acheiving our national goals. This is exemplified by the experience of the industrialised countries.

## Scenario of the Developed Nations

Before 1973, most analysts thought that energy use and GNP move together in lock-step. The energy events of the seventies ushered in the "Cogeneration Revolution" in the developed countries similar to the "Agriculture Green Revolution" in our country. This has given those countries a respite from shortages. In the United States while GNP has grown by 40% energy demand has increased only marginally. USA has further plans to reduce its energy consumption by 2.5% annually till 2000 A.D. Japan and West Germany use half as much energy per unit of economic output as the Untied States (Fig. 1).

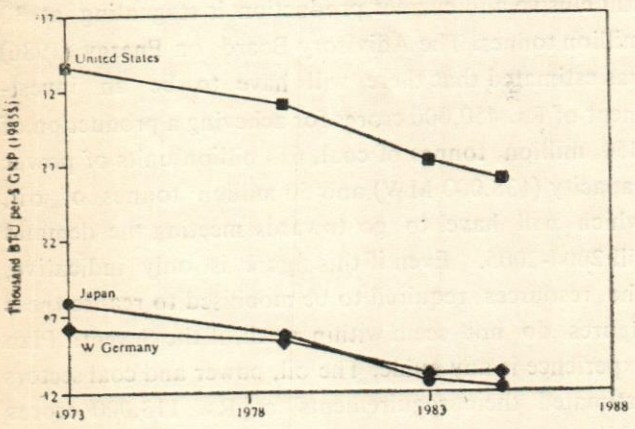


Fig. 1 Energy Intensity Reductions, 1973-85

In the EEC countries (OECD, 1987) the industrial sector has cut its energy consumption per unit of output by 24% between 1973 and 1983.

Rapid advances have taken place in enhancing industrial energy efficiency. This is very well proved by the overall energy output ratios. The principal features (world Energy Conference, 1986) underlying the improvements in the efficiency in the industrial sector are:

(a) **Technical Progress**: Despite declining real energy prices before 1974, the trend in the improvement of energy efficiency was visible due to modern energy consumption equipment involving high capital investment.

(b) **Changes in the Pattern of Industrial Output**: Energy intensive industries consume the bulk of the industrial energy requirements. With escalating energy costs, the prices of products from energy intensive industries also rose and demand for them declined in relative terms, resulting in reduction of their share of the GDP.

(c) **Increase in Energy Prices**: Price induced measures which clearly brought in cost escalation in manufacturing encouraged the industries to reduce energy inputs.

The lower phase of economic growth after the oil crisis has definitely had an impact on the level of energy consumption. Though it is dificult to assess the individual contribution of the above factors, it is estimated that in USA during 1972-81, the energy efficiency of the manufacturing sector has improved by 18%. Out of this 7% was attibutable to the technological improvements, 7% due to shifts in product mix and only 3% was price induced. While estimates from UK suggest a 50% contribution attributable to changes in the product mix, during 1970-73, estimates in Japan, Canada and Sweden show that about half of the overall improvement in energy efficiency is due to changes in products.

## Potential for Future Energy Conservation

It is generally recognised that there are three stages of energy canservation in industry.

*1. Housekeeping*

This involves improvements in monitoring and control aimed at reducing wastage, and requiring no significant investments.

*2 Retrofit*

This, normally, involve a small investment with big paybacks designed to improve the energy efficiency of the existing equipment.

*3. Process Technology Improvements*

These imply major investments that significantly alter production processes through the introduction of new and efficient equipment and control systems.

Several cases for various industries in OECD countries indicate that, virtually, all price-induced improvements in energy efficiency to date have been due to the first two stages which have accounted for perhaps 5-10% of the improvements in energy efficiency. It is expected that very little can be gained from further housekeeping improvements, although there is considerable scope for further efficiency gains due to retrofitting. The major gains for the coming decades will accrue through improvements in process technologies, development of newer materials etc. which require large scale capital investments. The decisions for these investments are affected by economic factors, as for instance, the need for new products or increased production capacity rather than by potential energy savings.

**Energy Saving Potential**

Based on a number of macro-projections, it has been indicated that about 30% of energy industry in West Europe could be saved by using the existing technology and with investments which are economic in the current climate of energy prices. A breakdown of the technical potential and estimated savings till 2000 AD is given in Table 1.

From the technical standpoint, these estimated savings are generally applicable to all developed countries. Gains in efficiency are not likely to be large, perhaps only 10-15% in the 1980s and 1990s. This is because the heavy industries are relatively efficient and their capital intensity makes adoption of new technologies difficult; the potential is greater in small and medium industries. However, the wide variety of technologies that exist and the problems of training and overcoming ignorance are also noticeable constraints.

TABLE 1 **Energy Savings in Western Europe from 1972 (Figures in Percentage)**

| Industry | Technical | 1976 | 1985 | 2000 |
|---|---|---|---|---|
| Iron & Steel | 25-35 | 0 | 10-15 | 15-30 |
| Other furnaces | 25-35 | 3-5 | 10-20 | 15-30 |
| Chemical (Fuel) | 15-25 | 0-2 | 5-20 | 15 |
| Others | 20-30 | 4-8 | 10-15 | 15-26 |

Source : World Energy Conference, (1987).

In the developing countries, organised energy conservation efforts are still at the infancy stage. Among the countries in the Far East, South Korea is the olny one with an organised conservation programme and the current thrust of activity is on the performance of audits and the gathering of information for development of a data base and specific plant goals (Table 2).

Thus, it can be seeen that substantial savings can be obtained, especially in large industries; however small industries which are common in these countries do not have the capability to invest in the newer technology which may be highly capital intensive and expensive. It is more viable for those countries that have relatively abundant supplies of labour to utilise technologies substituting labour for both capital and energy.

**The Indian Scene**

Indian industries are characterised by their high specific energy consumption (Table 3). The industries, in general, are yet to make their impact felt on the GNP vs energy growth rates though there have been individual industries which have benefitted from organising energy conservation at the unit level.

Though price induced measures and restricting the use of furnace oil in industries were initiated earlier, the first serious attempt by the Government of India

TABLE 2 **Potential Energy Saving in Selected Industries in Developing Countries**

| Industry | Developing Countries' total Commercial Energy Consumption Million tonne/ year | Potential Saving % Category A | Category B |
|---|---|---|---|
| Iron Steel | 109 | 3 | 15-20 |
| Petroleum Refining | 54 | 7 | 15-25 |
| Cement | 52 | 11 | 18-25 |
| Chemicals (Ammonia) | 19 | 2 | 20-25 |
| Pulp & Paper | 15 | 11 | 12-15 |
| Aluminium | 13 | 2 | 10-15 |

*Source* : World Bank Report (1983).

*Note* : Category A : refers to small investments consisting mostly of combustion efficiency improvements, insulation, steam system efficiency improvements and other housekeeping measures; paybacks within 10-20 months.

Category B : refers to large investments in retrofitting existing plants and additions to facilities including waste heat recovery, cogeneration, increased use of waste fuels, simple process changes and controls and replacement of inefficient equipment; paybacks in 2 to 5 years. Savings in categories A & B are not necessarily additive in several plants.

TABLE 3 **Comparison of Energy Use in Selected Industries in India and Advanced Countries**

(Million Kcal/tonne)

| | Steel | Cement | Pulp & Paper | Fertiliser |
|---|---|---|---|---|
| India | 9.50 | 2.00 | 11.13 | 11.25 |
| Italy | 4.03 | 0.89 | — | 9.92 |
| Japan | 4.18 | 1.20 | — | — |
| Sweden | 5.02 | 1.40 | 7.56 | — |
| UK | 6.07 | 1.30 | 7.62 | 12.23 |
| USA | 6.06 | 0.95 | 9.70 | 11.32 |
| West Germany | 5.21 | 0.82 | — | — |

*Source* : Tata Energy Research Institute (1984).

in the field of enregy conservation was the setting up of an Inter-Ministerial Working Group (IMWG) on utilisation and conservation of Energy in 1981, to recommend policies and programmes for achieving desired goals and targets for energy conservation. In 1982-83, the industrial sector accounted for 40% of the energy consumed, equivalent to 88 million tonnes of coal per annum. From a sample of 200 industrial energy audits conducted by the National Productivity Council covering twelve sectors of the industry, the picture that emerged of the total saving potential is as outlined in Table 4.

TABLE 4 **Potential Energy Savings in Industrial Sector : (Industrial Sector : Conservation Potential : 25%)**

| Energy Form | Unit | Present Annual consump. | Savings Possible | Investment required for creating eql. resource (Rs million/ unit) | Total Invest-required (Rs. Million) |
|---|---|---|---|---|---|
| Coal | Million tonnes | 70 | 17.5 | 500 | 8750 |
| Oil | ,, | 4 | 1.0 | 1800 | 1800 |
| Electricity | ,, | 60 Btu/kwh | 52.5 MW | 0.900 | 47250 |
| Total Investment for creating equivalent to energy capacity | | | | | 57800 |
| Investment required for implementing Energy Conservation Measures | | | | | 36000 |
| Annual Expenditure Saving in industrial sector by implementing conservation measures | | | | | 19250 |

Thus, it can be seen that Rs 19,250 million per annum saving potential existed in the industrial sector which could be realised with an investment of Rs 56,000 million. The equivalent investment to create additional energy capacity would mean an investment of Rs. 57,800 million. Thus, energy conservation investments were 1.6 times cost effective. Inspite of this, the response of industry as a

whole has been lukewarm. While some of the units in organised industry in the large scale sector have been alert and responsive, medium and small scale units have not appreciated the extent of possible savings and lack the expertise to achieve sustained savings. Another disquieting factor is that industries which are already efficient are striving to be more energy efficient but the inefficient ones are continuing to be wasteful in their practices. The challenge, therefore, lies in motivating the inefficient units to adopt energy efficient practices and improved technology.

It was recognised that while the immediate benefits to the individual enterprise may be marginal in the cost of energy saved, the cumulative effect on the economy as a whole is substantial. Further benefits to the economy accrue due to a cleaner environment and by avoided supply costs such as the cost of transportation, additional mining of coal, oil prospecting, etc.

**Suggested Policy Measures**

Keeping these in view the 1MWG spelled out some important policy guidelines:

(i) Good housekeeping measures such as tuning of combuston equipment, avoiding leakages, better insulation, proper maintenance, optimum use of capacity etc., go a long way in reducing energy consumption levels. There is need to evolve housekeeping standards for industries and to propagate the message of conservation through the mass media; labelling of appliances for energy consumption was also emphasised.

(ii) The main motivation for any industry to conserve energy lies in the ultimate financial economy. In this task, rational energy pricing policies and tax incentives for energy savings resulting from conservation efiorts play an important role. The report took into account the need to encourage industrial units to monitor their energy usage. A suggestion was made that the companies should include information on energy use in their annual reports and record energy—saving achievements.

(iii) Policies to reward energy efficient units during fuel and power shortage situations and thereby induce industries to boost energy conservation efforts wers highlighted. The need for carrying out overall social-cost benefit analysis of national conservation programmes at the macro-economic level, taking into account shadow prices, foreign exchange considerations, opportunity cost of subsidies etc. was stressed.

(iv) Co-generation systems need to be adopted on a large scale. Units consuming over 25 tonnes per hour of steam should be encouraged to adopt total energy systems and industrial conglomerates requiring large quantities of process steam should be persuaded to realise the full potential of the energy resources through co-generation. According to the IMWG, a potential of 1500 MW of additional power can be achieved in such industries through co-generation, without any extra fuel consumption being involved.

(v) By their very nature, energy conservation programmes will have to cover the activities of many government departments. An apex level steering group should, therefore, be set up with the responsibility of reviewing and monitoring various programmes, the formulation of suitable policy measures, the creation of formal organisational units wherever necessary etc. Such a group will ensure coordinated implementation of the programmes.

(vi) Financing energy conservation investment would require preferential treatment. It would be necessary to set apart separate budgets for energy conservation. Methods may have to be devised to generate adequate funds, if necessary by imposing a small cess on the fossil and other fuels consumed by the industry. Out of this cess, a revolving fund to be expanded by around Rs 100 crores every yeary over a span of ten years, should be set up for funding energy conservation schemes in the industrial

sector as a distinct programme. Since long term requirements of funding may be large, careful thought may have to be given by the appropriate government agencies. It might be necessary to identify the right agencies for administering these. These funds should be available not only for the marginal investment on equipment but also for the supporting training and educational activities.

**The Industry Response**

With respect to the above recommendations, there has been discernible progress in the adoption of good hausekeeping measures especially with regard to the consumption of fuel oil by industries. The post oil crisis era witnessed the setting up of the Petroleum Conservation Research Association (PCRA) which has been conducting diagnostic fuel utilisation studies in the industrial sector since 1976. As a result of PCRA studies (PCRA, 1987) a saving potential of 0.415 million kl of fuel oil has been achieved in 1625 industrial units out of a 3.38 million kl. consumption level which is about 9.7% of the total consumption in the industries studied. However, for the coal and electricity sectors, such organised efforts are yet to be established on similar lines. Over the years, there has been a growing awareness among the industries about the need for energy conservation. This is revealed by a follow-up study of 178 units conducted by the National Productivity Council in 1986. This exercise indicated that 70 units (40%) have implemented energy conservation programmes successfully while 29 unite (16%) are yet to start energy conservation programmes. The pace of implementation has generally been very slow and the energy savings achieved are Rs. 102 million against a saving potential of Rs. 840 million indicating that only 12.3% of the saving potential has been achieved in these units. Another survey conducted by the Federation of Indian Chambers of Commerce and Industry in 341 units has revealed that several industries are able to realise savings as in Table 5.

Some progressive units seem to be doing well in areas like energy accounting, auditing, housekeeping, replacement of machnery, instrumentation etc. The

TABLE 5 Energy Saving Achieved by Respondents

| | No. of Units | As of total respondents |
|---|---|---|
| Upto 5% | 128 | 37.54 |
| 5-10% | 72 | 21.11 |
| 10-15% | 34 | 9.97 |
| 15% and above | 43 | 12.81 |

*Source* : FICCI (1988)

above survey has revealed that there are several constraints being faced by units in achieveing energy conservation which can be summed up as given in Table 6.

TABLE 6 : Constraints in Energy Conservation Identified by the NPC Follow up Study

| Constraints | No. of Respondents | % |
|---|---|---|
| Incentives are not adequate | 127 | 37.24 |
| Soft Loans needed | 118 | 34.80 |
| Requisite equipment not available | 108 | 31.87 |
| Trained manpower not available | 106 | 31.09 |
| Consultancy services not available | 102 | 29.91 |
| Internal resource limited | 99 | 20.03 |
| Return on conservation not attractive | 87 | 25.51 |
| Non-availability of appropriate information on energy saving measures | 85 | 24.93 |
| Energy cost too low | 71 | 20.82 |

*Source* : FICCI (1988).
Columns are not additive.

**Non Energy Intensive Industries**

Inspite of the large potential for energy conservation, such industries have generally not been responsive to these programmes. There is a need to discip-

line the inefficient units by determining their legitimate energy requirements through scientific energy audits. Industry associations such as the CEI, ASSOCHAM and FICCI have been taking initiatives to motivate such industries to be energy conscious. However the measures implemented by the industries are routine housekeeping types, not involving any capital expenditure (except the glass industry which has discarded the oil-guzzling unit melters).

**Energy Intensive Industries**

Energy intensive industries are, by and large, price administered; energy efficiency is linked to technology and closely related to the economies of scale. Fertiliser is, for example, a sector where the installed capacities match those obtaining in developed countries. As a result, the fruits of energy efficiency are being realised. The aluminium sector was charactriesd by low capacity utilisation due to power restrictions. This has been obviated in the case of the recently set up National Aluminium Company with a captive power plant; the technology chosen is less energy intensive, consuming 14,500 kwh per tonne as against 16,500 kwh in other conventional plants. The cement industry withnessed progressive trends since the price de-control in 1982, where there has been a spurt in conversion due to energy efficient dry process. The refineries and petro-chemical units have organised energy conservation programmes and have incoporated waste heat recovery systems. The paper, textile and chloralkali sectors have not yet recorded significant gains, though leaders in the group have recorded good progress. As a rule, existing units are not enthused to invest in energy conservation, as there is not much incentive under the administered price environment. The new units are. however, regulated through the licensing mechanism and energy efficient features are being examined.

The energy shortage scenario entails innovative courses of action to ward against industrial stagnation such as the weaning away from energy intensive materials; priortising the end use of energy intensive materials; seeking alternate venues for processing e.g. in Mozambique hydel potential could be developed to smelt aluminium from the enriched Alumina shipped from India. Decision could also be taken to import energy intensive materials instead of energy. Such policy guidelines need careful thinking but have distinct merits in reducing the energy intensity in the manufacturing sector.

**Fiscal Measures**

On the fiscal side the government has announced the following provisions :

(a) 100% depreciation allowance for notified energy conservation equipment in 1983 (Annexure 1).

(b) Customs duty reduction for notified energy conservation equipment/devices in 1988 (Annexure 2).

The lists are restrictive and do not cover all energy conservation equipment. The provision of 100% depreciation allowance is mandatory for industries to benefit from energy conservation investments. This restricts units making marginal profits from making use of this provision, as they will not be in a position to announce dividends to share-holders if they exercise the write off option in one year. It would have been better if the provision was to allow enough leeway to avail of the depreciation allowance, as deemed fit by the industry with the ceiling upto 100%.

While the concept of a revolving fund specifically for financing energy conservation investments is yet to gain ground, IDBI has come out with the

— Energy Audit Subsidy Scheme

— Energy Conservation Equipment Finance Scheme.

The energy audit subsidy scheme promotes rational use of energy through energy audits in industries. The emphasis is on setting up targets or coordinates for specific energy consumption levels based on reasonably good housekeeping, operational and in-depth energy audit exercise. The costs towards the energy audits by approved energy consultants would be subsidised by IDBI. A complementary scheme funds the energy conservation investment.

The novelty of the scheme is the provision of soft loans with interest rates declining from 14% to 10% depending upon the percentage saving or reduction in unit level energy consumption as compared to the standard level of energy consumption. The scheme limits the promotions contribution to 10%. The energy audit costs borne by the units would be treated as part of the promoters' contribution, and there is a moratorium of two years on the repayment of the loan. However, the loans are limited to 5% of the gross fixed assets to the company and with a ceiling of Rs. 4 crores. It is hoped that in times to come, the ceiling will be revised upwards. Such a step would be necessary if capital intensive projects such as co-generation are to be implemented. This step by the IDBI would fulfil the long felt needs of the industry for concessional finance and separate investment schemes for energy conservation.

## Conclusion

Policies to promote co-generation are yet to be formulated. A nodal organisation for a concerted programme of energy conservation has not been instituted so far. Though the office of Adviser (Energy Conservation) had come into being by 1987, the organisation needs to be strengthened with requisite personnel and the objectives well defined. There has been efforts by the Advisory Board on Energy to frame the Energy Conservation Law with the help of the Indian Law Institute. The blueprint is still in the discussion stage. The Bureau of Indian Standards is showing greater initiative in drafting standards on energy conservation. But the entire energy conservation programme still lacks a focus, as the successive five year plans have not considered energy conservation as a resource for planning. The seventh plan approach document stressed the need for industries to adopt good housekeeping practices; but no positive programmes or allocations were spelled out. It is hoped that the Eighth Plan will draw up a comprehensive energy conservation plan with adequate financial allocations, with the nodal office of the Adviser (Energy Conservation). A well thoughtout energy efficiency agenda would go a long way in reducing energy intensity in the manufacturing sector and the methodology evolved could be profitably adopted for the other sectors of economy. Thus, a thrust on energy conservation in the Eighth Plan could foretell an energy easy position helping to attain the targetted 6% growth rate. The experience of developed nations has conclusively proved the merits of energy conservation as a major plank in energy management.

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## *ANNEXURE 1* List of Energy Conservation Equipment Eligible for Accelerated Depreciation

100 per cent Depreciation Allowance on written down vallue is allowed on energy saving devices and systems listed below :

(Item under IIIF(2A) under part I of Appendix I to the Income Tax Rules 1962, effective from April 1983).

(a) Spcialised boilers and furnaces

(i) Ignifluid/fluidized bed boiler
(ii) Flameless furnaces
(iii) Fluidized bed type heat treatment furnaces
(iv) High efficiency boilers (thermal efficiency higher than 75 per cent in case of coal fired boilers and 80 per cent in case of oil/gas fired boilers)

(b) Instrumentation and monitoring systems for monitoring energy flows :

(i) Automatic electrical load monitoring system
(ii) Digital heat loss meters
(iii) Micro-processor-based control systems

(c) Waste heat recovery equipments and co-generation systems

(i) Economisers and feed water heaters
(ii) Recuperators and air pre-heaters
(iii) Backpressure turbines for co-generation.
(iv) Heat Pumps
(v) Vapour absorption refrigeration system
(vi) Organic rankine cycle power system
(vii) Low inlet pressure small steam turbines.

(d) Power factor correcting devices

(i) Shunt capacitors and synchronous condenser systems.

## *ANNEXURE 2* List of Energy Conservation Equipment Eligible for Reduced Import Duty

Import duty in respect of following 15 specified energy conservation equipments has been reduced to 40% (35% basic+5% Auxiliary) ad valorem vide notification No. 30/88 Customs, dated 1.3.1988

| Sl. No. | Description |
|---|---|
| 1. | Flameless furnaces for reheating and heat treatment applications. |
| 2. | High velocity recirculating furnaces for reheating and heat treatment applications. |
| 3. | Low excess air burners (below 10% excess air). |
| 4. | Fuel oil emulsion burners. |
| 5. | Regenerative burners for application in forging and heat treatment furnaces. |
| 6. | Self-Recuperative burners (Burners using pre-heated air). |
| 7. | Flat flame burners. |
| 8. | Heat pipes for extracting heat from low temperature fluids and gases. |
| 9. | Heat pumps for space heating, water heating, cooling applications. |
| 10. | Free ball bucket steam traps with no links/hinges. |
| 11. | Automatic microprocessor based load demand controllers from efficient load management. |
| 12. | Microprocessor based combustion control system for boilers. |
| 13. | Light sensitive time switches for street light controls. |
| 14. | Microprocessor based automatic anode overpotential controllers in caustic, chlorine and aluminium industries. |
| 15. | Microprocessor based universal programmable timers for continuous and batch processes, such as in type industry and rayon industry. |

# Indian Journal of Industrial Relations

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# The Productivity of the Marketing Man: Some Behavioural Aspects

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*What are the behavioural traits that go towards maximizing marketing productivity ? This paper examines this issue and explores ways in which such productivity can be enhanced though appropriate behavioural interventions.*

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Behavioural-science research and practice in the Indian organisational context today has achieved considerable specificity. In most areas, generic formulations, increasingly, have given way to situation-specific applications.

Setting-specific behavioural work is available today in such diverse and wide-ranging fields as (a) educational establishment (Mathai et. al., 1977), (b) defence and police organisations (Roy, 1974; Valech, 1986), (c) the small-scale sector (Patel, 1978); (d) the rural context (Moulik, 1980); (e) large-size system (Balakrishna et. al, 1980); (f) bank organisations (Das, 1975); (g) public vis-a-vis private sector organisations (Sharma, 1983); and (h) government bureaucracy (Changati, 1979). Moderator variables such as culture (Sinha, 1973; Chattopadhyay, 1975) and organisational level (Varghese, 1975) have also been investigated. Evidence on meta-settings, particularly the studies of turnaround management (Khandwalla, 1981), contribute further to the specificity.

The functional area constitutes a specific management setting. Different functional areas, no doubt, have their own unique problems and constraints, and behavioural-science interventions, whether through research or training, which may be highly valid for one function, say manufacturing, may not necessarily be so for another, say, finance or marketing.

The present paper provides an overview of behavioral-science factors and interventions that are particularly relevant for marketing productivity in

Indian organisations. The Paper—I deals with the concept of marketing productivity with particular reference to the Indian environment. It outlines certain behavioural inputs in respect of which Indian experiences are available. It provides a summary and indicates particular directions for applied work.

*Marketing Organisations: Changing Profile*

Qualitative shifts in the marketing function are evident today. Shifts are noticeable not only in the environmental ambience but in the organisational dynamics as well.[1]

As far as the environmental factors are concerned, the increasing number and size of manufacturing units implies greater competition. Overcapacity in the two-wheeler industry is a case in point. Second, firms today have to dispense their goods over increasingly distant and scattered markets, exerting greater strains on the distribution systems. The effective distribution area of even consumer non-durables has increased manifold, involving rural distribution and deficient infrastructures. Third, in a situation of abundant choices, the consumer has assumed greater significance. Profitability is possible only as a corollary to consumer satisfaction. This environment demands departure from the conventional emphasis on the product, as also departure from discrete, unintegrated management actions. In industrial marketing, for example, sophisticated technology, and the customer's freer access to his own principals, make him more discerning, demanding greater precision in marketing.

Fourth, governmental policy fluctuations bring about rapid shifts in demand patterns, which even the highly strategic-oriented managements cannot anticipate. The recent governmental policy not to permit further licenses in the DAP fertilizer sector, for example, substantially dislocated firms that had earlier specialized in executing turnkey contracts, forcing them to diversify into pollution control and such other businesses. Unpredictable developments, such as inadequate monsoons, bring about demand recession and glut conditions, badly affecting fertiliser marketing, for example (Rao, 1984). Finally, there is the phenomenon of the "exploding" middle-class, which brings about unexpected and far-reaching shifts in demand patterns, e.g. in consumer electronics and in packaging materials. Marketing environment is the disturbed-reactive type and certainly not the placid and randomise conditions of yore (Emery, 1965).

Within the firm too, significant changes are evident. First, the grievance resolution ambiguities are increasing. Marketing organisations are far more conflict-prone today. White-collar unionism in the pharmaceutical industry is an example. Second, marketing organisations today reflect a vastly changing manpower composition particularly at the supervisory and managerial levels. From the nationally known management education institutions, for example, ever increasing proportions of management graduates, a majority of them engineers, are joining marketing. Third, the effective compensation levels of marketing personnel both at entry as well as at the profit-centre levels of accountability are comparatively higher. Such compensation levels not only then make people more sensitive and expectant in terms of their non-money needs, but also generate greater pressures for career and compensation planning. Finally, the work environment is characterised by greater stress.[2]

The challenge of the marketing function is likely to increase as the emergent tasks, such as rural marketing, become more demanding in the future.

*Applications for Marketing Productivity*

We examine four behavioural-science application areas viz. The Hiring Process including the Assessment Centre Techniques, Developing Marketing Personnel, Organisational Structure and MIS and Advertisement Research and Evaluation.

1. The present discussion on the marketing environment in India has benefitted from Neelamegham (1978). Also see Ramaswamy et. al. (1983).

2. For a relevant discussion on stress, see Mamoria (1985).

**The Hiring Process**

Predictor measures that yield satisfactory selection ratios relate both to (i) ability assessment and (ii) temperamental factors (Mandell, 1955).

The marketing man needs to display ability in verbal fluency, verbal comprehension, and social intelligence. Effective intelligence, i.e., spontaneous generation of problem-solving alternatives, given the time constraints, also no doubt becomes significant, particularly in personal selling situations. While standardised psychometric tests are available today for all the relevant abilities, these are assessable through the more convenient non-test measures as well, particularly the stress interview and the leaderless group discussion technique.

For the non-test measures to be predictive, however, interviewers and observers must have better goal clearity as to exactly what criteria they seek to identify. Lack of such clarity yields only certain omnibus stereotypes of little discriminative value. Social intelligence and sensitivity are better assessable through psychological tests, particularly through the empathy-based tests (Guildford, 1967; Ginzberg, 1964).

Temperamental, including the motivational factors, do not, however, lend themselves to valid non-test assessment. Personnel selection situations, especially in an unemployment ridden country like India, inevitably generate intense competitiveness, and non-test measures such as the interview, can yield only faked and socially desirable responses. For valid test assessment, it is, however, imperative that the forced-choice psychological inventories are used, which confront the applicant with equally desirable multiple choices.

Temperamental variables significant for marketing productivity, particularly at the supervisory and managerial levels, relate to stress and risk tolerance, expressiveness, practicality, self-assurance, assertiveness, flexibility, and tough-mindedness. Specific interest and value assessments also prove useful especially for senior-level marketing positions. Tests apart, careful analysis of biographical data, and then detailed exploration of the available cues through the personal interview, often proves highly rewarding.

For internal selection from amongst company candidates, the assessment centre technique proves useful. Current job performance ratings, even if valid, may not predict future potential; jobs at different hierarchical levels make qualitatively different demands. An assessment centre battery typically employs in basket tests, group tasks, job skill exercises, and sociometric ratings (Mackinnon, 1975).

A common inadequacy in the selection of marketing personnel is our failure to distinguish between consumer marketing and industrial marketing. While the former requires the ability to improvise, and social perceptiveness, industrial marketing situations involve many other considerations such as the nature of the customer's business, the key problems where the company products may be of assistance, who the people exactly are that would make the buying decisions, and what the competitor strategies are. Personnel selection tools, and also the criterion measures employed, should correspondingly be different.

**Developing Marketing Personnel**

Today's personnel training and development in the marketing area has two concerns: products information and persuasion techniques. A much wider variety of need-specific personnel development should, however, prove more meaningful in view of the total marketing milieu. Four areas seem particularly relevant: 1. Training for Effective Intelligence. 2. Communication Sensitivity. 3. Rationality and Assertiveness Training. 4. Composite Competence Development.

*Training for Effective Intelligence*

Short-range performance, and the influence process are central to the marketing technology. "Effective intelligence", therefore, becomes cardinal, i.e., the ability to articulate in given situations, and at short notice, appropriate problem-solving responses and also simultaneously handle a range of variables both cogni-

tive and social (Guildford 1967). Simulation techniques based on behavioural modelling produce adequate results in this regard, to the extent behavioural rehearsal and feedback are incorporated in the training process (Moses, 1978).

Grid-based training for marketing productivity is also relevant (Blake, 1970). It identifies behaviour which is likely to be weak and inffective in selling situations and locates the underlying reasons. Self-evaluation exercises, then, highlight the different grid positions and their respective advantages and disadvantages.

*Communication Sensitivity*

Communication training and workshops designed for marketing personnel normally emphasise verbal articulation, fluency and skills. In complex marketing situations, however, the communication input is equally important. At the same time, the articulate could be quite insensitive to environmental intangibles.[3] Communication training should therefore equip sales personnel with the ability to perceive and monitor, in interpersonal and small-group contexts, the more intangible and subtler aspects of human and business interactions.

Appropriate variants of the T-Group methodology (Craig, 1967), and also communication games with structured observation (Goldstain, 1974), could prove useful. The socially intelligent do, of course, internalise such training cues faster.

*Rationality and Assertiveness Training*

Marketing jobs are inherently stressful because effectiveness involves a large number of external and short-term human contacts—often with the unfamiliar.[4] The selling role entails a disadvantage in terms of the power relationship too, carrying greater liability to negative and dysfunctional emotions and feelings.

Assertiveness training helps rationally restructure their cognitive system and minimise their self-limiting beliefs and thought-patterns, and can therefore be highly productive. In particular Ellis, rational-emotive techniques (Ellis, 1962) and Beck's cognitive techniques (Beck, 1961) could yield enduring results in marketing training. The trainer must, however, have proper familiarity with the operant conditioning methodology (Skinner, 1953).

*Composite Competence Development*

Marketing mix is an interdependent system of product identification and development through pricing and credits dicisions, customer feedback and advertisement research. Composite competence, therefore, become essential for overall system effectiveness. Managers even at senior levels, however, have career background either in terms of sales or product development. The general and integrative exposures are absent.

Classroom settings cannot, however, be expected to contribute to composite competence development as much as role development, viz. job rotation and redesign. Incumbents must not, however, perceive such exercises as punitive.

**Organtsational Structure and MIS**

Three kinds of distortions are evident in Indian marketing organisations, viz., 1. Lop-sided job structure of intermediate-level managers. 2. Field feedback distortions. 3. Compensation imbalances.

*Job Structure of Intermediate-level Managers*

Thc complex problems of information witholding and feedback are well documented (Lawler, 1971). The diversity and far-flung nature of marketing operations, if anything, confound the problems further.

Authentic field feedback must, however, reach the central marketing establishments for policies and operating systems to be realistic. Formal systems cannot however, radically, retrieve all the dynamic and subtle information available in the field, particularly informa-

3. Correlation between articulation and intelligence, too, is doubtful. See Mandell (1970).
4. For a discussion on the "Contact Occupation" see Cattel (1957).

tion about customer product mix and product-service mix. Only field personnel in face to face encounters can provide such feedback information.

In practice, however, company meetings generally develop a downward traffic. There is subtle resistance and a pejorative climate develops, blocking field feedback (particularly in its subtler aspects). The dynamics of selective information given and selective perception both come in to play. Large blind-spots develop in the policy-making centres. The grid model can be usefully applied to marketing operations for auditing its overall communication effectiveness (Blake, 1970).

*Compensation Imbalances*

Equity plays a significant role in financial compensation vis-a-vis the quantum (Lawler, 1971). Marketing organisations betray two distortions in compensation structures having far-reaching implications particularly in view of the emergent industrial relations climate.[5]

First, the effective compensation, including perquisites, of top-level marketing managers seems disproportionately higher than that of the other functional-heads. Internally, too, their compensation levels seem inequitable compared to those of the other levels within marketing. Better rationalisation using more appropriate benchmarks appears overdue.

Second, the base compensation of sales personnel in a large majority of industries is relatively lower than that of their counterparts in the other functions. Historical fortuities seem to have determined the relative compensation levels. Job analysis and compensation restructuring appear overdue particularly in the context of such job costs as stress, employment security, degree of direct accountability, dependency of external resource, etc.

**Advertisement Research and Evaluation**

Advertisement research, including motivation research, has long been an important area. It ought to attract the attention of our psychological and sociological researchers particularly in view of the increasing television coverge, growth of rural markets, formation of consumer associations, etc.

Applied research could relate to questions in respect of (a) "the product personality"; (b) identifying the exact satisfaction consumers derive from particular products; (c) specifying what unique features consumer perceive in the product brands they use; and (d) determining the relative strengths of the various demand-creating forces under particular marketing conditions (Grissy, 1971).

**Summary and Direction**

Four behavioural-science application areas were outlined in the context of the changing characteristics of Indian marketing organisations. These relate to : A. The Hiring Process including Assessment Centre Techniques. B. Developing Marketing Personnel. C. Organisational Structure and MIS. D. Advertisement Evaluation and Research.

Two specific directions of organisational applications are apparent today, viz., (i) rural marketing; and (ii) industrial relations. First, it appears hightime that marketing organisations undertake appropriate planning and review exercises in oder to develop better capability for the emergent rural marketing, particularly in the pharmaceutical, transport and fertilizer sectors. Modified organisational structures and systems are required for better demand forecasting, appropriate product modification, and territory management. Today's elitist marketing organisations might prove inadequate.

Second, the industrial relations milieu in marketing requires better monitoring today. Unionisation among marketing personnel is of relatively recent origin in Indian organisations. In the area of according legitimacy and bargaining status to it, the attitude of manaegment is somewhat ambiguous. Management of unionism in marketing could prove unwieldy, given the dispersion and far-flung nature of the operations. The lack of legitimisation, however, is.

5. For a discussion see Stagner (1965).

probably contributing to inter-group distrust and militancy. Field inspection and supervision of sales personnel is becoming increasingly difficult. Necessary organisational preparations for collective barganing appear overdue. Field-oriented diagnostic surveys incorporating both compensation and accountability issues would also be relevant for marketing productivity.

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# Productivity Trends in Indian Automobile Industry

**NPC Research Section**

*Despite its tremendous potential for generating employment, both direct and indirect, for building entrepreneurship, for stimulating the development and for introduction of modern and sophisticated technologies, the performance of Indian automobile industry could not be considered inspiring in recent years. This brief report on the productivity performance of the industry examines its record with respect to some of the vital parameters.*

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Automobile Industry is an important segment of the coutry's engineering industry. It has a tremendous potential for generating employment, both direct and indirect, for promoting high grade skills, for building entrepreneurship and for stimulating the development and introduction of modern and sophisticated technologies. It also plays a vital role in the economic development of the country besides being of strategic importance for the country's defence and security needs.

The crucial role played by the automobile industry in the overall economic development of a country has led to its faster growth in almost all countries of the world-both developing and developed. Rapidly rising production of passenger cars and commercial vehicles in some of the world's major automobile producing countries (Annexure-I) is a clear evidence of the fact that a strong and viable automobile industry is considered a prime nacessity by almost every nation. That the importance of the automobile industry is well recognized all ever the world is further supported by the fact that some of the major automobile units in the USA, Japan and West Germany are currently counted amongst the world's top fifty industrial groupings, e.g. General Motors of USA is ranked 4th, Toyota of Japan is ranked 13th and Daimler of West Germany is ranked 17th (Times, 1000-1987-88).

**Importance of Automobile Industry in India**

In this vast country with greatly varying terrain and large inaccessible areas, road transpart naturally comes to acquire considerable importance. It is at

present the second most important means of transport for goods and passengers next to the railways (Table 1).

TABLE 1 Estimated Traffic Carried by Road

| Year | Passengers (BPKM)[1] | Freight (BTKM)[2] |
|---|---|---|
| 1951 | 40.4 | 12.1 |
| 1960 | 90.5 | 26.3 |
| 1970 | 233.8 | 62.5 |
| 1980 | 528.0 | 139.0 |
| 1982 | 724.4 | 183.0 |
| 1985 | 918.7 | 243.0 |
| 2000 | 3000 Plus | 735 Plus |

*Note* : 1. BPKM: Billion Passenger Kilometer
2. BTKM: Billion Tonnes Kilometers

*Source* : Kadiyali (1987).

In 1984 the road density in India was 0.45 kms per square kilometer. With a phased programme of road development, the road network is expected to expand to 27,00000 kms. by the end of the 20 century. The road density will then marginally increase to 0.57 kms/sq.km. The 7th Plan outlay for road development under the central and state sectors has been placed at Rs. 1819.75 crores and 4180.37 crores respectively. Considering the resource constraints and the past plan achievements, the projected targets of road development may not be fully achieved. However, even at the rate of past achievement (4.5 per cent per year), there is bound to be a further increase in the total road length and improvement in the percentage of all weather roads. This should bring about a substatial shift of traffic, both passenger & freight, from rail to road and, thus, provide the much needed fillip to the automobile industry, particularly to the commercial vehicle sectors.

**Development & Growth of Indian Automobile Industry**

In India the automabile industry took its birth as far back as 1942, although the assembly of vehicles from CKD packs had commenced much earlier, in 1928. In 1953 when the automobile assembly plants of GMC and Ford Motors were closed down, only five of the then existing automobile firms were recognised as actual manufactures. These were HML, SMPIL, PAL, APIL and Ashok Motors. Later, they were joined by TELCO, M&M and BTL and a few others. In the initial stages HML, PAL and SMPIL assembled vechicles from 50-60 per cent imported components and sub-assemblies obtained from their foreign principals. However, during the plan era, indigenisation received considerable emphasis and most of the automobile units began to emerge as fullfledged vechicle producers. Their scale of operations, however, remained at very low uneconomic levels (Annexure II)

The total vehicle production in India (for all manufactures) till 1980 was just a little more than 1 lakh per annum and reached a modest total of 2,51,919 in 1987-88 (AIAM, 1987) whereas the estimated economic annual output for a single automated plant is in the range of 2 to 4 lakh units. The Development Council for Automobiles & Allied Industries has estimated the minium annual economic capacity of a single unit at 50,000 for cars/jeeps and 30,000 for commercial vechicles.

The industry due to its small volume of output may continue to operate the component and assembly lines without automation, until such time, the demand for vehicles picks up sufficiently and it becomes feasible for individual plants to change over to automation and more modern technologies for their manufacturing and assembly lines. With a low per capita GNP of Rs. 3,640 and an equally poor disposable income, it seems unlikely that there will be any spectacular rise in the demand for automobiles to induce the existing automobile producers to opt for high level automation or sophisticated technologies in the near furture. It appears that the existing automobile units may, by and large, remain low output and high cost units for several yeai to come.

**Export Possibilities**

Exports are an important indicator of the development and maturity of an industry. While India was

importing assembled vehicles to a large extent until 1954 besides CKD packs and components, exports of vehicles began on a modest scale only in the Sixties. The extent of export of commercial vehicles from 1960 onwards is shown in Annexure-III.

The Indian auto industry came up primarily as an import substitute and began operations on a low key. Even today it has a limited variety of models and quantities to market. In the international market India is, therefore, still a marginal exporter. For example, in 1984 India's share of CV exports in relation to the total exports of all market economies was barely 0.09 per cent, the lowest among the developing countries except Singapore, Argentina & Ireland. In the face of stiff competition, from US, Japanese, German and face of automobile manufactures, it is unlikely that the exports will improve much, until the industry achieves economies of scale and is able to compete in the world market in equal terms.

In a study on Automotive Industry in Developing Countries, undertaken by the World Bank, it was brought out that "production costs for passenger cars ran about 2.2 times those in Europe. This was for a Fiat-type vechicle at very low volume (about 5,700 vechiles per year) and with a high domestic content. The Indian plant also maufactured two models of small and medium size trucks with a total output of just over 12,000 units annually". The then ex-factory prices for the case quoted in the Study were :

| *Ex-fy. price of passenger car* | *India* | *Europe* | *Ratio* |
|---|---|---|---|
| Before 1966 devaluation | Rs 11,320 | Rs 5,118 | 2.2 |
| After 1966 devaluation | Rs 12,664 | Rs 8,064 | 1.6 |

Citing the case of another manufacture of heavy (8-ton) truck the Study observed "The Indian export prices was actually six percent below the comparable European product immediately following devaluation, as compared to 23 per cent above, prior to devaluation. This was due to the fact that the volume of production was much closer to European standards i.e. about 19,000 in India as compared to 30,000 in Europe". The paper gave the following ex-factory prices for this type of vehicle :

| *Ex. fy. price* | *India* | *Europe* | *Ratio* |
|---|---|---|---|
| Before 1966 devaluation | Rs 30,000 | Rs 24,800 | 1.23 |
| After 1966 devaluation | Rs 35,000 | Rs 37,600 | 0.94 |

Dwelling on the reasons for the wide disparity of costs, the Study pointed out that there were two basic causes for the high cost structure in India :

(a) a much smaller scale of production relative to internationally competitive plants, and

(b) high procurement cost of materials and parts also produced by small scale plants under a protective regime.

Even though the World Bank Study was carried out scveral years back, position regarding the competitiveness of our automabile industry remains somewhat similar even today. A recent EMF Report ranks India at the bottom of the list of 9 industrializing countries in competitiveness (EMF, 1986).

Dispite lower wage rates, the production cost of automobiles continues to be high for various reasons. For determining efficiency in this capital intensive industry, the scale-of-economies and technology, thus, play a decisive role. It seems that the Indian auto manufactures will find it extremely difficult to establish themselves as exporters of any significance in the near future.

**Productivity Trends**

We have employed the following measures for assessing the overall performance of an enterprise :

(a) Total earnings to conversion cost ratio
(b) Capacity Utilization
(c) Profits to conversion cost ratio
(d) Ratio of Wages/Salaries to Sales
(e) Rates of stock turn to Sales
(f) Profit to sales ratio
(g) Sales & Earnings to employee ratio.

However, before examining the available data on capacity utilization and productivity, a look at the overall financial performance of the industry may be worthwhile. Table-2 gives a summary of some important financial statistics for the past three years of eight major Indian automobile companies. The figures reveal declining profits and rising costs, suggesting low efficiency of operations. Even though, the net sales have been going up every year, the profits have been coming down.

TABLE 2 **Financial Performance of Some Major Automobile Companies**

(Rs. crores)

| | 1984 | 1985 | 1986 |
|---|---|---|---|
| Net Sales | 1863.04 | 2309.70 | 2646.20 |
| Operating Profit | 191.59 | 213.28 | 237.29 |
| Depreciation | 65.91 | 81.90 | 75.53 |
| Interest | 99.49 | 113.74 | 161.32 |
| Profits before tax | 92.10 | 99.44 | 75.97 |
| Tax | 20.68 | 23.27 | 17.12 |
| Profits after tax | 71.42 | 76.17 | 58.85 |
| Tax as percent of Profit before tax | 22.50 | 23.40 | 22.60 |
| Dividend | 21.24 | 20.70 | 25.86 |
| Retained Profits | 50.18 | 55.47 | 32.99 |
| Net Worth | 622.01 | 750.11 | 817.13 |
| Gross fixed assets | 1160.16 | 1481.49 | 1919.39 |
| Profit after tax as percent of Networth | 6.10 | 5.10 | 3.10 |

*Note* : Total companies covered are 8.

*Source*: The Centre for Monitoring Indian Economy, Key Financial Data on Larger Business Units, May 1988 & November 1987.

### Capacity Utilization

As mentioned earlier, a common feature of all Indian automobile manufactures is their relatively smaller scale of operations. Although the first plant came into being sometime in 1942, the actual automobile manufacturing began only some times after 1953. The capacity build up has been rather slow for various reasons, and took an upward trend only from 1980 onwards. Commensurate with changes in capacity and rise and fall in the market demand for cars, Jeeps and commercial vehicles within the country the production of automobiles has been fluctuating from year to year.

As an indicator of the health of an industry, capacity utilisation is important. Table-3 shows the trends in installed capacity production and capacity utilisation for 3 major products of the automobile industry from 1970 onwards.

During the period 1970-75 there was little growth in capacity or production. In fact there was a general fall in the production of all types of vehicles which is attributable, largely, to the energy crisis of the early Seventies and the general economic recession that followed. With the pick-up of eccnomic activity from 1977 onwards the production began to improve once again. The period from 1981 witnessed hectic activity with an unprecedented rise in both capacity and production of cars, LCVs, HCVs and jeeps. Thereafter, once again, a stagnant trend emerged, particularly in the CV & Jeep sectors which seemed to be still continuing. While the CV sector is characterised by over capacity, the demand for jeeps is limited by the fact that the defence requirements are largely being met from the ordnance factories, civil demand being confined largely to survey teams and other field operations in the rural areas. High petrol prices and increased vehicle maintenance costs are some of the other factors which have also contributed to this general stagnation in the automobile indstry.

There has been a steep fall in the overall capacity utilisation from 1984 onwards (figuer 1) which continued till last year (expect for passenger cars). While the trend in production has been on the rise during the period, vastly excess capacity created in the boom period of 1980s has led to a fall in capacity utilisation from 1985 onwards mainly because of the demand not coming up to the anticipated levels. Table 4 shows individual capacity utilisation

TABLE 3 **Installed Capacity, Production and Capacity Utilisation**

| | 1970 | 1975 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|---|---|
| *Installed Capacity (000)* | | | | | | | | | | |
| Cars | 47.4 | 47.4 | 53.0 | 53.4 | 53.4 | 53.4 | 53.4 | 131.0 | 170.6 | n.a. |
| Jeeps | 10.0 | 13.0 | 18.8 | 20.0 | 20.0 | 20.0 | 20.0 | 30.0 | 40.0 | n.a. |
| CVs | 62.4 | 64.0 | 89.5 | 103.0 | 103.0 | 103.0 | 103.0 | 212.0 | 264.5 | n.a. |
| *Production (000)* | | | | | | | | | | |
| Cars | 35.8 | 23.3 | 30.5 | 42.1 | 42.6 | 44.9 | 64.1 | 88.7 | 101.5 | 124.7 |
| Jeeps | 9.3 | 8.2 | 17.3 | 17.0 | 21.4 | 29.4 | 24.1 | 28.5 | 28.6 | 28.8 |
| CVS | 40.6 | 38.0 | 65.9 | 89.7 | 88.4 | 88.7 | 93.5 | 105.3 | 95.0 | 99.0 |
| *Capacity Utilisation (Percent)* | | | | | | | | | | |
| Cars | 76 | 50 | 58 | 79 | 80 | 84 | 120 | 68 | 60 | 73* |
| Jeeps | 93 | 63 | 92 | 85 | 107 | 147 | 121 | 95 | 72 | 72* |
| CVs | 65 | 59 | 74 | 87 | 86 | 86 | 91 | 50 | 36 | 37* |

*Note* : * Capacity has been assumed to have remained at 1986 level.

*Source* : 1. The Centre for Monitoring Indian Economy, Production & Capacity Utilisation in 600 industries, 1986.
2. Kothari's yearbook on Business and Industry—1987.

TABLE 4 **Capacity Utilisation among Automobile Manufacturers**

| Company | Installed Capacity (000) | Production (000) | | | Capacity Utilisation % | | |
|---|---|---|---|---|---|---|---|
| | | 1985 | 1986 | 1986 | 1985 | 1986 | 1987 |
| Ashok Layland | 23.0 | 15.9 | 15.3 | 16.4 | 69.1 | 66.5 | 71.0 |
| Hindustan Motors | 45.0 | 26.9 | 25.7 | 25.0 | 59.8 | 57.1 | 55.6 |
| Mahindra & Mahindra | 35.0 | 33.5 | 32.7 | 34.6 | 95.5 | 93.4 | 99.0 |
| Maruti Udyog | 40.0 (1985-86) 100.0 (1986-87) | 51.6 | 80.2 | 92.6 | 129.0 | 80.2 | 92.6 |
| Premier Automobile | 54.5 | 29.4 | 30.2 | 27.4 | 53.9 | 55.4 | 50.3 |
| Standard Motors | 7.5 | 5.8 | 5.5 | 55.1 | 77.5 | 73.5 | 73.4 |
| TELCO | 58.5 | 47.3 | 46.9 | 49.2 | 81.0 | 88.2 | 84.2 |
| DCM Toyota | 15.0 | — | 2.5 | 2.8 | — | 16.7 | 18.6 |
| Bajaj Tempo | 20.0 | 13.8 | 13.2 | 15.7 | 69.0 | 66.0 | 78.5 |

percentages for some of the major automobile enterprises in the country.

The average capacity utilisation for a selected group of 164 Indian manufacturing industries for the period 1970 to 1986 is around 76 per cent (CMIE, 1986). Compared to this, both Mahindra & Mahindra and TELCO as also Maruti Udyog can be said to have performed quite well. However, the average capacity utilisation of the automobile manufacturing units in the world is between 83 and 86% (United Nations, World Economic Statiatics). Compared to this, it would seem that even TELCO & M&M have yet to go a long way to reach the international standard. The low capacity utilisation by the industry as a whole arises largely from the insufficient domestic demand and poor offtake due to technical, operational and market related factors such as :—

(a) Low per capita income which places passenger cars beyond the reach of a overwhelmingly large majority of the country's population.

(b) Poor export prospects due to high manufacturing costs and stiff market competition both in variety and quality.

(c) High excise duties and taxes which push up prices.

(d) Heavy maintenance & running costs of all vechicles.

(e) Technical constraints and lack of worthwhile R & D.

(f) Non-availability of certain critical raw materials at times.

(g) Irregular power supply and frequent breakdowns.

**Earnings-Conversion Cost Ratio**

The ratio of total earings to conversion costs being an overall indicator of productivity, is also a general measure of conversion efficiency of an enterprise. The figures in Annexure-IV reveal an unstable trend for the industry as a whole, although from 1984 onwards there has been a gradual decline year after year. There was some improvement in 1987 but it remained much below the 1984 achivement. Amongst the individual companies BTL showed an exceptionally high ratio for the four years.

**Other Indicators**

The ratio of profits to total conversion cost (Annexure-IV) is closely linked to earnigs-conversion costs ratio. Here again the pattern of performance is almost similar to what is indicated by the ratio of earings to conversion costs.

The ratio of wages and salaries to sales (Annexure-IV) shows what the employees cost the company to achieve the specified sales. Some companies show consistently better performance than the others throughout the six year period. The performance of such companies in other collateral areas of productivity also appears to be equally good. Rate of stock turn (ROST) indicates how many times a company turns its inventory (Annexure-IV). This measurement is normally done on a monthly basis but in the absence of required data, the figures shown are for the whole year. More or less all companies seemed to have operated close to the industry's average rate of stock turn for each year.

Profit performance can be monitored through two main indicators (i) Profits to cost ratio (PC) and (ii) Profit to Sales ratio (PS). PC is expressed in rupees and shows the ratio of profit to total cost and PS the amount of profit per rupee of total earnings. It is closely linked to the ratio of earnings to conversion costs. The trend in the ratios, as shown by the above two indicators (Annexure-IV) reveales a gradual decline in the performance of the industry as a whole during the six year period, although some individual companies showed some improvement occasionally. The trends generally conform to the picture presented by the financial data shown in Table-2.

Purchased Services to earnings ratio indicates how much purchased services cost a company for every rupee of a total earnings. The figures for the past 4 years (Annexure-IV) show a fair amount of uniformity in the ratios, though, a slight fall below the average level is shown by one or two companies

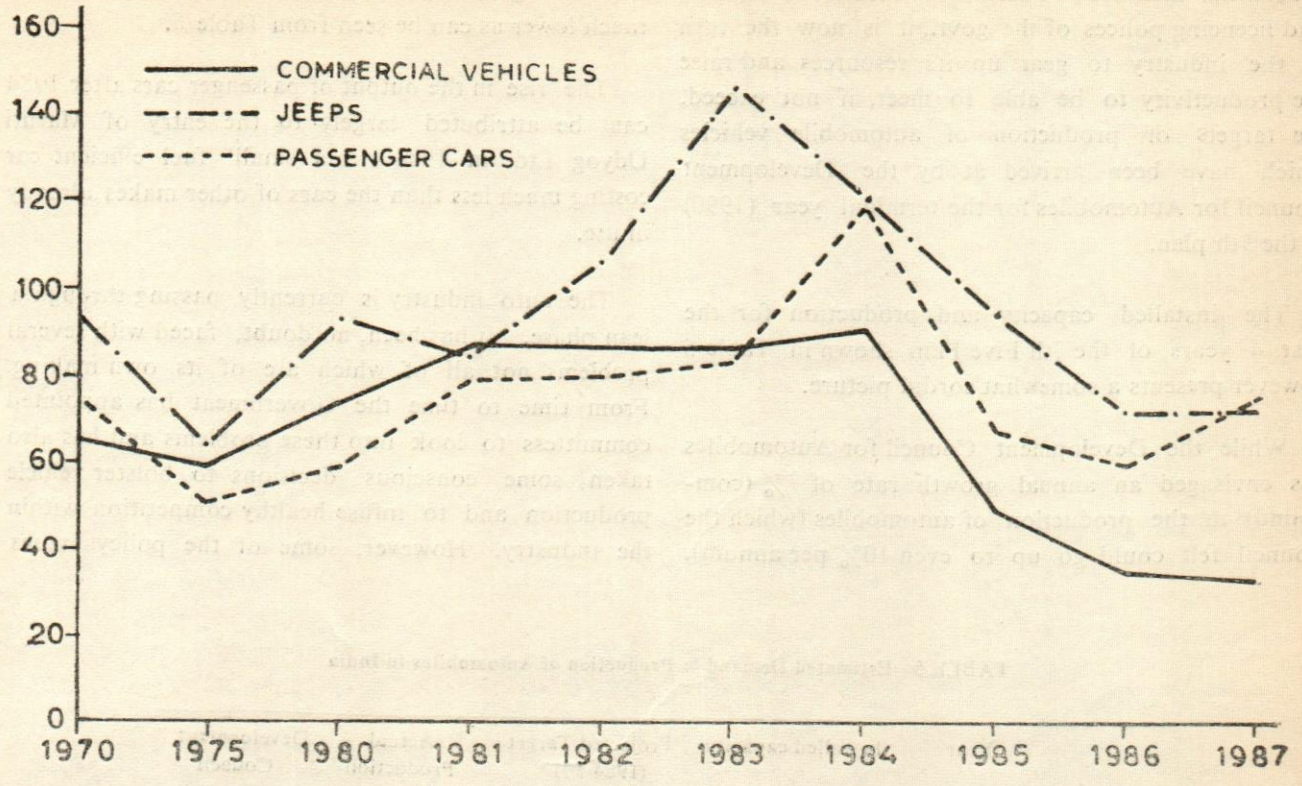


Fig. 1 Trends in Capacity Utilisation : 1970-1987

with occasional spurts. Such uniformity in the ratios may be due to the fact that the costs of most of the purchased services such as fuel and electricity, telephones, rent etc. do not change too freqently and that the consumption of these services moves in sympaty with production and sales, generally.

**Labour Productivity**

Labour productivity is measured through (i) sales per employee (SPE) (ii) earnings per employee (EPE) and (iii) Wages & Salaries to sales (WS) (Annexure-IV). While SPE and WS indicators are similar in nature, EPE is a more reliable indicator as the influence of mark up is removed. Labour productivity is one area which has always been the centre of attention of the industry as well as the Govt. The rising share of labour over the years has led to a low share of added value going to profits. If this trend continues, overall productivity performance may get a further setback. The ratios shown in Annexure IV may at a first glance give an impression that, by and large; all is well with the industry. This is far from being so. While a comparison between the productivity ratios of the Indian automobile industry and those of other established units in foreign countries may not be valid because of the palpable differences in technology, scale of operations, market conditions, state of the economy etc., an inter unit comparison should be quite in order. Such a comparision, however, seems to indicate that in some cases, the productivity ratios are from satisfactory, being much below the average for the auto industry.

**Future Outlook**

Indian automobile industry has now entered the maturity phase although it has still to go a long way way to approach the international standards. Of late, some of the leading companies, particularly in the LCV sector have been forced to cut back on their production. The commercial vehicle sector has, therefore, been pressing for change in govt. policy which will help stimulate domestic demand for automobiles especially for the light and medium commercial vehicles. After securing a

substantial measure of liberalization from the taxation and licencing polices of the govt., it is now the turn of the industry to gear up its resources and raise the productivity to be able to meet, if not exceed, the targets of production of automobile vehicles which have been arrived at by the Development Council for Automobiles for the terminal year (1990) of the 7th plan.

The installed capacity and production for the first 4 years of the 7th Five Plan shown in Table 5 however presents a somewhat sordid picture.

While the Development Council for Automobiles has envisaged an annual growth rate of 7% (compound) in the production of automobiles (which the Council felt could go up to even 10% per annum), the actual growth (except in the case of cars) has been, much lower as can be seen from Table 6.

The rise in the output of passenger cars after 1984 can be attributed largely to the entry of Maruti Udyog Ltd. in 1984 with a 'small' fuel efficient car costing much less than the cars of other makes already in use.

The auto industry is currently passing through a lean phase. It has been, no doubt, faced with several problems not all of which are of its own making. From time to time the Government has appointed committess to look into these problems and has also taken some conscious decisions to bolster vehicle production and to infuse healthy competition within the industry. However, some of the policy issues

TABLE 5 **Estimated Demand & Production of Automobiles in India**

| | Year | Installed capacity | Projected Target (1984-87) | Actual Production | Development Council Target (1990) |
|---|---|---|---|---|---|
| Cars | 1984 | 53,400 | 80,000 | 64,100 | |
| | 1985 | 1,31,000 | 91,000 | 88,700 | 1,54,000 |
| | 1986 | 1,70,000 | 1,04,000 | 1,01,500 | |
| | 1987* | 2,25,000 | 1,18,000 | 1,24,700 | |
| Jeeps | 1984 | 20,000 | 28,000 | 24,100 | |
| | 1985 | 30,000 | 31,000 | 28,500 | 45,000 |
| | 1986 | 35,000 | 34,000 | 28,600 | |
| | 1987* | 35,000 | 38,000 | 28,800 | |
| CVs | 1984 | 1,03,000 | 1,06,000 | 93,500 | HCV |
| | 1985 | 2,12,000 | 1,19,000 | 1,05,300 | 1,20,000 |
| | 1986 | 2,64,000 | 1,35,000 | 95,000 | LCV |
| | 1987* | 1,46,480 | 1,52,000 | 99,000 | 75,000 |

*Note* : *As per the scheme of broad banding permitted by by the government the available installed capacities are composite figures. We have, therefore, assumed the 1986 figures of installed capacity for calculation of capacity utilisation percentages.

*Source* : Drawn from different sources, a major portion being from (a) The Centre for Monitoring Indian Economy, Production & Capacity utilisation in 600 industries and AIAM Publications.

TABLE 6 Growth Trends in Production of all Vehicles

| | 1984 % | Growth 83/84 % | 1985 | Growth 84/85 % | 1986 | Growth 85/86 % | 1987 | Growth 86/87 % |
|---|---|---|---|---|---|---|---|---|
| Jeaps | 24,100 | 18% | 28,500 | 18% | 28,600 | 0 35% | 28,800 | 0.7% |
| Cars | 64,100 | 42% | 88,700 | 38% | 1,01,500 | 14% | 1,24,700 | 22.8% |
| CVs | 93,500 | 5.4% | 1,05,300 | 12.6% | 95,000 | 9.8% | 99,000 | 4% |

*Source* : Association of Indian Automobile Manufacturers, (1985).

like levels of indigenisation, selling prices of vehicles, quality/durability standards, economy of operation, technology up-gradation, excise & taxes etc. which have been raised again and again over the past few years still remain unresolved. These have also featured in the terms of reference of the Tariff Commissions and Development Council for Automobiles appointed by the Government. These are indications of the government's concern for the industry's problems, but clear cut policies have yet to emerge.

In view of the huge investments made in the automobile industry particularly in the LCV sector during the last few years, mainly with foreign collaboration, the problem of unused manufacturing capacity and regular outgo of foreign exchange has assumed great importance from the national angle.

According to indudstry sources (AIAM-1988) high and rising cost of inputs and heavy tax burdens are two of the major contributory factors which have led to the current slump in the demand for commercial vahicles. Tardy efforts at indigenisation, low productivity, poor fuel efficiency and indifferent vehicle quality are some of the other factors which have further aggravated the problem of sluggish demand.

Efforts to export of vehicles have proved equally unrewarding because of the lack of competitiveness of our vehicles in the international market both in quality, price and after sale service arrangements. These are some of the problems and issues which stand out for urgent review and solution to help the industry to strengthen its growth and stabilize its operations.

**Conclusion**

The automobile industry is of strategic importance in the context of the country's economic development and its defence and security needs. Its importance has grown over the years and from a simple CKD assembler, it has now acquired the status of a full fledged automobile producer. The scale of operation has, however, remained small which has seriously handicapped its efforts to compete in the world market.

Despite continuous, *albeit* slow, expansion of road network in the country, the growth of the automobile industry has not come to the expected levels, The quality and cost of its products are still below the international standards primarily because of uneconomic scale of operations which preclude the possibility of introducing automation in its assembly and manufacturing units.

Though India has been exporting automobile for the past three decades or so, it still remains a marginal exporter. The position is unlikely to change very much in the near future as most of the automobile manufactuers continue to be low output high cost units and cannot stand in competition with the long established automobile manufacture elsewhere in the world.

There has been a steep fall in capacity utilisation from 1984 onwards in almost all sectors of the auto industry. The entry of Maruti Udyog with a small fuel efficient car has provided some respite to the car sector but the situation in the auto industry as a whole

remains somewhat unsatisfuetory. The vehicle market has now turned into a buyer's market and unless the industry becomes resource efficient and brings the sales price dawn and also raises the quality of its products, the demand for its product may remain sluggish.

Productivity in the industry, in general, is on the low side. Some individual units have, however, performed better than the others. To reach international standards, the industry has yet to go a long way. The automobile industry, for long, has been used to a protected market and has been unfamiliar with campetition within its own ranks. It will now have to gear up its resources and managerial talents to improve productivity, reduce costs and tone up the quality of its products, if it has to survive. There are no soft options available now or later.

**Abbreviations**

AIAM—Association of Indian Automobile Manufactures
APIL Automabilc Products of India Limited
AL Ashok Leyland
ALL Allwyn Nissan Limited
BTL Bajaj Tempo Limited
CMIE Centre for Monitoring Indian Economy
DCM DCM Toyota
HCV Heavy Commercial Vehicles
HML Hindustan Motors Ltd
LCV Light Commercial Vehicles
M & M Mahindra and Mahindra
PAL Premier Automobiles Ltd.
SAL Sipani Automobiles Ltd.
SMPIT Standard Motor Products of India Ltd.
SCL Simpson and Company Ltd.
TELCO Tata Engineering & Locomotive Company

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□

*ANNEXURE—1* **Vehicle Production in Some Industrialized Countries 1982-1985 (000)**

| Country | 1982 | 1983 | 1984 | 1985 |
|---|---|---|---|---|
| Canada | 1276.0 | 1525.4 | 1841.8 | 1930.6 |
| Mexico | 476.5 | 284.0 | 347.0 | 424.1 |
| USA | 6902.3 | 9109.2 | 10697.0 | 11359.0 |
| Brazil | 840.1 | 1723.0 | 848.7 | 955.0 |
| Japan | 10811.8 | 11105.3 | 11453.5 | 12080.2 |
| Korea | 137.4 | 204.6 | 256.8 | 361.3 |
| France | 3543.2 | 3631.8 | 3324.3 | 3082.3 |
| W. Germany | 4051.6 | 4157.3 | 4029.9 | 4442.4 |
| Itally | 1448.4 | 1569.1 | 1596.1 | 1562.5 |
| Holland | 99.2 | 114.3 | 117.1 | 116.5 |
| UK | 1150.0 | 1283.6 | 1128.6 | 1305.1 |
| Sweden | 375.7 | 424.1 | 442.1 | 468.0 |
| Czechoslovakia | 220.2 | 220.0 | 226.4 | 232.5 |
| GDR | 224.2 | 229.2 | 246.3 | 257.3 |
| Poland | 275.9 | 321.0 | 333.2 | 340.2 |
| Spain | 1063.4 | 1229.1 | 1258.2 | 1371.3 |
| Yugoslavia | 177.8 | 188.8 | 206.4 | 197.2 |
| USSR | 175.2 | 162.0 | 166.0 | 168.0 |
| India | 135.9 | 130.8 | 157.5 | 194.3 |
| World Total | 36210.7 | 39728.6 | 41657.6 | 44165.0 |

*Note* : 1. Break up total does not tally with world total.

2. Figures include passenger road transport vehicles seating more than nine persons and road transport vecheles designed for conveyance of goods including vehicles for special purposes, and passenger cars, three or four wheelers designed for carrying passengers.

*Source* : United Nations Industrial Statistics—1985.

*ANNEXURE—II* **Annual Output of Vehicles By Manufactures (Nos)**

| Year | Jeeps | | | Passenger Cars | | | | | Commercial Vehicles | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M & M | MUL | BTL | PAL | MUL | SM | SAL | Total | TELCO | AL | PAL | HML | BTL | M&M | SM | SCL | Total |
| 1977 | 9594 | .. | 20256 | 17481 | .. | 111 | 171 | 38019 | 23419 | 8083 | 1881 | 969 | 4770 | 953 | 1627 | .. | 41702 |
| 1978 | 11010 | .. | 20987 | 2931 | .. | 117 | 331 | 34366 | 29108 | 10947 | 1264 | 2383 | 6507 | 1354 | 1907 | .. | 53470 |
| 1979 | 12340 | .. | 17523 | 11550 | .. | 56 | 106 | 29235 | 31685 | 12315 | 1079 | 2599 | 6509 | 3084 | 2425 | .. | 59696 |
| 1980 | 15068 | .. | 21752 | 9729 | .. | 6 | 51 | 30538 | 31768 | 12928 | 1235 | 4880 | 9801 | 3617 | 3491 | 591 | 68311 |
| 1981 | 17029 | .. | 23197 | 18874 | .. | 4 | 31 | 42106 | 45034 | 15031 | 3282 | 5303 | 8589 | 7234 | 4459 | 820 | 89752 |
| 1982 | 19660 | .. | 21836 | 2077 | .. | 1 | 126 | 42674 | 43097 | 16363 | 2797 | 2496 | 11708 | 9034 | 4751 | .. | 90246 |
| 1983 | 21660 | .. | 23683 | 20929 | 175 | 1 | 302 | 45090 | 46074 | 13411 | 1293 | 1908 | 9626 | 9658 | 5395 | .. | 87365 |
| 1984 | 20130 | n.a.* | 24376 | 26620 | 12087 | .. | 930 | 74298 | 46740 | 14430 | 952 | 2307 | 12906 | 11515 | 5810 | .. | 94660 |
| 1985 | 21755 | n.a.* | 24064 | 29223 | 48635 | 185 | 954 | 103079 | 46904 | 15938 | 856 | 302 | 13757 | 11701 | n.a. | .. | 101228 |
| 1986 | 21405 | 6387 | 22387 | 28501 | 63504 | 1476 | 399 | 116267 | 49242 | 15265 | 855 | 4 | 13136 | 11297 | n.a. | .. | 94885 |
| 1987 | 29120 | n.a.* | 25561 | 31191 | 90909 | 744 | 18 | 148423 | 56662 | 16347 | n.a. | n.a. | 15664 | 5522 | n.a. | .. | 105500 |

*Note* : 1. Some production figures are for the financial years e.g. HML, AL, PAL, MUL, etc.
2. Break-up total may not add to World Total.
* Included in the production figure for cars/vans etc.

*Source*: (i) Association of Indian Automobile Manufactures, The Automobile Industry Statistical Profile, 1985.
(ii) Annual Reports of Companies concerned.
(iii) Hindu Sept. 22, 1988.

*ANNEXURE-III* **Export of Commercial Vehicles 1960-1987**

| | | 1960 | 1964-64 | 1969-70 | 1974-75 | 1979-80 | 1981-82 | 1983-84 | 1985-86 | 1987-88 |
|---|---|---|---|---|---|---|---|---|---|---|
| Vechiles for Transport of goods materials etc. | No. | 13 | 208 | 1557 | 2271 | 4419 | 4841 | 1614 | n.a | 3858 |
| Buses and CV Chasis etc. | Rs. (Lacs) | 2.44 | 53.3 | 581.0 | 1758.2 | 4294.4 | 5300.0 | 3325.0 | 5400.0 | 6851.0 |

*Source* : DGCI & S Monthly statistics of Forgein Trade.

## *ANNEXURE-IV* Productivity Indicators for Indian Automobile Industry

| Productivity Indicator | Year | Industry Average | AL | BTL | HM | M&M | MUL | PAL | SM | TELCO | DCM | ALL | Aver-age | High-est | Low-est | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| Total earnings | 1982 | 1.19 | 1.18 | .. | .. | .. | .. | .. | 1.23 | ... | .. | | | | | |
| to conversion | 1983 | 1.55 | 1.78 | 3.6 | 1.48 | 1.29 | .. | 1.33 | 1.26 | 1.53 | .. | | | | | |
| cost ratio | 1984 | 1.85 | 1.36 | 6.0 | 1.47 | 1.28 | 1.14 | 2.63 | 1.20 | 1.23 | .. | .. | | | | |
| (T/C) (Rs) | 1985 | 1.29 | 0.92 | 8.2 | 1.33 | 0.93 | 0.31 | 1.27 | 1.17 | 1.26 | .. | .. | | | | (a) Some aberr- |
| | 1986 | 1.20 | 1.42 | 6.4 | 1.25 | 1.36 | 0.14 | 1.96 | 0.79 | 1.03 | 0.32 | 0.55 | | | | ations have |
| | 1987 | 1.22 | 1.22 | .. | 1.19 | 1.35 | 1.15 | 1.09 | .. | 1.31 | 0.55 | 1.05 | 1.38 | 8.21 | 0.14 | been intro- |
| Profits to conversion | 1982 | 0.21 | 0.20 | .. | .. | .. | .. | ... | 0.26 | .. | .. | .. | | | | duced in the |
| cost ratio | 1983 | 0.17 | 0.11 | 0.65 | 0.31 | 0.18 | .. | 0.11 | 0.14 | 0.13 | .. | .. | | | | results due |
| (P/C) (Rs.) | 1984 | 0.16 | 0.10 | 0.81 | 0.24 | 0.17 | 0.31 | 0 09 | 0.13 | 0.07 | .. | .. | | | | to the |
| | 1985 | 0.12 | 0.06 | 0.68 | 0.21 | 0.11 | 0.04 | 0.14 | 0.09 | 0.08 | .. | .. | | | | inclusion |
| | 1986 | 0.08 | 0.08 | 0.68 | 0.17 | 0.07 | 0.09 | 0.14 | −0.26 | 0.09 | 0.43 | −0.78 | | | | of data of |
| | 1987 | 0.04 | 0.09 | .. | 0.01 | 6.08 | 0.13 | (negl.) | .. | 0.01 | −0.47 | −0.75 | 0.13 | 0.61 | 0.78 | some new |
| Ratio of Wages and | 1982 | 12.2 | 8.7 | .. | .. | .. | .. | .. | 15.4 | .. | .. | .. | | | | companies |
| Salaries to | 1983 | 13.2 | 8.7 | 4.04 | 13.6 | 13.0 | .. | 19.5 | 14.0 | 12.6 | .. | .. | | | | whose per- |
| Sales (%) | 1984 | 13.7 | 9.7 | 3.5 | 14.4 | 14.0 | 18.6 | 23.8 | 15.1 | 14.0 | .. | .. | | | | formance |
| | 1985 | 13.5 | 10.7 | 3.0 | 15.2 | 15.4 | 3.6 | 22.6 | 16.7 | 13.8 | .. | .. | | | | has yet to |
| | 1986 | 13.0 | 9.7 | 3.0 | 16.4 | 15.6 | 0.8 | 23.2 | 20.8 | 14.4 | 4.4 | 3.0 | | | | stabilize. |
| | 1987 | 12.6 | 10.7 | .. | 15.5 | 15.2 | 1.9 | 25.0 | .. | 14.9 | 2.9 | 7.4 | 13.0 | 25.0 | 0.86 | (b) Some figures |
| Rate of Stock | 1982 | 0.32 | 0.34 | 0.26 | .. | .. | .. | 0.33 | 0.23 | .. | .. | ... | | | | refer to |
| turn to sales (I/S) | 1983 | 0.29 | 0.26 | 0.30 | 0.38 | 0.23 | .. | 0.31 | 0.26 | 0.30 | .. | .. | | | | financial |
| | 1984 | 0.27 | 0.25 | 0.29 | 0.33 | 0.24 | .. | 0.22 | 0.23 | 0.27 | .. | .. | | | | years. |
| | 1985 | 0.28 | 0.30 | 0.20 | 0.35 | 0.33 | .. | 0.27 | 0.33 | 0.25 | .. | .. | | | | |
| | 1986 | 0.32 | 0.25 | .. | 0.42 | 0.33 | .. | 0.27 | .. | 0.34 | .. | .. | | | | |
| | 1987 | 0.29 | 0.27 | .. | 0.41 | 0.27 | .. | 0.32 | .. | 0.27 | .. | .. | 0.29 | 0.42 | 0.20 | |
| Profit to sales ratio | 1982 | 5.1 | 3.8 | 0.9 | .. | .. | .. | .. | 5.7 | .. | .. | .. | | | | |
| (P/S) (%) | 1983 | 4.4 | 2.4 | 9.0 | 5.2 | 4.3 | .. | 3.7 | 3.1 | 3.7 | .. | .. | | | | |
| | 1984 | 3.6 | 2.2 | 8.7 | 5.7 | 4.2 | 0.11 | 3.4 | 2.9 | 2.2 | .. | .. | | | | |
| | 1985 | 3.3 | 1.4 | 5.8 | 5.8 | 3.8 | 1.10 | 4.7 | 2.2 | 2.9 | .. | .. | | | | |
| | 1986 | 2.2 | 1.7 | 6.5 | 5.9 | 1.8 | 1.26 | 5.1 | −0.1 | 1.6 | 10.0 | −15.2 | | | | |
| | 1987 | 1.2 | 2.2 | .. | 2.1 | 2.0 | 2.0 | 5.8 | .. | 0.5 | −8.8 | −24.6 | 3.3 | 10.0 | −24.6 | |

*(Contd.)*

*ANNEXURE-IV (Contd.)*

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ratio of Purchased | 1982 | 0.30 | 0.32 | .. | .. | .. | .. | .. | 0.13 | .. | .. | .. | | | | |
| Services to Total | 1983 | 0.26 | 0.21 | 0.19 | 0.24 | 0.25 | .. | 0.24 | 0.14 | 0.29 | .. | .. | | | | |
| Earnings | 1984 | 0.25 | 0.29 | 0.11 | 0.24 | 2.26 | 3.40 | 0.10 | 0.15 | 0.35 | .. | .. | | | | |
| | 1985 | 0.30 | 0.43 | 0.10 | 0.27 | 0.36 | 1.84 | 0.20 | 0.17 | 0.33 | .. | .. | | | | |
| | 1986 | 0.33 | 0.29 | 0.08 | 0.29 | 0.24 | 4.32 | 0.22 | 0.30 | 0.41 | 1.80 | 1.10 | | | | |
| | 1987 | 0.33 | 0.32 | .. | 0.28 | 0.24 | 0.62 | 0.27 | .. | 0.31 | 0.93 | 0.38 | 0.29 | 4.32 | 0.08 | — |
| Total Earnings per | 1982 | | 58.4 | | | .. | .. | .. | .. | .. | .. | .. | | | | |
| employee | 1983 | | 91.9 | | | .. | .. | 55.46 | .. | 84.6 | .. | .. | | | | |
| (Rs. 000) | 1984 | | 73.0 | | | 323.7 | 5.97 | 128.6 | | 77.5 | .. | .. | | | | |
| | 1985 | | 61.2 | | | 218.7 | 24.46 | 74.5 | | 89.0 | .. | .. | | | | |
| | 1986 | | 95.9 | | | 254.2 | 16.20 | 77.1 | | 76.9 | .. | .. | | | | |
| | 1987 | | 95.7 | | | 224.9 | 267.6 | 79.3 | | 104.2 | .. | .. | .. | 323.7 | 61.2 | — |
| Sales per employee | 1982 | | 260.1 | | | .. | .. | .. | | .. | .. | .. | | | | |
| (Rs 000) | 1983 | | 252.6 | | | .. | .. | 129.3 | | 193.7 | .. | .. | | | | |
| | 1984 | | 242.3 | | | 999.0 | 39.0 | 134.9 | | 205.3 | .. | .. | | | | |
| | 1985 | | 277.6 | | | 842.5 | 521.7 | 171.0 | | 226.9 | .. | .. | | | | |
| | 1986 | | 320.1 | | | 714.8 | 900.8 | 179.9 | | 238.3 | .. | .. | | | | |
| | 1987 | | 333.8 | | | 632.8 | 1513.0 | 183.0 | | 276.2 | .. | .. | .. | 999.0 | 3.20 | — |

*Note* : 1. The above calculations are based on the published financial data contained in

(i) CMIE publications Key Financial Data on Large Business Units, for Various Years.

(ii) Kothari's Year book on Business and Industry-1987.

(iii) Annual Reports of the Companies concerned.

# Grievance Handling System in Tata Steel

Any progressive industrial organisation should have a sound grievance handling system as a key component of its industrial relations management strategy. This may seem fairly obvious, but the key to a successful strategy lies in a mechanism which can take note of grievances as and when they arise, instead of allowing the dissatisfaction, which is the starting point of the grievance, to simmer on without finding expression in forums created for this purpose. Here it might be mentioned that a grievance may be real or imaginary but has to be tackled nevertheless. If the grievance is real, the need for curative action is obvious; if it is imaginary, the need to explain and clear up the atmosphere is all the more imperative.

Tata Steel has an enviable record in the area of industrial relations and this has been due, in a large measure, to the committees set up for the handling of grievances. The first Works Committee was set up as early as 1919. For a while it remained dormant because of the internecine rivalry among various trade union factions. It was revived in 1946 in the form of the West Plant Joint Committee and the East Plant Joint Committee for departments in the Western and Eastern zones of the Works respectively.

In 1956 an agreement was signed between the management and the Tata Workers' Union for a programme towards closer cooperation. An important clause pertained to the introduction of a grievance handling procedure for all departments, in consultation with the Unions. It was also agreed to review the working of the Works Committees in this light. Following this, the Committees were divided into its zonal counterparts. The idea was to decentralise the grievance handling procedure so that grievances originating at a particular department can be tackled in that department itself, in the shortest possible time and at the lowest possible level. It is a three stage procedure with an appropriate form for each stage.

Individual grievances and complaints are not discussed at any level other than that specified in this procedure, except that if the Union so desires, such cases may be put up for discussion at the Central Works Committee.

Policy matters and their interpretations are not discussed at any level except with the top management. The Union, however, can take up such matters at the Central Works Committee.

It should be noted here that the system is designed to ensure that the Works Committees serve the purpose for which they came into being, and do not become toothless bodies. For this reason, representations for the redressing of grievances from employees to the various authorities either directly or through the Union, are not entertained, at least until the case has been either disposed of or withdrawn from the Works Committee.

However, in exceptional cases, like those involving the grievances of a number of workmen, or on questions of principle or policy or any other important matter where immediate action is necessary, the

Union may directly take up the matter with the appropriate level of mananement. In important cases, the President or the General Secretary of the Union may ask the management for a joint inquiry. The following subjects come under the purview of this procedure :

Action
Amenities and/or facilities
Continuity of service
Compensation
Discharge/dismissal
Fines
Increment
Leave
Medical
Misconduct
Nature of job
Promotion (excluding selection by interview)
Safety appliances
Suspension
Transfer
Victimisation
Warning letter

What follows are the steps involved in the grievance handling procedures outlined in some detail. This may help in bringing out the decentralised nature of the whole system.

**Stage One**

(a) If any employee has a grievence, he meets his shift-in-charge or equivalent and talks it over with him. In cases of appeal against punishments excluding suspension, discharge or dismissal, the employee can meet his General Foreman or equivalent. If necessary, he can obtain a copy of Grievance Form-1. He has to fill in the form and submit it within one week of the date on which the facts on the basis of which the grievance has arisen, became known to him, except that in the case of promotions, a time limit of six weeks from the date of promotion in question is allowed.

(b) The grievance form is handed over to the shift-in-charge, General Foreman, or equivalent, as the case may be, who arranges to issue an acknowledgement receipt. He makes necessary enquiries, and returns the form to the employee concerned with his remarks in the space provided for this purpose or, with the remarks of the head of the department (where the matter is beyond the jurisdiction of the General Foreman or the shift-in-charge or equivalent) within the next two working days from the receipt of the form. In cases requiring reference to higher authorities, this time limit is relaxed. If necessary, the employee can discuss the case further with the supervisor concerned in the light of his remarks. The employee can also take the help of the Union representative in presenting or discussing the case at this and/or the next stage.

**Stage Two**

(a) If the employee is still is not satisfied with the reply at the stage one, he may obtain from the General Foreman or the shift-in-charge or equivalent, as the case may be, a copy of Grievance Form-II, enter there in the reasons for reconsideration of the case, and submit the form to the head of his department within three working days of the receipt of the reply at stage one; he is given an acknowledgement receipt.

(b) Appeals against suspension can be sent to the head of the department on Grievance Form-II or on ordinary paper, within seven days of the receipt of orders or after the last date of suspension, whichever is later. Appeals in such cases need not go through stage-I of the grievance handling system.

(c) The head of the department discusses the issue with the employees and the supervisor concerned and returns this Form with his remarks within three working days of receipt of the Form. In cases requiring reference to higher authorities or to another department, this time limit is relaxed.

**Stage Three**

(a) If the employee is still not satisfied with the reply, he may appeal to the Chairman of the Zonal Works Committee concerned, on Grievance Form-III,

within seven working days of the receipt of the reply at stage II.

(b) Appeals against orders of discharge or dismissals are addressed to the Chairman of the zonal works committee concerned, on Grievance Form-III (copies of which are made available at the Employment Bureau) or on ordinary paper, and these are considered at Stage III, in the first instance. The employee should appeal within six weeks of the receipt of the orders, except that in cases, where the employees discharged or dismissed are out of Jamshedpur at the time when the orders are issued, the time limit is three months from the date of issue of such orders.

(c) The decision reached by management, after due consideration of the recommendations of the zonal works committee is communicated to the employee on Grievance Form-III through the proper channel. The zonal works committee's unanimous recommendations are considered final when no objection is raised by either the management or the Union within 10 days of the receipt of such recommendations.

(d) Where such recommendations are not unanimous or have not been accepted by the management or the Union, the zonal works committee refers the case to the Central Works Committee for consideration.

Both the Management and the Union are free to raise objections on the unanimous recommendations of the committee, though generally unanimous recommendations are accepted *in toto*. Objections are raised only when the recommendations contravene any laid-down policy. A time limit of 10 days is set for raising objections. If no objection is raised within this period, the management takes necessary action to implement the recommendations. This is communicated as the management's decision to the departmental head concerned who in turn communicates the decision to the employee on Grievance Form-III.

At the Central Works Committee (CWC), which normally meets every Friday afternoon, the General Manager (Works) and the Deputy Director of Personnel (Works) discuss many pressing problems with Union officials. The cases referred by the zonal works committees are also considered there besides others on the agenda of that committee. The decision taken there is communicated in the same fashion to the employee concerned. Similarly, the Special CWC at its periodic meetings disposes off the cases referred by the Non-Factory Employees Works Committee. Tables 1—3 show the performance of the

TABLE 1 : **Performance of Zonal Works Committees and Central Works Committees**

*Number of grievances (subjectwise) handled by various ZWCs from 1982-83 to 1986-87*

| | 1982-83 | 1983-84 | 1984-85 | 1985-86 | 1986-87 |
|---|---|---|---|---|---|
| Acting/Seniority | 23 | 33 | 42 | 53 | 28 |
| Promotion | 30 | 41 | 37 | 52 | 29 |
| Warning | 9 | 1 | 8 | 11 | 4 |
| Suspension | 40 | 39 | 34 | 35 | 30 |
| Discharge/Dismissal | 83 | 66 | 53 | 61 | 64 |
| Miscellaneous | 25 | 46 | 37 | 46 | 33 |
| Total | 210 | 226 | 211 | 258 | 188 |

TABLE 2 : **Number of ZWC Meetings held during last 5 years**

| | |
|---|---|
| 1982-83 | 120 |
| 1983-84 | 128 |
| 1984-85 | 95 |
| 1985-86 | 113 |
| 1986-87 | 101 |

TABLE 3 : **Performance of CWC/Spl. CWC**

| | No. of meetings held of CWC/ Spl. CWC | No. uf cases handled by CWC/Spl. CWC |
|---|---|---|
| 1982-83 | 26 | 173 |
| 1983-84 | 23 | 299 |
| 1984-85 | 21 | 152 |
| 1985-86 | 17 | 179 |
| 1986-87 | 16 | 97 |
| Total | 103 | 900 |

Zonal Works Committees and Central Works Committee.

The workers by and large have a lot of faith in this system. The strength of the procedure lies in :

1. Its sticking to the time schedule rather strictly.
2. Management's credibility which has been built over the years.
3. Officers who are involved, directly or indirectly, because of whom a worker puts a grievance, do not hold it personally against the worker.
4. Scope of jurisdiction is well defined.
5. Matters relating to wages, hours of work, bonuses and also matters falling within the purview of the other joint committees such as JDC and other ancillary joint committees are excluded from the purview of the zonal works committees. In other words, the terms of reference, functions and jurisdiction of the committee are clearly enunciated and accepted by all concerned and adhered to.
6. Support by a stable trade union.
7. Codification of the Company's rules and practices and the availability of the copies at different levels of management.
8. Participation of the aggrieved employee, his Union representative and his supervisor at different levels of discussions.
9. Every effort is made in the meetings of the Works Committees to keep the discussions "fact-oriented" instead of "employee-oriented".
10. Conventions are respected, e.g. publication of seniority list of employees, acting and promotion charts are made known to all and followed strictly; unanimous recommendations of the works committees are implemented unless they are contrary to the Company's policies.
11. It is always borne in mind by the members of the works committees that they are not instruments of the collective bargaining but are designed to make a joint review of employees grievance and make appropriate recommendations.

Tata Steel, thus, not only recognises the grievances of workers, actual or perceived, but also takes pains to solve them. Besides, the management also takes preventive action in areas where there is likelihood of grievances coming up.

*S.N. Pandey*
*Executive Director*
*Tata Steels*
*Jamshedpur*

*Productivity, Vol. 29, No. 3, October-December 1988, 341-344*

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# BOOK REVIEW

**THE GOOD AND BAD NEWS ABOUT QUALITY, By Edward M. Schrock and Henry L. Lefevre, Marcel Dekker, Inc., New York and Basel, 1988, 264p, $54.00**

The good news is that we know how to economically manufacture high quality products. The bad news is that many manufacturing companies have not learned the good news. Now Japan has a better reputation for quality than the land of its tutors. The ability of the United States to produce complex and sophisticated products is still outstanding, but this is not enough. The products must be safe, reliable and strong enough to withstand abuse without hurting anybody. Customers must also feel that they are getting their money's worth.

This is the central message contained in this volume. The book discusses the organisational principles and administrative procedures, for the top management to follow in order to understand the language of quality control, recognise the tools of quality professionals and maximise the product quality at minimum cost. The book was conceived by Edward M. Schrock, a pioneer in the field of quality control. He, however, did not live to see it published. Henry L. Lefevre completed the book.

The uniqueness of this book is in two factors: one, that the authors have approached the subject as managers, not as statisticians. And secondly, the fundamental concepts as well as the methodology, technology and procedures are discussed at the leading edge of the discipline.

The modern approach to quality and reliability concerns excellence, argue the authors. Excellence when the product is designed, excellence when the product is made, excellence as the product is used and excellence throughout its lifetime. But excellence does not result without effort and products and services of superior quality and reliability require an appropriate combination of statistical, engineering, managerial and motivational efforts.

Edward and Henry had the advantage of working as managers and consultants. Within this volume, the reader will, therefore, find the means to create, control, and improve quality and reliability in ways that are cost effective, that enhance productivity and that create a motivational atmosphere that is harmonious and constructive.

Emphasis on the customer as the ultimate judge of quality serves as the catalyst to bring about the integration of techniques, methods and managerial effort for quality. Schrock has rightly broadened the concept of inspection from the emphasis and detection and correction of defective materials to the control of quality through analysis and prevention of quality problems.

The author introduces the concepts under seven characteristics calling them the fearful dragons. Some of them are very important such as 'Quality Control doesn't Need High-level managers', 'Quality is a Departmental function', etc. The next chapter rightly concentrates on Myths and Realities, followed by Keys to Managing Quality.

The operators are now the 'master craftsmen'. No one else really knows the details of what's going on in

the shop. In order to capitalize on the operator's closeness to the work, many companies are training shop personnel in statistical techniques. This helps them to participate in the correction of quality problems. The importance of quality improvement is, therefore, through participation in such forums as quality circles.

According to the author, the most important key to quality is the knowledge of customer requirements. Who are your customers? Men? Women? Senior citizens? Teenagers? Southerners? Easterners? Under privileged? The affluent? Each group has different expectations. One thing customers normally want is reliability. Customers are a company's greatest resource. Organisations that understand and provide for their needs, wants and desires will be rewarded.

Schrock observes that quality starts with the suppliers. If their quality is poor, the product quality will be poor. Do your purchasing, quality and design departments visit your suppliers? They should work as a team, evaluating the vendor's ability and willingness to provide quality products. The author advises the development of good lines of communication between the firms quality representative and the vendor's; and to ensure the use of the same equipment and procedures, when inspecting parts and materials by the firm and the vendor.

The authors have devoted one chapter to management of controlable defects and another to worker controllable defects. This clarifies their respective roles in defects prevention.

Due coverage has been given to process capability, and other techniques. The proverb, "one picture is worth more than a thousand words" is relevant here. Frequency distribution charts, control charts and other techniques are just as useful. Regression analysis being an important statistical tool is covered in detail to determine the effect one variable has on another. Now, that they are computerised, these analyses can be run by the average clerk.

The book is intended for those in manufacturing, engineering, marketing and management, as will as the consuming public, all of whom have an interest and stake in the improvement and maintenance of quality and reliability in the products and services. I trust that the reader will benefit from the disasters and successes that have been described.

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**MODERN SMALL INDUSTRY IN INDIA, By Ram K. Vepa, Sage Publications, New Delhi, 1988, 193p, Rs. 175.00.**

A publication of this type by a former member of the Indian Administrative Service who had held several responsible positions in the government will certainly be read with great interest. The matter presented in the publication also acquires considerable authenticity as Dr. Vepa himself headed for quite sometime the Small Industry Development Organisation as Development Commissioner for Small Scale Industries.

Chapters 1, 2 and 3, Introduction, Growth of Small-Scale Industry and Organisational Structure respectively present detailed information about the growth of small industries and the organisational structure of modern small industry and 'village and small industries sector'. Most of the statistical data and structural as well as policy aspects will, naturally, acquire historical importance only. But these chapters provide a good link with the past as the Modern Small Industry movement is a very significant post-independence development in the Indian economy. The remaining four chapters which discuss the key issues, field planning for small industry development and prospects for 1990 as also the conclusions are of great interest because they contain views and reflections of the author on this Modern Small Industry sector such as aberrations in planning and implementation of the programmes, achievements, its great potentialities as a bridge between the medium and large industries and traditional industries. The Appendix Chapter deals with the comparative position of Indian Small Industry movement vis-a-vis small

industry development in Japan and China with different political systems, strategies and socio-economic and cultural backgrounds. These differences will explain the relevance or otherwise of such comparisons.

In India, Modern Small Industry includes the manufacturing activity, although there is some evidence in recent years of broad-banding the concept to include servicing and maintenance and more importantly, the business enterprises as in Japan. It is not enough until we accept in totality and change even the description from small industry to small enterprises, the emphasis being on enterprise. The author has rightly touched the core of the problem when he has questioned the lack of conceptual clarity. The author's suggestion to set up a separate department of small industry in the Ministry of Industry to cover all small industries of different descriptions, no matter whether they are traditional, rural or tiny, has come no sooner. 'Fragmentation of the decentralised small industries sector between several agencies spread into different Ministries' to use the author's language, 'has lead to problems of coordination, although in actual practice, this is achieved through frequent meetings of the officials of the agencies concerned'. These meetings are certainly not a substitute for an umbrella organisation.

The author has also suggested a Small Industry Commission to be set up to advise the Small Scale Industry Development Commissioner periodically. While there can be several organizational innovations that can tried, the fact remains that it is the Planning Commission and the administrative ministry which have to apply their minds constantly on policy issues and take initiatives to correct the imbalances that come to surface in the growth of this sector from time to time. For instance, the modern small industries are highly urban oriented and our expectation that they would act as a bridge between the traditional industries and large and medium industries and also remove certain regional imbalances in the growth of agriculture and industry together have been belied. Further, it is also a fact that over 80 to 90 per cent of the registered small industries are tiny industries by their size of investment and even employment. Therefore, it is apprehended that these smaller of the small industries are not getting enough attention from the authorities. In this respect, most of them share the disadvantages of traditional industries. The dichotomy between the small industries and the tiny industries is very sharp and the SIDO and Small Industries Associations appear to protect the conspicuously big but pass for small industries.

The author has dealt at the length with the harm that can possibly be done by unqualified and time-bound policy of reservation, but the data on the progress made in some reserved items in Table 22 show decidedly that the policy of reservation has helped the growth of this sector. In situations like ours,it has to be admitted that a policy of reservation has an important place in the development of such industries. Modernisation is an important key area and the book does not deal with the quantitative and qualitative achievements under this programme.

The chapter on prospects for the nineties, largely, is author's own vision. He says that 'this is the challenge of the nineties to the small industry sector—to be in the vanguard of industry, and not its trailing edge; to be a pace-setter rather than a follower; and to make it the dynamic component of industrial economy'. The vision of the author seems to be a very fantastic one if only it materialises putting the small industry in the centre of the industrial scene of the country. However, as stated earlier, in the absence of any strong lobby for the traditonal rural and tiny industries, the gap between these segments of industries is everwidening. This is in fact a most disquieting trend of the post-independence Indian planning for industrial development.

The small industries sector in India, although has made several strides in terms of diversification of production including the most sophisticated electronic goods like colour televisions, measuring equipments, etc., cannot be described that it is 'walking on two legs'. It, however, continues to be of great interest to economists and planners because of its great potential in a developing country. There are a several non-quantifiable advantages of a

decentralised production which the country has inherited from the past, peaceful harmonious cottage production, absence of trade unionism, involvement of inter-family members and above all, creating self-employment to name a few, which do not find adquate place in the book. In fact, the small industries movement in India is trying to imitate the so-called Western pattern. The fault perhaps lies in our obsession with what is good and relevant for the West which is not necessarily so in our conditions. A reader would look for more durable solutions which are typically Indian, no matter howsoever they are unpalatable.

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*New Delhi*

**BANK AND CUSTOMERS—A BEHAVIOURAL ANALYSIS, By Sushila Singal, Shri Ram Centre, New Delhi, 1987, 233p, Rs 125.00.**

Banks in India, public sector or other wise, have made rapid strides in terms of business gains but as far as customer service and satisfaction are concerned they have miles to go.

Dr. Singhal has chosen a significant institutionalised customer service sector for her research; the study, moreover, comes at appropriate time. Her effort to probe into the behavioural dynamics of bank-customer interface is commendable especially in the context of the limited amount of literature on the subject.

Customer service for any service industry is the hallmark of its success or failure; but is one of the most neglected areas, nonetheless. In fact, we have not been able to develop a work culture which is geared to customer satisfaction; banks being no exception. Theoretically, any organisation—industrial, commercial, service or professional—has to exist primarily for customer service and satisfaction but the existing scenario proves otherwise.

The research design of the study is quite exhaustive and incorporates the correlation between the perceptions of employees' job-behaviour and customer service. It is quite valid to hold that ultimately what the position incumbent thinks of his job and how he accordingly sets to work gets translated in his job-behaviour vis-a-vis his clientele. Dr. Singhal has also worked out that howsoever good the infrastructural facilities a bank may provide to its employees, it makes them very little effective unless they really want to work. In other words, employees' own perception of their work-place determine the quality of their output to a very large extent. Bank employees are qualified and well equipped people but not motivated enough and therefore the resultant is poor customer service.

Some of the issues raised by the author are relevant to the question of excellence in the banking industry in terms of organisational control, interface relationships, management of industrial relations, customer service and further research. One of the issues is a direct offshoot of nationalisation, which has added the dimension of political control over bank management. Political control has created different 'clouts' within and outside the banks. An off-shoot of this is unionization. An oridnary employee does not trust the management but the union, howsoever inefficient the latter may be. Employee unions in particular have been the beneficiary of the political pressure which erodes managements' power position and credibility.

Another issue is the growing incidence of frauds in banks which reflects two things—the incapacity of management to lay down appropriate operational procedures and the loyalty of the personnel involved in such cases.

The insights provided by the author realistically reflect the working dynamics of banks in India in the post nationalisation period. These insights would also provide analogical reference data to understand the work-behaviour of other public sector organisations.

Banks are in theory accountable to the nation and society; this research has broken this myth. Customers are taken for a ride many a time. The research by

the author has done a great service to the banking industry by giving them data based feedback. The sponsor's must be congratulated for promoting the study. Finally, I must confess to being disinclined towards serving the flaws in this work since the author has brought out what rampantly exists but has been evading our knowledge.

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**PRODUCTIVITY, INNOVATION, MANAGEMENT AND DEVELOPMENT, By P.N. Rastogi, Sage Publications, New Delhi, 1988. 263p, Rs. 185.00, (hard cover)**

The book deals with the "why" and the "wherefore" of productivity. Concepts of culture and values provide the basis of productivity analysis. The quest for productivity is linked with man's search for meaning/purpose of life and without a strong spiritual support system a durable culture of productivity cannot be sustained. Work reported in this book adopts a cross-cultural perspective. Productivity differentials among nations are due to variations in productivity norms which may be viewed in terms of the variability in productivity culture.

A productivity approach views an organization as an instrument for the production of goods and services for the society. If organizations prosper by causing damages to society—the author calls them social parasites. If they are wasteful they are social delinquents. If their work is disrupted due to internal disharmony they are socially irresponsible. Even governments can cause damage to the productivity culture. The strength of the productivity culture depends on the strength of mutually supportive relationships among the social actors involved.

The author differentiates between creativity and innovation as the former denotes the 'thinking' of new things and the latter denotes the 'doing' new things. A multi-feedback loop representation of innovation process permits a number of analytical inferences to be drawn from the model, apart from their depiction of the multilateral interaction relationships within the system.

The author has very forcefully argued that the HR theories, though insightful, fail to address a number of issues such as goals bereft of social and moral significance, limited number of incentives, participation without substance autonomy devoid of authentic relationships. He identifies certain 'missing' factors in the pursuit of productivity-such as the linkage of organizational goals with larger social purposes, elevation of moral basis of work etc. Chapter V identifies the culture of productivity. Productivity culture of the nation and the organization together with the cultural configuration is very effectively brought out. The description is original and thought provoking. Feedback linkages between basal values, productivity norms, culture and economy of a nation are depicted. Basal values of Japanese, American and Indian cultures are presented which according to the author would cover a whole spectrum of scenarios. Productivity is viewed as a socio-cultural phenomenon. Logic employed in this chapter is very sound, though, at times one gets the impression that the author holds very strong views/opinions on basal values of various cultures.

The author has attempted a chapter-wise elaboration of the productivity cultures of Japanese, American and Indian societies respectively. The author identifies core norms of societies, their basal values, management systems and interorganisation cooperation. Attention has been paid to the spiritual support system of Japanese society, quest for spiritualism in American society as well as facets of the weak productivity culture in Indian Society. Issues raised by the author are relevant and important. He has, moreover, been rather forthright and candid about expressing them, though, one may want these to be substantiated.

Chapter IX presents a new thesis of S-Productivity culture, exploring spiritual options for plural societies. Spiritual basis for common indentity is thought to provide the necessary motivation for higher productivity. The superordinate and superrational framework of truth, love, inner serenity and righteous action constitute the essence of human life. He

describes ethico-legal problems of management in this context. Chapter X describes restructuring of behavioural processes in organizations under the S-Productivity Culture. Chapter XI identifies the role of S-Productivity culture in eliminating poverty, unemployment and inflation, It provides a morphological map of rural poverty and depicts the interrelationship between moral norms, economic development and social problems. The last Chapter provides a rationale from S-Productivity culture and its cascading effect.

Though one may feel that many of the views expressed in the book are yet to be validated and hence are at best opinions or propositions, yet the contents of the book are revealing and thought provoking and very forcefully introduce a spiritual dimension to the concept of productivity. One hopes for more specific case studies to validate these concepts to come up in future. This book is nevertheless a welcome addition to productivity literature.

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**ENVIRONMENTAL CHALLENGES OF DEVELOPMENTAL PROCESS, "Environment Management in India," By R.K. Sapru, Ashish Publishing House, 1988, 595p, Rs. 500.00 (two volumes).**

Environment management is often misunderstood as the mere management of resources of an ecosystem. It should actually be considered as the sound management of all activities which have an impact on the environment. It is an essential tool to meet the basic human needs of the population on a sustainable basis. In practice, the environmental management techniques put great emphasis on the planning of new or modified activities to prevent or mitigate their harmful impact on the environment. Dr. Sapru, who hails from the faculty of public administration at Punjab University has made an attempt to focus on the environmental management techniques pursued by the Government. Views of a large number of experts, specialised in diverse fields, on these issues, have been edited and presented in two volumes.

The author has tried to give an overview of the environmental challenges faced by today's modern society with a focus on the public response to these challenges. In all, there are 48 presentations covering three major issues—(a) rapid urbanisation & it's impact on environment (b) ever increasing denudation of forests and afforestation programmes launched by the Government and (c) the legal aspects of environmental protection in India.

India has the third largest urban population in the world after USA and USSR. As per 1981 Census, the urban population in India was estimated at around 167 million, representing about 24% of the total population. It is estimated that by the year 2000 AD., about 65% of the population in India will live in cities with 100,000 or more population. The impact of this urbanisation on the environment and the resulting complex and interlinked, problems like housing, transportation, water supply, sewerage, sanitation etc. are discussed. The experts have also reviewed possible approches to overcome these challenges and the strategies to provide a better quality of urban life.

It is wellknown that denudation of forest cover will ultimately result in increasing water shortage, recurrent land slides, increasing incidents of woods in the plains, high sedimentation load in flowing water, shortage of fuel etc. In fact some of these effects are already being experienced in the ecologically sensitive Himalayan region. Current national forest policy emphasises social forestry including afforestation of wasteland, apart from conservation and protection of existing forests cover. While, discussing details of various social forestry schemes launched by the Government and their envisaged positive impacts on environment, a word of caution is given on the possible negative environmental impacts like excessive use of fertilisers, pesticides replacement of ecosystem by an artificial monoculture, etc.

A Number of issues on the existing constitutional and legal provisions for environmental protection in India have been included in these two volumes. Specific cases where the Municipal and other Acts have been used from time to time for dealing with pollution

problems have been cited. The need for enacting additional comprehensive legislation for controlling noise pollution in India has also been emphasised. In fact 25% of the total presentations are on legal aspects and in the process, several authors have repeatedly quoted the Supreme Court's decision on Ratlam Municipality Case of 1980.

In addition, there are presentations on specific and lesser known issues like the Bioenvironmental control of malaria, fisheries development and environment, foreign trade and environment, politico-adninistrative aspects of environment protection, etc. It would however have been more useful if the author had edited these presentations and classified them subsector wise to avoid repetitions.

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**CAPITAL BUDGETING DECISION UNDER RISK AND UNCERTAINTY, by J.D. Agarwal, Indian Institute of Finance, New Delhi, 168p, Rs. 150.00**

Capital budgeting is one of the the important areas of financial management, on which a lot of attention has been devoted during the post world II era.

Ever since the work of Joel Dean, the literature on capital budgeting has grown so rapidly that it has tended to diverge from rather than converge to a unified whole. Agarwal's book on capital budgeting decision under risk and uncertainty is not just another addition to the existing literature but another brick on the theories and techniques which have been developed, over a period of time. The book opens up newer frontiers and vistas by challenging the existing techniques as outdated and far from reality.

The book in all has nine chapters. In the first three chapters the author explains in an analytical manner the nature and meaning of capital budgeting decisions besides giving a brief background of the literature. These three chapters present a complete picture of capital budgeting decisions in a summarised form.

In the next three chapters the author presents the findings of his own research based upon an empirical investigation, to establish that firms in general pursue multiple objectives. The author has also attempted to prove that the techniques which help evaluate capital budgeting decision assuming a single objective do not give an optimal solution. The author not only makes a case of evaluating projects keeping in view the multiple objectives but also presents a model suggesting how to rank various multiple objectives in order of their priority.

In chapters 7 & 8 the author suggests two models : A Goal Programming Model and A Stochastic Goal Programming Model for evaluating capital projects under conditions of certainty, risk and uncertainty. Although an application of goal programming model has been presented and a computerised solution is given, no such attempt has been made by the author for the stochastic goal programming model which according to the author has been developed to incorporate risk and uncertainty.

The author's goal programming model which has several advantages, opens up the whole approach of capital budgeting and adds a new dimension. Besisdes the weakness of providing the solution in fractions, the goal programming approach suffers from it, would be helpful in decision-making. Of course the author suggests in the last chapter that an integer goal programming model can take care of this weakness. The author also spells out a number of areas on which further research may be carried out.

The book would be immensely useful for executives of financial institutions, companies, Government, policy making bodies, bankers and management consultants in evaluating the projects thoroughly. The book would also be useful to teachers, researchers and students of finance, economics, business management, commerce and operations research.

*K.L. Handa*
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*Indian Institute of Public Administration, New Delhi*

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# BOOKS IN BRIEF

**Advanced Information Technology in the New Industrial Society : The Kingston Seminars**

*By Arthur Cotterell, Oxford, Oxford University Press, 1988, 144p, £7.95*

This book is a collection of papers presented at a seminar at the Kingston College of Further Education, UK, in Autumn 1986, on the role of information technology in the future economic development in Britain. The papers discuss the impact of current revolution in information technology on industry, on education and training for industry and on society.

**Automatic Control—1987**

*By R. Isermann, Oxford, Pergamon Press, 1988, 10 volume set, £ 1000*

Automatic Control 1987 is the proceedings of the 10th IFAC World Congress. In an area of continuing development and research, and with the ever increasing importance of automation and technology within industry, this publication provides information on the state-of-the-art and future developments in automatic control.

**Labour Administration : Profile on Pakistan**

*By International Labour Organisation. Bangkok, ARPLA, 1988, 213p, £8.00*

The profile on Pakistan reviews the organisational structure and functions of the Ministry of Labour, Manpower and Overseas Pakistanis and provides the budget and the organisation charts of the various services in the labour administration system. It is the fourth in a series of profiles, the earlier ones being on Hong Kong, Bangladesh and Thailand.

**Labour Administration : Profile on the Philippines**

*By International Labour Organisation, Bangkok, ARPLA, 1988, 85p, $6.00*

The profile traces, in a historical and developmental perspective, the growth of labour administration. The historical background of the Department of Labour and Employment emphasises both its role as a major institution in labour administration and its growth in terms of organisational structure and responsibilities as it contributes to national development. The creation of the department affected the institutional and substantive involvement of labour administration in national development/work. This is a fifth in a series of profiles, the earlier ones being on Hong Kong, Bangladesh, Thailand and Pakistan.

**Management's Hidden Enemy : And What Can be Done About it**

*By David S. Brown, Mt.Airy, Lomond Publications, 1988,123p. $ 29.50*

This book is concerned with some of the most wasteful, costly and debiliting aspects of present day administration systems and suggests what can done about them. The enemy is dysfunctionalism, a pervasive evil the author says, which has received too little attention. It is an analysis of dysfunctional problems with practical suggestions of how to deal with them.

**Marketing Eonvironment and Practices in Nepal**

*By Y.S. Vermand, M.P. Dhal, New Delhi, Sterling Publishers, 1988, 176p, Rs. 150*

This volume presents the proceedings of a Seminar-cum-Workshop organised by the Institute of Management, Nepal. There are articles by distinguished authors on the marketing practices of four of the leading undertakings of Nepal. The contents have been arranged in four sections (i) Marketing System and Environment; (ii) Marketing Environment of Nepal; (iii) Marketing Practices in Nepal; and (iv) Marketing Practices as Interaction between Marketing Principles and Environment.

**Modern Small Industry in India : Problems and Prospects**

*By Ram K. Vepa, New Delhi, Sage Publications, 1988, 193p, Rs. 175 (HB), Rs. 75 (PB)*

This book outlines the progress made over the last thirty years in the small industry sector. It identifies some key areas which need greater attention on the part of policy makers if the small industry sector is going to successfully meet the challenges posed by modern technology. It also identifies thrust areas which are likely to gain in importance.

**Office Management : An introductory Text Book**

*By Mrityunjoy Banerjee, Calcutta, Book Syndicate, 1987, 230p, Rs. 20*

An attempt has been made to present the important aspects of modern office management in this publication which is designed as a text book at the undergraduate level. It conforms to the syllabuses of the few leading universities and institutions that have incorporated office management as a paper in thier courses.

**Personnel Selection and Productivity**

*By Mark Cook, Chichester, John Wiley & Sons, 1988, 276p, $ 49.95*

This volume emphasizes that personnel selection must lie at the heart of any consideration of how psychology can relate to working productivity. The author describes the value of good employers, the importance of job description and job analysis in the process of personnel selection. He reviews the major selection methods and discusses technical issues of validity tests.

**Planning at The Gross Roots**

*By Kamta Prasad, New Delhi, Sterling Publishers, 1988, 200p, Rs. 125*

This book deals with the rational methodology, data requirements, problems of integration and coordination, planning machinery etc. It also reviewed the past attempts made in this direction and in the process has analysed the causes of slow progress of this scheme. The book discusses in detail the three important schemes of poverty allevation programme namely IRDP, NREP and RLEGP and based upon some field studies in states of Gujarat and Bihar, highlights the weakness and implementation problems at the district level.

**Planning for Coal Sector**

*By Gopal K. Kadekodi, Delhi, B.R. Publishing Corpn., 198p, Rs. 125*

It is a publication sponsored by the Institute of Economic Growth, Delhi. This book examines the issues based on extensive field data from coal mines, coking units and project areas, exhaustibility, cost of mining, pricing of coal, technological options, coal beneficiation, soft and beehive cokes, exploring more coal and environmental effects. It has a focus on planning and policy options econometric models of cost and productivity. Cost-benefiit analysis of coal mine projects and optimisation models of choice of techniques form the basic facets of enquiry into the nature of this important energy sector.

**Planning for Rural Development : Issues and Case Studies**

*By Ravindra H. Dholakia and Sundershan Iyengar, Bombay, Himalaya Publishing House, 1988, 133p, Rs. 100*

This study is based on author's first-hand experience of action-research carried out in the Gujarat

State. It presents five specific case studies of different schemes/projects covering different aspects of micro-level planning for rural development. The book highlights issues and problems one is likely to face while planning any intervention for rural development under the present circumstances. It provides useful insights into the planning process that would countribute towards improving management of special programmes for rural development.

**Productivity and Value: The Political Economy of Measuring Progress**

*By Folke Dovring, Wesport, Greenwood Press, 1987*

This book takes a critical look at the "generic" concepts of productivity as they are used in most of the conventional literature. In particular, the author challenges the concept of "total-factor" productivity as a vaild indicator of successes or failures in economic policy and in the economy generally. Economists, business leaders, economic journalists, and politicians will find this book useful in explaining the current controversies in productivity research, and by what means they are likely to be resolved.

**Productivity, Investment and Import Substitution in Indian Industries**

*By N.C. Gupta, New Delhi, Radha Publications, 1987, 162p, Rs. 120*

The present study is a modest attempt to examine three specific aspects of non-ferrous basic metals industries, namely productivity, investment and import substitution. The measurement of import substitution is confined to primary non-ferrous metals, namely aluminium, copper, lead and zinc. The book presents estimates of different indices of productivity, such as partial productivity ratios, total factor productivity indices; estimates based on production function for the two periods ie 1948 to 1958 and 1960 to 1970.

**Productivity Plus**

*By Jahn G. Belcher Jr., Houston, Gulf Publishing Co. 1987, 237p, $ 24.95.*

This book offers key management strategies for obtaining and sustaining peak performance in any company or organisation. This is not a "Shot-in-the-arm" programme or a dose of short-term motivation. Productivity Plus offers proven techniques to integrate high productivity and competitiveness into the organisation as constant, clear-cut objectives. It covers all aspects of productivity, including how to get top-management commitment, involve and reinforce employee, and measure productivity, the role of the union; and the quality/productivity connection.

**Putting the Just-In-Time Philosophy into Practice**

*By P.J. O'grady, London, Kogan, Page, 1988, 138 p, $ 16.95*

This book describes the essential features of Just-In-Time (JIT) approaches to manufacturing and how JIT can be successfully implemented. JIT marks a significant departure from previous western approaches to manufacturing management and aims to improve quality levels and customer service while decreasing lead times and inventory levels. The use of simple though effective methods can, with proper management, lead to continuous improvements in the manufacturing operation. The book is aimed at production, operations and manufacturing managers.

**The Just-In-Time Breakthrough: Implementing the New Manufacturing Basics**

*By Edward J. Hay, New York, John Wiley, 1988, 227p, $ 24.95*

This book is a comprehensive, practical, clearly written explanation of the JIT (Just-In-Time) concept and its relationship to quality, vendors, management, systems and technology. Examples from actual companies illustrate the technical and managerial problems involved in changing to JIT, and how to address them. The book tells why the JIT approach makes sense, explains the managerial implications and then, tells how to go about implementing it.

**Transnational Corporations in a Developing Country: The Indian Experience**

*By Johri Martinussen, New Delhi, Sage Publications, 1988, 228 p. Rs. 150*

This volume is a comprehensive assessment and analysis of India's policies towards transnational corporations (TNCs) since the late sixties. It also reviews the most important acts and rules governing TNCs in India and, then, investigates the administration and implementation of the policies contained therein. It analyses the implementation of the Foreign Exchange Regulation Act and the functioning of the industrial approval system.

**Understanding Computers**

*By Dinesh Kumar, New Delhi, BPB, 1988, 400p, Rs. 36*

The book is written for laymen and provides essential information about computers and other various components, how they function and what they can do. It also helps a prospective buyer in making sound selection from the plethora of computers and application packages available in the market.

**Worker Consciousness and Trade Union Response**

*By E.A. Ramaswamy, New Delhi, Oxford University Press, 1988, 242p, Rs. 150*

This book is a comparative study of trade unionism in four major industrial centers of Bombay, Calcutta, Madras and Bangalore. It portrays the contemporary scene by examining broad trends in the labour movement and the individual styles of prominent leaders and assessing specific unions against this back drop.

**Compiled by :**

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National Productivity Council
New Delhi

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